

ADHD ASSESSMENT: INCREMENTAL VALIDITY OF OBJECTIVE MEASURES OF
CHILD BEHAVIOR

By

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To my teachers – including the families who come seeking guidance from the mental health profession

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Attention-Deficit/Hyperactivity Disorder (ADHD) is one of the most common psychological disorders of childhood. As such, determining empirically supported assessment procedures for diagnosing ADHD is an important research goal. Current guidelines highlight the necessity of including multiple informants and settings in the assessment process. While multiple methods (e.g. paper and pencil questionnaires, computerized measures of attention) are also commonly used by psychologists as they conduct ADHD evaluations, there is little research concerning the incremental validity of various methods.

In order to examine this issue, the current study evaluated the degree to which clinic-based measures of child behavior (in this case, clinician ratings of child behavior during testing and child performance on a computerized measure of attention) predicted functional impairment above and beyond parent and teacher ratings of ADHD. The study also considered the impact of oppositional and defiant symptoms, which make up the most commonly occurring comorbid condition with ADHD.

Participants included a sample of 27 children who met diagnostic criteria for ADHD. Correlational analyses revealed that parent and teacher ratings of ADHD and

oppositional symptoms were strongly related to parent and teacher ratings of impairment, respectively. Clinic-based measures of ADHD behavior were mildly to moderately associated with impairment indices. Bivariate correlations also revealed that clinician ratings were significantly associated with age, parent ratings of hyperactivity/impulsivity, and oppositional/defiant symptoms. Computerized attention (CPT) scores were significantly associated with age and moderately associated with teacher ratings of hyperactivity/impulsivity at a level that approached significance. According to hierarchical regression analyses, neither clinician ratings of behavior during testing nor the CPT composite added a significant increment to the prediction of impairment above and beyond ADHD ratings. Interestingly, Oppositional Defiant Disorder (ODD) symptoms explained a high degree of variance in impairment, in some cases greater than ADHD symptoms.

The current findings support the notion that clinicians should rely heavily on symptom checklists as cost and time-efficient means of diagnosing ADHD. The outcome of this and other studies question the ecological validity of measures of clinic-based behavior. Taken together, the results call for a strong reliance on assessment measures and methods that tap the child's everyday attention, impulsivity and activity level.

CHAPTER 1 INTRODUCTION

Overview of Attention-Deficit/Hyperactivity Disorder

Attention-Deficit/Hyperactivity Disorder (ADHD) is a neurodevelopmental disorder of childhood characterized by developmentally inappropriate levels of inattention, hyperactivity, and impulsivity. With an estimated prevalence in the general school-age population of approximately 8% (Center for Disease Control, 2005) and 4-12% in pediatric primary care settings (American Academy of Pediatrics [AAP], 2000), ADHD is one of the most common childhood disorders. Indeed, ADHD accounts for a large number of referrals to physician and child mental health professionals (Barkley, 1998). Research suggests that a disproportionate number of males as compared to females are diagnosed with the disorder, with an estimated ratio of approximately 9:1 in clinical samples and a ratio of 4:1 in epidemiological samples (Cantwell, 1996).

According to the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV; APA, 1994), the diagnostic criteria for ADHD incorporates two symptom groupings based on inattention and hyperactivity/impulsivity. Depending upon the number of symptoms present within each grouping, one of three ADHD subtypes of ADHD are considered when making a diagnosis. These include the Predominantly Inattentive, Predominantly Hyperactive-Impulsive, and the Combined subtypes. The DSM-IV criteria also explicitly incorporate requirements regarding symptom onset (before 7 years of age), symptom duration (at least 6 months), developmental deviance, and cross-situational pervasiveness of impairment from ADHD symptoms. The DSM-IV makes specific mention that there must be evidence of clinically significant impairment in social, academic, or occupational functioning. Indeed, level of impairment is a

diagnostic consideration that carries very relevant implications with regard to treatment, as children with ADHD often have difficulty in the classroom or on the job, display lower adaptive functioning and poorer self-care, have more social problems, and are at higher risk for unintentional injury (Barkley, 1998; Barkley, Fischer, Smallish, & Fletcher, 2006).

Assessment of ADHD

Assessment of ADHD is a process that involves the consideration of information from multiple informants (e.g. parents and teachers), multiple settings (e.g. home and school), and oftentimes, multiple methods (interviews, observations, rating scales). It is important to note that specific assessment practices vary depending on what the goals for assessment are. In research settings, for example, a primary objective is to obtain a diagnosis. In clinical settings, on the other hand, assessment is broader and may involve making a diagnosis, treatment planning, and evaluating a treatment over time (Pelham, Fabiano, & Massetti, 2005). Further, as Anastopoulos and Shelton (2001) note, other potential influences on how assessment is carried out may include the clinician's level of experience, his or her beliefs about the cause of psychopathology, the degree of methodological rigor employed, and the fact that there is quite a large array of instruments to select from.

Given the complexity inherent in the assessment process, both the American Academy of Pediatrics (2001) and the American Academy of Child and Adolescent Psychiatry (2007) have published general guidelines for evaluating children suspected of having ADHD. These guidelines feature key components, such as screening for ADHD when core symptoms are present, employing DSM-IV criteria as the primary basis from which a diagnosis of ADHD is given, gathering information about symptoms from parents and teachers, assessing for the presence of coexisting conditions, and

using DSM-IV based rating scales rather than global questionnaires (AAP, 2001). Interviews with the parent and teacher through using structured and semi-structured interviews, verbal narratives, and/or open-ended questions are suggested by the American Academy of Pediatrics as an effective means to determine age of onset and frequency and duration of symptoms across settings. While structured interviews such as the National Institute of Mental Health's Diagnostic Interview Schedule for Children (DISC-IV) have strong empirical support (Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000), there are limitations in that the format can be quite lengthy. Open-ended questions, on the other hand, while not empirically supported in and of themselves, are valuable in clinical settings as they provide some of the information essential for diagnosis, such as age of onset and frequency of symptomatology—and are effectively supplemented by structured self-report rating scales.

Parent and teacher rating scales are a common and efficient means to get information about the presence and severity of the child's symptoms and, importantly, to determine the degree to which the child's symptoms are significantly different from same-aged peers (Pelham, Fabiano, & Massetti, 2005). Such scales tend to be easy to use, efficient, and do not require special training on the part of the informant (Hinshaw & Nigg, 1999). A noteworthy feature of rating scales is that they target appraisals from adults who observe the children in their daily environment (such as the home or school), where disruptive behaviors are likely to occur (Barkley, 1998). Barkley points out, however, that these measures require the informants' opinions and perspectives on child behavior and may reflect biased responding. The author emphasizes that professionals should take multiple informants into account while at the same time

considering the developmental history in order to grasp the key features of a child's behavior. Among the numerous available DSM-IV-based narrow band scales, several stand out as possessing strong empirical support. The Conners Rating Scales (Conners, 1997, 2008), for example, have been proven useful in a wide variety of clinical and research settings. Available in parent, teacher, and adolescent self-report forms, they are relatively easy to administer and have strong psychometric properties, all of which make them appealing. The scales have been used to establish the convergent validity of other ADHD symptom ratings scales as well as measures of externalizing behavior disorders (Collett, Ohan, & Myers, 2003). Further, in treatment outcome studies, the parent and teacher versions of the scale have shown sensitivity to methylphenidate treatment effects in children with ADHD (Gadow, Sverd, Sprafkin, Nolan, & Grossman, 1999).

In addition to parent and teacher ratings of the child's ADHD symptoms, the DSM-IV also specifies that there must be evidence of impairment in academic, social, or occupational domains of functioning. Indeed, children with ADHD have been shown to be impaired in a variety of areas, including adaptive functioning (difficulties with self-help and independent behaviors), academic functioning, social functioning, and home/family functioning (Biederman et al., 1999; Shelton et al., 1998; Lahey et al., 1998; Pelham et al., 1998). Examples of the range of impairments include not adjusting to changes in routine or showing appropriate concerns for safety, being less likely to comply with adults, breaking classroom rules, being more likely to repeat a grade level, demonstrating less cooperation among peers, and having problems interacting with siblings and family members. Despite the emphasis placed on the impairment criterion

by the DSM-IV diagnostic guidelines for ADHD and the research that testifies to the presence of significant functional problems in these children, the DSM-IV does not specify how impairment should be gauged. As Bird et al. (2005) highlight, research instruments offer the potential to strengthen the clinical process by helping obtain reliable diagnostic conclusions. There are several general measures of impairment that possess empirical support, including the Vineland Adaptive Behavior Scale (Sparrow, Balla, & Cicchetti, 1984), the Children's Global Assessment Scale (Shaffer et al., 1983), the Columbia Impairment Rating Scale (Bird et al., 1993), and the Brief Impairment Scale (Bird et al., 2005). Some of the limitations of the existing global measures (the reader is referred to a review by Winters, Collett, and Myers [2005] for a more extensive review of existing measures for use with children and adolescents) are that most are unidimensional and provide only a single rating for overall impairment, many are rather lengthy and thus are not ideal for use in clinical settings, and none link impairment to difficulties that occur specifically as a result of ADHD behavior. In response to the need for a multidimensional measure to quantify impairment in children and particularly in children with ADHD, Fabiano et al. (2006) developed the Impairment Rating Scale (IRS), whose parent and teacher versions provide information on the child's functioning across various domains, including relationship with peers, relationship with parents, relationship with teacher, academic progress, and self-esteem. Multiple areas of impairment are important to consider, especially in treatment planning, as these are often the reason for referral and constitute possible treatment targets (Angold, Costello, Farmer, Burns, & Erkanli., 1999). Of note, the IRS also taps the rater's assessment of the child's need for treatment and special services. Preliminary findings from a recent

study, which used samples of children with ADHD and two school-based samples, indicated that both parent and teacher versions of the IRS demonstrated good temporal stability, correlated with other impairment ratings, and successfully discriminated between children with and without ADHD (Fabiano et al., 2006). The authors also indicated that although the correlations between ADHD symptoms and the IRS ratings of impairment tended to be large, there was substantial unshared variance between these measures.

A thorough evaluation of ADHD should also include an assessment for comorbid disorders; for as many as two-thirds of clinic-referred children with ADHD also have a diagnosis of another condition that affects their functioning (Cantwell, 1996). Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD) are the most common comorbid conditions associated with ADHD, with estimates ranging between 54 and 84% in some samples. Estimates also indicate that up to 25-35% of children with ADHD have learning disabilities (Pliszka, Carlson, & Swanson, 1999). Prevalence rates of comorbid internalizing problems, while not uncommon, tend to be lower (MTA Cooperative Group, 1999). To assess for comorbidity, broadband measures such as the Behavioral Assessment System for Children (BASC; Reynolds & Kamphaus, 2002) or the Child Behavior Checklist (CBCL, Achenbach, 1991) are commonly used as they tap into multiple dimensions of child functioning, possess strong psychometric properties, and are relatively efficient to administer.

Laboratory measures of vigilance and sustained attention are sometimes used during comprehensive clinical ADHD evaluations, particularly because they offer the appeal of a controlled assessment that is grounded in a child's actual behavior (Barkley,

1998; Heaton et al., 2001) and they are not subject to biases that sometimes plague parent-report measures. The test most commonly used in research and clinical settings to evaluate sustained attention in children suspected of having ADHD is the Continuous Performance Test (CPT), originally developed by Rosvold, Mirsky, Sarason, Bransome, and Beck (1956). CPTs now constitute a broad category of tests, but they all share a basic design that involves a rapid presentation of changing stimuli and directions requiring test-takers to be vigilant of an infrequently occurring stimulus (Riccio, Reynolds, & Lowe, 2001). Two types of errors, omissions and commissions, are thought to reflect problems relating to sustained attention and impulsivity. Omissions occur when a subject misses a target stimulus, while errors of commission occur when a subject responds in the absence of the target stimulus. While the American Academy of Pediatrics (2001) warns that laboratory-based measures should not be used making diagnoses of ADHD due to questionable ecological validity and the lack of data to suggest favorable levels of sensitivity and specificity, such measures can be useful in understanding elements of cognition in ADHD (Pelham, Fabiano, & Massetti, 2005). It is noteworthy that research has consistently shown that children with ADHD perform more poorly than normal control groups on continuous performance tasks (Epstein et al., 2003). While scores may not necessarily imply a diagnosis of ADHD as problems of attention can result from various childhood problems, some measures do seem to reflect the presence of attention problems.

With the definition of ADHD being highly grounded in the behaviors displayed by a child in his or her daily life (APA, 1994) it is no surprise that behavioral observations have a long history of use in evaluating for ADHD. Many observational measures, such

as the Classroom Observations of Conduct and Attention Deficit Disorders (COCADD; Atkins, Pelham, & Licht, 1988) and the Classroom Behavior Code (Abikoff, Gittelman-Klein, & Klein, 1977), involve an independent observer who evaluates the child's behavior in a clinic or naturalistic (e.g. classroom) setting. Behavior codes are based on elements such as time spent on-task and out-of-seat behavior. The observational codes from the measures listed here exhibit acceptable reliability and validity, effectively discriminate between children with ADHD and comparison children, and have demonstrated sensitivity to the effects of treatment (Pelham, Fabiano, & Massetti, 2005). Another observational measure, the Hillside Behavior Rating Scale (HBRs; Gittelman & Klein, 1985), utilizes a seven-item scale where observers rate a child's behavior during a testing situation. The HBRs items assess domains that directly relate to DSM-IV ADHD symptoms as well as disruptive behavior more generally. Instead of using a Likert-scale format, the rater is asked to choose an operationally-defined descriptor that corresponds best to the child's behavior during the observation period. Preliminary evidence provides support for the internal and interrater consistency of the HBRs as well as its convergent and concurrent validity (Willcutt, Hartung, Lahey, Loney, & Pelham, 1999).

Incremental Validity in Assessment

As illustrated by the many components involved in a thorough psychological evaluation of ADHD that are described above, assessment of the disorder is not simply a matter of considering specific behaviors using a single measure at a given time point (Johnston & Murray, 2003). The authors point out that assessment of children and adolescents should be multimodal (including, for example, interviews, rating scales, and behavior observations), multi-informant (most commonly incorporating information from

parents and teachers), and involves gathering data in different settings. As such, the evaluation process requires ongoing decision-making as well as a synthesis of many pieces of information on the part of the clinician. With the variety of measures and methods available for assessing ADHD, the question of how to select and combine data derived from these measures is particularly relevant. Johnston and Murray state that the entire assessment process, including the particular instruments and procedures for how to combine the incoming information, should be empirically supported. Indeed, the American Psychological Association's (APA) move to establish a Psychological Assessment Work Group in 1996 testifies to the emphasis placed on using scientifically validated assessment instruments. In fact, many psychological tests appear to demonstrate sound psychometric properties, including validity that, in some cases, are comparable to that of medical tests (Meyer et al., 2001; Johnston & Murray). It is also widely agreed upon that using a battery of tests is preferred over more simplified approaches. It should be noted, however, that there is relatively little empirical data in either the adult or child literature to suggest how to best and most efficiently combine multiple assessment components for purposes of diagnosis, assessing impairment, and/or treatment planning (Hunsley & Meyer, 2003; Johnston & Murray).

Questions of incremental validity relate to determining the most efficient and effective means of assessing ADHD. Johnston and Murray (2003) define incremental validity as answering the following question: "Does the procedure or method add to the assessment process in a way that improves the outcome?" (p. 496). As mentioned previously, psychometric properties of psychological tests are necessary but not sufficient in determining incremental validity. In their comprehensive review covering

the incremental validity in the psychological assessment of children and adolescents, Johnston and Murray define various types of incremental validity. First, the incremental validity of multiple informants conveys whether or not different informants contribute unique, clinically-useful information to the assessment processes. Smith, Pelham, Gnagy, Molina, and Evans (2000) found that in a sample of adolescents with ADHD, adolescent self-report of ADHD symptoms did not contribute incremental validity over and above parent reports in predicting the observed frequency of negative behavior. With respect to combining parent and teacher reports, the results seem to depend on the goal of the assessment. Power et al. (1998) and Power, Costigan, Leff, Eiraldi, and Landau (2001) found that in a population of school-age children, teacher reports were more useful than parent reports for ruling out a diagnosis of ADHD and for discriminating between subtypes of ADHD. On the other hand, a combination of both parent and teacher reports tends to be more useful for confirming a diagnosis of ADHD (as documenting the presence of core symptoms across situations is a prerequisite for diagnosis).

A second type of incremental validity, which involves measures of multiple constructs, relates to whether or not considering more than one domain of functioning (or construct) adds value to the assessment (Johnston & Murray, 2003). The authors note that most studies involving incremental validity and the assessment of child/adolescent problems are of this type. For example, Hinshaw et al. (2000) reported that assessing more than one aspect of child functioning improves the ability to predict response to treatment. In a report on the findings from the MTA study, Hinshaw et al. noted that children with ADHD and anxiety responded equally well to medications and

psychosocial treatments, whereas children with ADHD and ODD responded best to medication treatment. Studies of incremental validity of multiple constructs have also looked at the contribution of including family and parenting characteristics in the assessment of child behavior problems, with results supporting this practice (DeVito & Hopkins, 2001; Ford et al., 1999).

A third type of incremental validity, and the one most pertinent to the current study, is that of multiple methods. The incremental validity of multiple methods considers the contribution and utility of adding additional methods to an existing strategy of assessment. Studies utilizing multiple methods have most commonly combined the informant's responses on questionnaires with objective measures of the child's behavior. Here, objective measures may include naturalistic observations, laboratory analogues, and performance on laboratory tasks (Johnston & Murray, 2003). Even though these types of measures offer the theoretical appeal of being grounded in child behavior and the potential to add unique information beyond traditional parent and teacher report measures, little research has addressed the incremental validity of these methods (Johnston & Murray). The literature that does exist reflects mixed results. Lobitz and Johnson (1975) indicated that parent reports of their children demonstrated high levels of sensitivity and specificity: 90% of clinic-referred and 90% of nonreferred children were correctly classified based on these reports. Of note, however, neither laboratory based nor home observations of the child's behavior added significantly to these prediction rates. Similarly, Sleator and Ullmann (1981) found that observations of whether or not the child displayed "obvious hyperactive" behaviors during his or her visit to the physician's office did not correspond well with parent and teacher reports of

ADHD. Further, these observations did not significantly add to the prediction of future problems. Sleator and Ullmann concluded that their findings lend evidence to the notion that the patient's behavior in the clinic setting is not always indicative of his or her usual behavior. In comparison to these studies, which suggest negligible incremental validity of clinic-based measures of child behavior, Glutting, Robins, and de Lancey (1997) found that examiner's standardized ratings of inattentive, hyperactive, and impulsive behaviors during intellectual testing provided useful information about the child's ADHD features. Willcut, Hartung, Lahey, Loney, and Pelham (1999) discovered that ratings of inattentive, hyperactive, and disruptive behavior made by examiners during psychological testing of preschool children did provide a significant increment in the prediction of impairment above and beyond parent and teacher behavior ratings and other controlled variables, such as age, gender, IQ, and the presence of other psychopathology in addition to ADHD. In light of this significant increment, the findings suggest that clinician-based ratings of child behavior may, in fact, be useful as an additional indicator of ADHD. This study considered behavior ratings of preschool children only; thus, the authors note that future studies of clinic behavior in older children would provide a needed extension of their work.

Factors that likely influenced the findings of the above studies include the nature of the specific behaviors observed, the standardization of the observational measures, the type of other information that was available during assessment (Johnston & Murray, 2003) as well as the degree of shared variance between the predictor and outcome variables. Despite these potential confounds, the question of the incremental validity of multiple methods is an important one worth pursuing. Compared to other methods of

evaluating child behavior, measures such as naturalistic or clinic-based observation systems and continuous performance tests tend to be relatively more labor and cost-intensive. In light of the greater cost and time commitments inherent in these techniques, questions exist as to whether they offer unique information by adding incrementally to the assessment process. The current study will provide a framework for evaluating the empirical support for utilizing multiple methods (i.e. symptom-based ratings scales and clinic-based behavioral measures) in the assessment of ADHD.

Current Study

The purpose of this study is to examine the incremental validity of measures of child behavior in the context of a comprehensive clinical evaluation of ADHD. As indicated, there are few published studies that address the issue of incremental validity as it relates to the assessment of child and adolescent psychological disorders in general. The several studies that deal with the incremental validity of multiple methods in ADHD assessment have yielded conflicting results; thus, the question persists as to whether or not including additional measures of child behavior adds unique information above and beyond parent and teacher reports of ADHD symptoms. In their comprehensive review of issues related to incremental validity in the psychological assessment of children and adolescents, Johnston and Murray (2003) state that determining incremental validity is facilitated when the criterion is “objective, widely agreed upon, and not confounded with the information used in prediction” (p. 499). Although it would be of great interest to determine whether or not clinic-based measures of child behavior add value (above and beyond parent and teacher ratings of ADHD symptoms) in predicting a diagnosis of ADHD, it is difficult to arrive at a valid diagnosis without considering these measures (i.e. observational measures, DSM-IV symptom-

based rating scales). As such, when diagnosis is the criterion variable, it is likely confounded with the information used in prediction. Willcut, Hartung, Lahey, Loney, and Pelham (1999) lessened the impact of this confound by instead using functional impairment as the criterion variable. As described in an earlier section, children with ADHD have been shown to be impaired in a variety of areas, and it is this impairment that often brings affected children to the attention of service providers. It has also been suggested that indices of impairment are more predictive of outcome than are measures of ADHD symptom severity (Pelham, Fabiano, & Massetti, 2005). In a large scale study of school-aged youths, Angold, Costello, Farmer, Burns, and Erkanli (1999) found that individuals with symptomatic impairment were much more concentrated among service users compared to individuals with a diagnosis but no impairment. Impairment is also highly relevant in that the domains of functioning (e.g. adaptive, academic, social, home/family functioning) make for viable treatment targets (Pelham, Fabiano, & Massetti, 2005). The Willcut, Hartung, Lahey, Loney, and Pelham (1999) study, which utilized impairment as the criterion variable, operationalized this construct with various teacher, parent, and child measures, including global indices of impairment, measures of social competence and social functioning, and measures of academic achievement and IQ. It should be noted that since the time of this study, parent and teacher-report measures have been newly developed to assess ADHD-specific impairment across relevant domains of functioning. The Impairment Rating Scale (IRS; Fabiano et al., 2006) is of particular interest, due to its multidimensional nature, preliminary evidence of acceptable psychometric properties, and the availability of both parent and teacher forms.

The current study will therefore, using impairment as the criterion variable, seek to evaluate the incremental validity of measures of child behavior above and beyond parent and teacher ratings of ADHD. The study will also attempt to consider the impact of oppositional and defiant symptoms, which make up the most commonly occurring comorbid condition with ADHD. Exploring oppositional symptoms is of interest, especially since there is historically a very strong relationship between ODD and symptoms of hyperactivity and impulsivity (American Academy of Child and Adolescent Psychiatry, 2007). Based on previous research on the link between impairment and ODD symptoms (Fabiano et al., 2006), it is also likely that symptoms of oppositional and defiant behaviors will be very strongly related to impairment. The relationship between child demographic variables (such as age and IQ) and their relationship to impairment will also be considered. The specific aims of the current study are as follows:

Aim 1: To extend the findings of the Willcutt, Hartung, Lahey, Loney, and Pelham (1999) study by using a predominantly school-age (as opposed to preschool) sample of children to determine whether examiner ratings of child behavior during psychological testing provide a significant increment in the prediction of functional impairment beyond parent and teacher ratings of symptoms after controlling for the demographic variables that are found to correlate significantly with impairment. It is hypothesized that ratings of behavior in the clinic will be associated with measures of impairment after controlling for significant demographic characteristics and will provide unique information beyond parent and teacher ratings of ADHD symptoms.

Aim 2: To determine if child performance on a Continuous Performance Test (CPT), a laboratory measure of attention/impulsivity, provides a significant increment in

the prediction of functional impairment beyond parent and teacher ratings of symptoms after controlling for significant demographic characteristics. It is hypothesized that children's performance on the CPT will be significantly associated with measures of impairment after controlling for significant demographic variables and will provide new information above and beyond parent and teacher ratings of ADHD symptoms.

Aim 3: To determine the contribution of the examiner ratings of child ADHD behavior and child performance on the CPT in predicting functional impairment beyond parent and teacher ratings of symptoms after taking into account child oppositional/defiant characteristics and significant demographic variables. It is hypothesized that both the clinic-based examiner ratings and the performance index from the CPT will provide unique information as components of a comprehensive clinical evaluation. The relative contribution of these indices versus oppositional/defiant symptoms is an aim that is exploratory in nature.

CHAPTER 2 METHODS

Participants

Participants were drawn from cases seen for psychological evaluation at the Behavioral Institute of Atlanta (BIA) in Atlanta, GA. BIA is a group practice that provides assessment and treatment services for individuals and families displaying a range of problems (e.g. ADHD, Oppositional Defiant Disorder, anxiety and mood disorders).

Participants for the study were required to have a primary diagnosis of ADHD, based on whether or not the child met Diagnostic and Statistical Manual-Fourth Edition (DSM-IV; American Psychiatric Association, 1994) criteria for the disorder. Children, between the ages of 6 and 16, with both ADHD Combined Type and ADHD Inattentive Type were recruited, as these are the most frequently occurring ADHD cases seen in clinical settings. The diagnoses were based on data derived from parent interviews, information from the child's clinical history, information from parent and teacher behavior rating scales, behavioral observations, and the laboratory measures described in the current study. In order to appraise whether or not the child met requirements for impairment as specified by the DSM-IV, clinicians based this assessment on their impressions from the interview as well as from measures routinely completed during the course of the evaluation, including but not limited to measures of IQ, academic achievement, and scores from broadband measures of psychological functioning.

Participants were also considered for inclusion in the study if they met DSM-IV criteria for other disruptive disorders, including Oppositional Defiant Disorder (ODD) or Conduct Disorder (CD). It was appropriate to include children with these types of comorbid conditions, as ODD and CD are commonly found in children with ADHD (American

Academy of Child and Adolescent Psychiatry, 2007). Therefore, including these children was thought to add to the representativeness of the sample.

Participants were excluded from the study if they met DSM-IV criteria for Mental Retardation [i.e. they obtained a Full Scale IQ score of 70 or less on the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV; Wechsler, 2003)]. Participants were also excluded if they received a formal diagnosis of Learning Disability or an Axis I diagnosis other than the ones listed (ODD, CD) to ensure that the results of this study were specific to a sample of children with ADHD/other disruptive disorder. These specific criteria were also used because the excluded conditions can be expected to result in school impairment and potentially confound the relationship between measures of ADHD symptoms and the major dependent variable of the study, impairment.

The final sample consisted of the first 27 children with a diagnosis of ADHD who met the specified inclusion and exclusion criteria. Of this sample, 19 of these children met diagnostic criteria for ADHD Combined Type, and 8 of these children met diagnostic criteria for ADHD Inattentive Type. A majority of this sample (77.8%) was not on any kind of medication to treat his/her ADHD symptoms. Consistent with ADHD prevalence rates, a majority of the children were males: twenty (74.1%) individuals were males, and 7 (25.9%) individuals were females. The age of the children ranged from 6 to 16 ($M = 10.30$, $SD = 2.83$), and their reported Full Scale IQ from the WISC-IV ranged from 73 to 130 ($M = 104.52$, $SD = 13.68$). The IQ score of 73 at the low end of the range was thought to be an underestimate of the child's true functioning (due to severe attention deficits during testing) rather than a result of true Borderline intellectual abilities. For those about whom ethnicity information was provided, the ethnicity

breakdown of the sample included 19 (70.4%) Caucasians, 3 (11.1%) African Americans, and 2 (7.4%) Hispanic/Latin Americans. There were three children (11.1%) for whom ethnicity information was not available. Tables 2-1 and 2-2 provide detailed demographic information about the child sample and the parent respondents.

According to the obtained mean scores across administered measures (Table 2-3), most child participants were characterized as meeting the clinical cutoff score of T-Score \geq 65 for parent and teacher ratings of DSM-IV symptoms of inattention and hyperactivity/impulsivity. The mean parent and teacher ratings of DSM-IV ODD were elevated but not in the significant range. In addition, mean clinician ratings on the ADHD-related items of the Hillside Behavior Ratings Scale (HBRS) were strikingly similar to previously published data for HBRS scores in an ADHD sample (Willcut, Hartung, Lahey, Loney, & Pelham, 1999). Similarly, mean parent and teacher ratings on each version of the Impairment Ratings Scale (IRS), when rounded up to the nearest whole number, met the optimal cut-point of 3. This cut-off point was found by Fabiano et al. (2006) to exhibit the optimal predictive power across parent and teacher versions of the IRS such that a child who received a score of 3 or greater consistently met DSM-IV criteria for ADHD. The mean score on the auditory/visual computerized measure of attention (IVA CPT) was very close to the beginning of the Average range ($M = 89.08$; scores between 90 and 110 are considered “Average”), which suggests that the current sample, as a whole, scored fairly well on this measure. As one would expect given the inclusionary criteria for this study, the combination of mean scores across a majority of these measures was indicative of a sample with clinically significant ADHD characteristics.

Procedure

Institutional Review Board (IRB) approval was obtained prior to initiating the study. Parents whose children met inclusion criteria for the study were approached about their willingness to participate as well as their willingness to allow their children to participate in the study. Parents were given a detailed description of the study and were asked to sign an informed consent form. Most of the collected data consisted of measures that were routinely completed during the course of the evaluation. The evaluations themselves occurred either in the morning or afternoon over a two day time period, and the ratings scales were provided to parents and teachers by the first day that the child was seen. The routinely collected measures included parent and teacher versions of the third edition of the Conners Rating Scales (Conners 3; Conners, 2008) and parent and teacher versions of the Impairment Rating Scale (IRS; Fabiano et al., 2006). Of note, for the evaluations that were carried out during the summer or early fall of the school year, the child's previous year's teacher was requested to fill out the teacher-report ratings scales. Children also completed a computerized measure of attention, the Integrated Visual and Auditory Performance Test (IVA CPT; Sandford & Turner, 1995). Informed consent requested permission for the clinician to make ratings of each participant's attention and impulsivity during testing, as well as to videotape a portion of testing. Ratings were recorded using the Hillside Behavior Rating Scale (HBRS; Gittelman & Klein, 1985). The clinician completed this measure shortly after the administration of the IQ measure, the Wechsler Intelligence Scale for Children-Fourth Edition (WISC-IV, Wechsler, 2003). The WISC-IV was always the first administered test within the test battery. The particular task and setting were chosen as it was assumed that the administration of the IQ measure allowed the rater enough time to be able to

observe the behaviors of interest. In addition, the tasks within the intelligence measure include mildly stressful problem-solving tasks, which may approximate academic endeavors experienced by the child on a regular basis.

Inter-rater reliability of the clinician ratings during testing was established on approximately 30% of the total sample. Taped recordings of children completing the WISC-IV were provided to a laboratory research assistant. This assistant had received prior training in making observations and accurately filling out the Hillside Behavior Rating Scale. An inter-rater reliability analysis using the Kappa statistic was performed to determine consistency between the clinician and research assistant's ratings. The inter-rater reliability was found to be significant ($\text{Kappa} = 0.73$, $p < 0.001$), which is considered an acceptable level of agreement (Landis & Koch, 1977).

Measures

Conners 3rd Edition (Conners 3; Conners, 2008): The long version of both parent and teacher forms were used. The parent and teacher forms (possessing 108 and 113 items, respectively) assess primarily externalizing behaviors, including those related to ADHD and oppositional/defiant symptomatology. The directions requests parents (or teachers, given the particular form) to consider the child's behavior during the past month, and responses are given on a Likert scale, ranging from "Not at all true (Never, Seldom)," "Just a little true (Occasionally)," "Pretty Much True (Often, Quite a bit)" to "Very much true (Very often, Very frequently)." Strengths of the Conners rating scales include their large normative base, evidence of strong psychometric properties, and its supported factor structure (Conners, 2008). T-scores from the parent and teacher DSM-IV Hyperactive-Impulsive and the DSM-IV Inattentive subscales were of primary interest, as elevated scores on these subscales reflect above average correspondence

with DSM-IV diagnostic criteria for major subtypes of ADHD. Composite ODD scores, computed by summing parent and teacher DSM-IV Oppositional Defiant subscale scores, were also considered in follow-up analyses.

Impairment Rating Scale (IRS, Fabiano et al., 2006): The authors of the scale note that the IRS is a rationally derived instrument whose items reflect areas of functioning that are considered to be impaired in children with ADHD. The parent version covers seven domains of functioning, including relationship with peers, relationship with siblings, relationship with parents, academic progress, self-esteem, influence on family functioning, and overall impairment. The teacher version possesses six domains of functioning, which are relationship with peers, relationship with teacher, academic progress, self-esteem, influence on classroom functioning, and overall impairment. Raters are instructed to determine the severity of the child's impairment/need for treatment based on a continuum by placing an X on a line. For scoring purposes, the line is divided into seven equal segments. The position of the X represents a score between 0 (no problem/definitely does not need treatment or special services) and 6 (extreme problem/definitely needs treatment or special services). Average scores, used in the current study, were calculated by completing the appropriate permutation across domain scores. Both parent and teacher versions of the IRS have been shown to exhibit good temporal stability, strong correlations with other impairment ratings and behavior measures, and evidence of convergent and discriminant validity. Further, the IRS has been shown to contribute unique variance above and beyond ratings of ADHD symptoms when predicting future impairment as assessed by global impairment measures (Fabiano et al., 2006).

Integrated Visual and Auditory Performance Test (IVA, Sandford & Turner, 1995)

is a measure of visual and auditory attention. This Continuous Performance Task paradigm requires the participant to click a computer mouse button whenever he or she sees or hears the number “1” and to refrain from pressing the mouse when he or she sees or hears a “2.” As part of the administration protocol, each participant receives a standard set of instructions and completes a practice test prior to the real test. The IVA CPT presents auditory/visual stimuli and common/rare targets in a counterbalanced fashion that reportedly controls for fatigue and learning (Sandford & Turner, 1995). The IVA CPT’s scoring yields visual and attention quotients that have a mean of 100 and a standard deviation of 15. The Combined Attention Quotient, a measure that provides a general indicator of attention, was used in the current study. The IVA CPT has been found to be useful in differentiating children with ADHD from normative samples (Sandford & Turner).

Hillside Behavior Rating Scale (HBRS, Gittelman & Klein, 1985): This scale contains seven items on which observers rate a child’s behavior during testing. Within each item, the rater is asked to choose a descriptor (the number of descriptor choices ranges from five to seven) that best corresponds with the behavior that the child displays during testing. The three HBRS items that directly relate to symptoms of DSM-IV ADHD include motor activity, distractibility, and impulse control. The four areas that assess disruptive behavior in more general terms include frustration tolerance, cooperation, interest in tasks, and attention seeking. A total composite score is obtained by summing all seven HBRS items. The HBRS has been shown to possess satisfactory psychometric properties, with reliability values ranging from .68-.76,

evidence of an ability to discriminate children with and without ADHD, and sensitivity to the effects of stimulant medication (Willcutt, Hartung, Lahey, Loney, & Pelham, 1999). The above study utilized a composite ADHD score, computed by summing the three HBRS items that directly correspond to DSM-IV ADHD items, in their analyses of the HBRS. In an investigation of whether the utilization of a subset of HRBS items influenced the results, the authors found that the results were virtually identical in the two scenarios in which either the ADHD composite or HBRS total scores were used. This was likely due to the high correlation ($r = .96$) between the ADHD composite and total score. In light of this finding and to provide for a greater degree of variation, the total score was used in analyses addressing all current primary aims. As noted earlier, in order to provide reliability data, a research assistant was trained by the investigator to complete the HBRS based on child behavior portrayed in specific video segments obtained during testing. The video segments were selected from real-life clinic examples, illustrating varying degrees of inattentive, hyperactive, and disruptive behaviors. As there is presently no gold standard by which to judge the reliability of HBRS ratings, trainees' ratings were compared to those provided by the study investigator. Sufficient agreement (exact correspondence on at least 5 of the 7 items) was required on at least two measures before in vivo ratings were made. As previously indicated, the research assistant subsequently completed HBRS ratings on a larger subset of 8 children. Comparing these ratings to clinicians' ratings provided further support for the inter-rater reliability of the HBRS (Kappa agreement = .730).

Demographic Form: The parent-completed demographic form consisted of 15 questions asking about the child and family. Child-focused demographic information

included age, gender, grade level, classroom placement, ethnicity, psychological diagnoses, medical illness diagnoses, treatment services received (including psychological), and current medication regimen. Family-focused demographic information included age, gender, ethnicity, marital status, occupation, educational level and nature of the caregiver's relationship to the child.

Statistical Analyses

The current study used impairment as the criterion variable to evaluate the incremental validity of measures of child behavior (clinician ratings of child behavior during testing and child performance on the CPT) above and beyond parent and teacher ratings of ADHD. It was expected that the clinic-based measures would provide at least some new information to that provided by ADHD symptom ratings scales. The study also considered the relationship between oppositional/defiant symptoms and impairment, as ODD symptoms make up the most commonly occurring comorbid condition with ADHD. Prior to addressing the specific aims of incremental validity, initial correlational analyses were conducted to assess the relationship between hypothesized predictor variables (e.g. parent and teacher ratings of ADHD and ODD symptoms, HBRS ratings, and CPT scores) and parent and teacher ratings of impairment. Subsequently, hierarchical regression models were used to evaluate the incremental validity of the clinic-based measures of child behavior.

Analysis 1: First, consideration was given to whether age, gender, IQ, and/or medication status were independently related to child impairment, as indexed by ratings from the parent and teacher forms of the IRS. Those demographic and child characteristics found to be significant were included in the first step of a hierarchical multiple regression analysis to ensure that findings reflected a specific relationship

between HBRS ratings and scores of functional impairment. Of note, the impairment scores from parent and teacher versions of the IRS were considered in separate regression analyses as distinct dependent variables for all analyses. This was done in order to consider parents and teachers as unique informants, particularly given the very low level of correspondence between parent and teacher ratings of impairment ($r = .07$) in this sample. Measures of ADHD symptomatology, indexed by DSM-IV Inattentive and DSM-IV Hyperactive-Impulsive scores from parent and teacher forms of the Conners 3, were each entered as separate indices in the second step of the regression analyses to determine the association between these measures and impairment. Finally, HBRS total composite scores were entered into the third step to determine if these behavioral ratings during testing added significantly to the explained variance in IRS impairment scores.

Analysis 2: A second set of hierarchical multiple regression analyses were conducted to determine whether child performance on the IVA CPT added incrementally in predicting functional impairment. Again, the demographic and child characteristics that were significantly associated with impairment were entered into the first step of the equation to control for these variables. Parent and teacher reports of ADHD symptoms were entered in the second step of the regressions. Lastly, the Combined Attention Quotient of the IVA CPT was entered into the model to establish whether this index provided a significant increase in the explained variance of the IRS impairment scores.

Analysis 3: To explore the unique contribution of Oppositional-Defiant symptoms in predicting impairment, a final set of regression analyses was performed. The first step of the equations included relevant demographic variables and the ODD composite.

The second step included parent and teacher reports of ADHD symptoms. The IVA CPT Quotient and HBRS scores were entered in a final step only if these were found to be significant predictors of impairment in earlier analyses.

Table 2-1. Demographic characteristics of child participants

	N (%)	M	SD
Child Age			
ADHD (Total)	27	10.30	2.83
ADHD(Subtypes)			
Combined	19	9.37	2.54
Inattentive	8	12.50	2.27
Child Gender			
Boys	20		
Girls	7		
Child IQ		104.52	13.68
Child Ethnicity			
Caucasian	(70.4%)		
African Am.	(11.1%)		
Hispanic	(7.4%)		
Unidentified	(11.1%)		
Special Services			
No	20		
Yes	6		
Unidentified	1		
Medication Status			
Yes	5		
No	21		
Unidentified	1		

Table 2-2. Demographic characteristics of parent respondents

	N (%)
Parent gender	
Male	4
Female	23
Parent marital status	
Married	(81.5%)
Divorced	(3.7%)
Remarried	(14.8%)
Parent education	
Some college/AA	(7.4%)
College	(48.1%)
Masters or above	(33.3%)
Unidentified	(11.1%)

Table 2-3. Descriptive statistics for the administered measures

	<i>M</i>	<i>SD</i>
Parent IRS Average	2.52	1.29
Teacher IRS Average	2.76	1.45
Conners Parent Ratings		
Inattention	71.11	11.28
Hyperactivity/Impulsivity	65.59	14.77
Oppositional/Defiant	57.48	14.18
Conners Teacher Ratings		
Inattention	68.33	12.32
Hyperactivity/Impulsivity	66.30	17.23
Oppositional/Defiant	57.89	15.95
HBRS ADHD Ratings	6.44	2.69
IVA CPT Composite	89.08	21.34

Note: Higher scores on the IRS, Conners, and HBRS suggest more severe/clinical problems. Lower quotient scores on the IVA CPT suggest greater attention difficulties.

CHAPTER 3 RESULTS

Preliminary Analyses

The statistical package SPSS for Windows (SPSS Inc., 2008) was used for all statistical analyses. The data was first analyzed to determine the presence of outliers as well as possible deviations from normality. The standardized residuals for each variable of interest were computed in order to detect outliers. As none of the standardized residuals were more than three deviations from the mean, outliers did not emerge as a concern (Weinberg & Abramowitz, 2008). All cases were kept for consideration in subsequent analyses. In addition, the distributions for each of the variables met the regression assumption for normality (e.g. the skewness and kurtosis values were all within an acceptable range).

Table 3-1 shows a correlation matrix, which depicts the associations among variables of interest, including relevant demographic variables, symptom ratings, clinician ratings of child behavior during testing, and child performance on a computerized CPT. With respect to demographic variables, neither age nor Full Scale IQ was found to be significantly related to parent ratings of impairment. In addition, separate t-tests were run to examine the relationship between the categorical variables of gender and medication status to ratings of impairment. Neither of these factors related significantly to parent-rated or teacher-rated impairment. It can be noted that age did emerge as a significant predictor of teacher-rated impairment ($r = -.57$, $p <.01$). The direction of the relationship was such that teachers tended to rate younger children as more impaired than older children. Age was thus entered into subsequent regression analyses (as a demographic variable to be controlled for) when teacher

impairment was the dependent variable. Given their lack of significant associations with impairment, no other demographic variables were included in subsequent analyses.

Other notable correlations with parent ratings of impairment included parent ratings of inattention ($r = .72, p < .01$), parent ratings of hyperactivity ($r = .50, p < .01$), and ratings of oppositional/defiant behavior ($r = .65, p < .01$). More severe inattentive, hyperactive, and oppositional symptomatology was associated with higher parental reports of impairment. Clinician ratings of ADHD behavior during testing ($r = .20$) and child performance on the CPT ($r = .36$) were mildly to moderately associated with parent ratings of impairment. It should be noted, however, that instead of emerging as a negative association as one would expect, those children with higher levels of impairment within the home actually scored better on the computerized test of attention.

Teacher ratings of inattention ($r = .45, p < .05$), teacher ratings of hyperactivity ($r = .63, p < .01$), and ratings of oppositional/defiant behavior ($r = .53, p < .01$) were significantly associated with teacher ratings of impairment. The direction of the relationship was such that increased levels of inattentive, hyperactive, and oppositional symptomatology were associated with greater teacher reports of impairment. Children's ADHD behavior during testing ($r = .26$) and performance on the CPT ($r = -.25$) were only mildly to moderately correlated with teacher ratings of impairment, in the expected directions. Despite the non-significant mild to moderate level of the obtained correlations, HBRS and CPT ratings were retained in subsequent hierarchical regression analyses (described below), given the theoretical importance of these variables to the study.

The bivariate correlations also revealed that the clinician ratings of ADHD behavior during testing were significantly associated with age ($r = -.57, p < .05$), parent ratings of hyperactivity/impulsivity ($r = .51, p < .05$), as well as with oppositional/defiant symptoms ($r = .50, p < .01$). CPT scores were significantly associated with age ($r = .49, p < .05$) and moderately associated with teacher ratings of hyperactivity/impulsivity at a level that can be viewed as approaching significance in light of the moderate correlation ($r = -.35, p = .08$).

Primary Aims

Aim 1: To Determine the Incremental Validity of Ratings of ADHD Symptoms and Child Behavior During Testing in Predicting Functional Impairment

For the subsequent hierarchical regression analyses, relevant demographic variables, as described above, were entered into the first block of the equation. The predictor variables, either parent or teacher scores from the DSM-IV Inattention and Hyperactivity/Impulsivity subscales, were then entered into the next block. Finally, clinician ratings during testing (HBRS scores) were entered into the final block of the analyses.

Predicting parent-rated functional impairment

None of the demographic variables were found to be significantly related to parent-rated functional impairment. Therefore, only two blocks were used in this model. The overall regression model predicting parent-rated functional impairment was significant ($R^2 = .68, F [3,23] = 16.31, p < .001$). As can be seen in Table 3-2, the first block showed significant direct effects for parent ratings of inattention ($\beta = .66, t = 5.54, p < .001$) and parent ratings of hyperactivity/impulsivity ($\beta = .39, t = 3.30, p < .01$). Block two of the equation showed a non-significant direct effect for HBRS ratings ($\beta = -.12, t =$

$-.86$, $p = .40$). In summary, parent ratings of inattention most strongly predicted average parent ratings of functional impairment. Parent ratings of hyperactivity and impulsivity predicted parent-rated impairment to a moderate degree. Clinician ratings during testing were a non-significant contributor of unique variance to the regression model.

Predicting teacher-rated functional impairment

The overall regression model predicting teacher-rated functional impairment was significant ($R^2 = .52$, $F [4,22] = 6.03$, $p < .01$). Table 3-3 shows a significant negative effect for age ($\beta = -.56$, $t = -3.41$, $p < .01$) in the first block of the equation. Block two of the equation showed a non-significant effect for teacher ratings of inattention ($\beta = .19$, $t = 1.20$, $p = .24$) and a significant effect for teacher ratings of hyperactivity/impulsivity ($\beta = .37$, $t = 2.17$, $p < .05$). The final block showed that HBRS ratings did not significantly add to the regression equation ($\beta = -.03$, $t = -.15$, $p = .88$) in predicting teacher-rated functional impairment. Overall, when controlling for age, teacher ratings of hyperactivity and impulsivity emerged as the strongest predictor of teacher-reported impairment.

Aim 2: To Determine the Incremental Validity of Ratings of ADHD Symptoms and Child Performance on the Continuous Performance Test in Predicting Functional Impairment

For the subsequent hierarchical regression analyses, relevant demographic variables were entered into the first block of the equation. The predictor variables, either parent or teacher scores from the DSM-IV Inattention and Hyperactivity/Impulsivity subscales, were entered into the second block. The total score from the IVA CPT, representing a composite index of visual and auditory attention, was then entered into the final block of the analyses.

Predicting parent-rated functional impairment

As previously noted, none of the demographic variables were significantly related to parent-rated functional impairment; therefore, two blocks were used in this model. The overall regression model predicting parent-rated functional impairment was significant ($R^2 = .68$, $F [3,23] = 16.29$, $p < .001$). As shown in table 3-2, the first block showed a significant direct effect for parent ratings of inattention ($\beta = .63$, $t = 5.00$, $p < .001$) and parent ratings of hyperactivity/impulsivity ($\beta = .40$, $t = 3.23$, $p < .01$). Block two of the equation showed a non-significant direct effect for the IVA CPT total score ($\beta = .11$, $t = .85$, $p = .40$). Again, parent ratings of inattention and hyperactivity/impulsivity were the best predictors of parent-rated functional impairment. Children's performance on the CPT was a non-significant contributor of unique variance to the regression model.

Predicting teacher-rated functional impairment

The overall regression model predicting teacher rated functional impairment was significant ($R^2 = .53$, $F [4,22] = 6.28$, $p < .01$). Table 3-3 shows a significant negative effect for age ($\beta = -.56$, $t = -3.41$, $p < .01$) in the first block of the equation. Block two of the equation showed a non-significant effect for teacher ratings of inattention ($\beta = .19$, $t = 1.20$, $p = .24$) and a significant effect for teacher ratings of hyperactivity/impulsivity ($\beta = .37$, $t = 2.17$, $p < .05$). The final block showed that the IVA total score did not significantly add to the regression equation ($\beta = .12$, $t = .70$, $p = .49$) in predicting teacher-rated functional impairment. Similar to the other teacher model, teacher ratings of hyperactivity and impulsivity emerged as the strongest predictor of impairment, while the measure of attention from the CPT was non-significant.

Follow-up Aim: To Determine the Predictive Value of Oppositional Defiant Disorder Symptoms Relative to Other Variables in Predicting Functional Impairment

In light of the high correspondence between ODD symptoms and impairment ($r = .65$ for parent-rated impairment and $r = .53$ for teacher-rated impairment), ODD symptoms were entered into the first block of the equation to determine whether the presence of this variable would suppress the effects of other previously significant variables. Parent or teacher scores from the DSM-IV Inattention and Hyperactivity/Impulsivity subscales were entered into the second block of the equations. Given the lack of significant contributions of the HBRS ratings and the IVA CPT scores, these variables were not included in testing subsequent regression models.

Predicting parent-rated functional impairment

The overall model predicting parent-rated impairment was significant ($R^2 = .75$, $F [3,23] = 23.35, p < .001$). As shown in Table 3-4, block one showed a significant direct effect for ODD symptomatology ($\beta = .65, t = 4.31, p < .001$). Block two showed a significant direct effect for parent ratings of inattention ($\beta = .58, t = 5.39, p < .001$). Unlike the previous parent models, the effect for parent ratings of hyperactivity/impulsivity was no longer significant ($\beta = .17, t = 1.30, p = .21$). The model suggests that ODD symptomatology and inattention were the strongest predictors of parent-rated functional impairment, suppressing the effects of parent reports of hyperactivity/impulsivity.

Predicting teacher-rated functional impairment

The overall model predicting teacher-rated impairment was significant ($R^2 = .57$, $F [4,22] = 7.25, p < .01$). As shown in Table 3-5, block one showed an almost significant direct effect for ODD symptomatology ($\beta = .34, t = 1.92, p = .07$) as well as a

significant negative effect for age ($\beta = -.42$, $t = -2.40$, $p < .05$) Block two showed a non-significant direct effect for teacher ratings of inattention ($\beta = .16$, $t = .99$, $p = .33$) and a significant effect for teacher reports of hyperactivity/impulsivity ($\beta = .35$, $t = 2.09$, $p < .05$). In summary, children's younger ages, the presence of ODD symptoms, and higher teacher ratings of hyperactivity/impulsivity contributed the most to teacher-rated functional impairment.

Table 3-1. Correlations among variables of interest

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age	--	-.17	.20	-.33	-.16	-.37	-.44*	-.57*	.49*	.09	-.57**
2. IQ		--	-.04	.01	-.02	.17	-.02	-.25	.27	-.12	.00
Parent Ratings											
3. Inattention			--	.16	.13	-.15	.29	.14	.32	.72**	-.16
4. H/I				--	-.02	.38*	.62**	.51*	.11	.50**	.26
Teacher Ratings											
5. Inattention					--	.44*	.25	-.07	-.06	.25	.45*
6. H/I						--	.30	.17	-.35	.01	.63**
7. ODD composite							--	.50**	.09	.65**	.53**
8. HBRS								--	-.27	.20	.26
9. IVA CPT									--	.36	-.25
10. Parent IRS										--	.07
11. Teacher IRS											--

* $p < .05$, ** $p < .01$

Table 3-2. Hierarchical regression analyses predicting parent-rated functional impairment

DV: Parent IRS	β	B	t	$R^2 \Delta$	Total R^2
Model 1					
Block 1					
Inattention	.66	.08	5.54**		.67
Hyperactivity/Impulsivity	.39	.03	3.30**		
Block 2					
HBRS Ratings	-.12	-.03	-.86	.01	.68
Model 2					
Block 1					
Inattention	.63	.07	5.00**		.67
Hyperactivity/Impulsivity	.40	.03	3.23**		
Block 2					
IVA CPT Composite	.11	.01	.85	.01	.68

**p < .01

Table 3-3. Hierarchical regression analyses predicting teacher-rated functional impairment

DV: Teacher IRS	β	B	t	$R^2 \Delta$	Total R^2
Model 1					
Block 1					
Age	-.56	-.28	-3.41**		.32
Block 2					
Inattention	.19	.02	1.20		
Hyperactivity/Impulsivity	.37	.03	2.17*	.20	.52
Block 3					
HBRS Ratings	-.03	-.01	-.15	.00	.52
Model 2					
Block 1					
Age	-.56	-.28	-3.41**		.32
Block 2					
Inattention	.19	.02	1.20		
Hyperactivity/Impulsivity	.37	.03	2.17*	.20	.52
Block 3					
IVA CPT Composite	.12	.01	.70	.01	.53

*p < .05, **p < .01

Table 3-4. Follow-up hierarchical regression analysis predicting parent-rated functional impairment

DV: Parent IRS	β	B	t	$R^2 \Delta$	Total R^2
Block 1					.43
ODD Composite	.65	.04	4.31**		
Block 2				.32	.75
Inattention	.58	.07	5.39**		
Hyperactivity/Impulsivity	.17	.02	1.30		

** $p < .01$

Table 3-5. Follow-up hierarchical regression analysis predicting teacher-rated functional impairment

DV: Teacher IRS	β	B	t	$R^2 \Delta$	Total R^2
Block 1					.41
Age	-.42	-.21	-2.40*		
ODD Composite	.34	.02	1.92		
Block 2				.16	.57
Inattention	.16	.02	.99		
Hyperactivity/Impulsivity	.35	.03	2.09*		

* $p < .05$

CHAPTER 4 DISCUSSION

Determining empirically supported assessment procedures for diagnosing ADHD in children is an important goal for applied research. Current guidelines highlight the necessity of including multiple informants (parents and teachers) and settings (home and school) in the assessment process. Multiple methods (e.g. paper and pencil questionnaires, computerized measures of attention) are also commonly used by psychologists as they conduct ADHD evaluations. While the different approaches tend to vary in cost and the amount of time taken for administration, there is little research concerning the utility of adding additional methods to an existing assessment strategy. As the variety and scope of assessment procedures expand, this concept of incremental validity has been cited as increasingly important to explore (Hunsley & Meyer, 2003; Johnston & Murray, 2003). Yet, as Hunsley and Meyer note, there has been little systematic effort to explore the incremental validity of psychological assessment procedures.

The few studies that have looked at the incremental validity of multiple methods in ADHD assessment have yielded conflicting results. For example, Lobitz and Johnson (1975) found that neither clinic based nor home observations of child behavior added significantly to the optimal classification rates offered by parent reports. Gathje, Lewandowski and Gordon (2008) discovered that child commission errors on a computerized measure of attention explained a very small amount of unique variance in a Global Impairment Index, composed of impairment scores across a variety of measures. In contrast, other studies have supported the utility of clinic-based methods of assessing ADHD behavior during testing as offering useful information about the

child's ADHD features (Glutting, Robins, & de Lancey, 1997). One such study found that ratings of inattentive, hyperactive, and disruptive behaviors made by examiners during psychological testing of preschool children did provide a significant increment in the prediction of impairment above and beyond parent and teacher behavior ratings (Willcut, Hartung, Lahey, Loney, & Pelham, 1999). The mixed findings regarding the incremental validity and uniqueness of clinic-based measures make the current investigation relevant, especially in light of the time and financial resources required to employ these types of instruments.

The current study sought to evaluate the incremental validity of multiple assessment methods, which included symptom-based parent and teacher ADHD ratings, behavioral observations of the child during testing, and child performance on a combined auditory/visual computerized measure of attention. While it would be of interest to determine whether the above measures add incremental value in predicting a diagnosis of ADHD, it is difficult to arrive at a valid diagnosis without considering these very symptom-based, observational, and performance-based instruments. Impairment was selected as the criterion variable not only to avoid this confound but also because it is functional impairment that often brings children to the attention of service providers. Current research also suggests that impairment is highly predictive of outcome and warrants an important focus in ADHD assessment. A growing body of literature highlights the necessity of including formal assessments of impairment in ADHD evaluations (Fabiano et al., 2006; Pelham, Fabiano, & Massetti, 2005). The use of the newly developed Impairment Ratings Scale (Fabiano et al.), which has shown good preliminary reliability and validity as a separate standardized measure of impairment, is

an improvement over previous studies, which have looked at this construct using a variety of post-hoc indices that are not ADHD specific. The current study, therefore, using impairment as the criterion variable, was designed to evaluate the incremental validity of measures of child behavior (clinician ratings of child behavior during testing and child performance on the CPT) above and beyond parent and teacher ratings of ADHD. It was expected that the clinic-based measures would provide some new information above and beyond the ADHD symptom rating scales. As an additional exploratory aim, the study also considered the impact of oppositional and defiant symptoms, which are commonly observed in children with ADHD

The study included a sample of 27 children who met diagnostic criteria for ADHD and who did not meet criteria for a learning, mood, or other Axis I disorder apart from a disruptive behavior disorder. Mean scores across parent and teacher rating scales suggested that most children in the sample met the clinical cut-off criteria for DSM-IV Inattention and DSM-IV Hyperactivity/Impulsivity. Mean DSM-IV Oppositional Defiant scores were elevated, but not in the clinically significant range. Further, mean scores from the parent and teacher Impairment Ratings Scale and from the Hillside Behavior Rating Scale suggested clinical levels of dysfunction. It should be noted that the inclusion of an ADHD sample, as opposed to a combined (ADHD plus a nonclinical) group, was appropriate for addressing the current study's aims, as it is within this type of clinical sample that measures such as the CPT are most commonly used. Enough variability was present in the scores such that the data met required assumptions for normality.

Preliminary Analyses

First, bivariate correlations were run to determine the relationship among variables of interest, including relevant demographic variables, symptom ratings, clinician ratings of child behavior during testing, and child performance on a computerized CPT. Parent ratings of ADHD and ODD symptoms were most strongly related to parent-rated impairment. Age, teacher ratings of ADHD, and ODD symptoms were significantly correlated with teacher-rated impairment. Clinic-based measures of ADHD-related behavior, which included clinician ratings of behavior during testing and child performance on the CPT, were only mildly to moderately associated with both impairment indices. The bivariate correlations also revealed that the clinician ratings were significantly associated with age and parent ratings of hyperactivity/impulsivity as well as with oppositional/defiant symptoms. CPT scores were significantly associated with age and moderately associated with teacher ratings of hyperactivity/impulsivity at a level that approached significance. These significant associations indicate some degree of initial overlap across methods. The recurring appearance of age as being significantly associated with a number of variables suggests that younger children show the most overt symptoms of inattention and hyperactivity/impulsivity, while older children may be more subtly affected by their ADHD, at least in the one-on-one clinic setting.

Parent/Teacher Ratings of ADHD Symptoms and Impairment

In order to consider specific aims of the study pertaining to the incremental validity of ADHD assessment procedures, hierarchical regressions were conducted. Results of regression analyses showed that parent reports of inattentive and hyperactive/impulsive behaviors accounted for a significant percent of the variance in parent-rated impairment. Parent ratings of inattention were relatively more predictive of impairment than parent

ratings of hyperactivity and impulsivity, although both indices of ADHD symptoms demonstrated large effect sizes. With teacher ratings of impairment as the criterion variable, age and teacher ratings of hyperactivity and impulsivity explained a significant portion of the variance. Teacher ratings of inattention did not contribute to the model at a level that was statistically significant. Taken together, these findings are consistent with studies that have found ADHD symptomatology and impairment to be moderately associated, with most bivariate correlations ranging from .20 to .50 (Gathje, Lewandowski, & Gordon, 2008; Fabiano et al. 2006). Findings also supported the assumption that different aspects of the child's presentation and behavior are most salient depending on whether the rater is a parent or classroom teacher. Teachers likely notice age-specific deviations because they have a broader experience base from which to judge behaviors (Murray et al., 2007). Also, teachers may be more apt to notice and report hyperactive-impulsive behaviors, which are more concrete, readily observable, and may disrupt classroom activities, while parents have a range of settings from which to make ratings on both hyperactive and inattentive behaviors. The degree to which teachers observe inattentive behavior may be influenced by the degree to which specific structured aspects of classroom activity are enforced. That the two main factors of ADHD were differentially related to impairment is not surprising, since the individual symptoms that comprise the factors have varying positive and negative predictive powers that are rater specific (Power, Costigan, Leff, Eiraldi, & Landau, 2001). One implication for ADHD assessment, particularly with the impending development of the DSM-V, is how the clinician should weight and combine specific ADHD symptom ratings from parents and teachers.

Parent/Teacher Ratings of ODD Symptoms and Impairment

Ratings of oppositional/defiant symptomatology were highly predictive of parent and teacher-rated impairment ($\beta = .65$ for the parent model, and $\beta = .34$ for the teacher model). In most cases, the unique predictive value of ODD symptoms exceeded that of ratings of hyperactivity and inattention. Conceptually, it makes sense that these symptoms would be highly associated with the “problem/need for treatment” response anchor within the Impairment Rating Scale. ODD symptoms such as temper tantrums, argumentativeness with adults, and rule-breaking, are likely the most readily recognizable by raters, closely followed by hyperactive/impulsive symptoms. The high level of correspondence between ratings of ODD symptoms and symptoms of hyperactivity/impulsivity both in the current sample ($r = .62$) and in a much large sample ($r = .67$) from which the Conners-3 was normed (Conners, 2008) help explain why these two dimensions of child behavior showed similar patterns of significance in the regression models. In fact, in the parent model, ODD symptoms and parent-rated symptoms of hyperactivity and impulsivity were so highly interrelated that the effect of the latter became insignificant when the ODD variable was entered first into the model. One could conclude that it is these more overt oppositional and hyperactive behaviors that tend to bring families into a psychologist’s office for a comprehensive evaluation. Other studies also attest to the idea that deviant and impulsive behaviors are highly associated with a perceived need for treatment services (Rowe, Maughan, Costello, & Angold, 2005). Angold and Costello (1996) found that children with as few as two or three ODD symptoms involving psychosocial impairment exhibited high rates of psychiatric service utilization and psychiatric morbidity. Thus, children with both ADHD and ODD symptoms are most likely to be identified as having significant difficulties

functioning at home, with peers, and in the classroom. It is arguable that these children require the most immediate, comprehensive, and long-lasting treatment plans.

Clinicians' Ratings During Testing

Contrary to expectations, clinician ratings on the HBRS during testing did not provide a significant increment in predicting impairment above and beyond parent and teacher ratings of ADHD symptoms. Indeed, preliminary correlational analyses did not provide support for an initial strong relationship between these clinician ratings and parent/teacher ratings of impairment. The negative findings are consistent with the existing literature that has questioned the external validity of clinic-based based observations (Lobitz & Johnson, 1975; Sleator & Ullmann, 1981; Edwards et al., 2005). While there is intuitive appeal for the idea that test behaviors reflect enduring characteristics of child behavior, this assumption has been called into question. One study, which conducted a meta-analysis investigating the ecological validity of test observations, reported very conservative or negligible predictive values (average $r = .18$) (Glutting, Youngstrom, Oakland, & Watkins, 1986). With regards to ADHD, findings pertaining to the general diagnostic utility of clinic-based observations are mixed. A 2005 study (Edwards et al.) found that clinician ratings of child behavior during standardized IQ and achievement testing were related to parent but not to teacher ratings of ADHD behaviors. The relationship between clinician and parent ratings was much stronger for hyperactive and impulsive behaviors than it was for inattentive behaviors. Interestingly, this was borne out in the current study, in which the HBRS ratings were significantly associated with parent reports of hyperactivity/impulsivity ($r = .51, p < .01$) but not parent ratings of inattention. Also similar to the above 2005 study, no significant associations were found between clinician ratings during testing and

teacher ratings of ADHD behaviors. The lack of correspondence between clinic-based observations and teacher ratings provides an important cautionary point, particularly because some surveys have found that physicians often rely on their own observations of child behavior during the office visit to make diagnostic decisions about ADHD (Copeland et al., 1987). Clinic-based ratings are certainly not a substitute for gathering cross-situational information about a child's behavior from both parents and teachers.

One relevant question regarding clinician ratings of ADHD behavior during testing is the following: if these ratings are not significantly related to overall parent or teacher-rated impairment and are limited in their generalizability, what is it that they predict? The study by Willcutt, Hartung, Lahey, Loney, and Pelham (1999) used a variety of very specific indices of impairment (from a variety of measures) in their regression models and found that HBRS scores were predictive of teacher and peer reports of social discord, above and beyond ratings of ADHD symptomatology. While the design of the current study was to consider average impairment as opposed to specific indices, the researcher did go back and enter each item of the parent and teacher impairment scale to consider the relationship of clinician ratings to individual domains of child functioning. Most HBRS incremental validity findings remained negligible; however, HBRS ratings were found to provide a more substantial increment in the degree of variance explained when predicting teacher ratings of specific aspects of social impairment (item: "How the child's problem affect his or her relationship with other children") [*semipartial r = .12*, with semipartial correlations close to .15 at this point in a hierarchical regression being considered clinically meaningful (Hunsley & Meyer, 2003)]. This result, combined with the 1999 study findings, tentatively suggests that when a child shows overt ADHD

symptomatology in the office setting, he or she is likely to demonstrate social impairment among their peers and teachers as well.

Another line of research has focused on the intrasession validity of test observations; that is, the strength of association between test observations of behavior and other measures of formal test scores that are given around the same time. A summary of research in this area suggests that observations of child behavior during testing possess moderate and meaningful levels of intrasession validity (Glutting, Youngstrom, Oakland, & Watkins, 1996). Research has also suggested that standardized ratings of children's inattentive and avoidant behaviors during testing can affect the magnitude of their IQ scores (Glutting, Robins, & de Lancey, 1997). In the current sample, an exploration of correspondence of behavior ratings with other concurrent measures revealed moderate relationships. For example, HBRS ratings correlated moderately with children's working memory index scores from the IQ test ($r = -.40$) and modestly with children's performance on the IVA CPT ($r = -.27$). Due to sample size constraints, the above correlations did not quite reach significance. Still, these associations were somewhat higher than the cross-situational associations with average parent and teacher-rated impairment, teacher ratings of inattention and hyperactivity/impulsivity, and parent ratings of inattention. The primary value, then, of behavior observations during testing seems to be the clinician's ability to gauge behavioral impact upon other measures completed by the child during the evaluation. Standardization and the provision of norms for behavior ratings scales such as the HBRS are worth pursuing. Further development of such measures would help clinicians

quantify their argument for why a child's behavior may have negatively impacted his or her testing scores.

Children's Performance on the Continuous Performance Test

Also contrary to expectations, children's performance on the IVA CPT did not provide a significant increment in predicting impairment above and beyond parent and teacher ratings of ADHD symptoms. Initial correlational analyses did not provide support for a significant link between CPT scores and parent or teacher-report measures of impairment. CPT scores were, however, significantly associated with age and moderately associated with teacher ratings of hyperactivity/impulsivity at a level that approached significance. The appeal of continuous performance tests is their grounding in children's actual behavior, which can be directly measured and quantified. Parameters from continuous performance tests have been found to be correlated with ADHD symptoms generally (i.e. across symptom domains), and most all CPT manuals attest to the ability of the test to differentiate between ADHD and normal control groups (Epstein, Erkanli, Conners, Klaric, Costello, et al., 2003). Information regarding the sensitivity, specificity, and incremental validity of CPT measures is sparse, however. The data that is available suggest that none can be used with confidence for diagnostic decision-making, either alone or in conjunction with other assessment procedures (Rapport, Chung, Shore, Denney, & Isaacs, 2000). The authors of the latter study point out that when considering results from a laboratory measure of attention, one does not know if deviant scores are due to inattention or from other cognitive deficits such as visual-perceptual difficulties and/or working memory problems. Similar to clinician's judgments of children's ADHD behavior during testing, the ecological validity of CPT measures has been called into question. Studies suggest little overlap between CPT

outcome measures and parent/teacher ADHD ratings scales (Corkum & Siegel, 1993; Alloway et al., 2009). These studies also point out that many children who perform well on the CPT do, in fact, meet diagnostic criteria for ADHD. To reinforce this point, approximately 30% of the current sample (in which all children received a diagnosis of ADHD) achieved overall Attention Quotients that were 100 or better (with 100 considered exactly “Average”). Interestingly, when compared to all other variables, age showed the highest association with CPT performance in this sample ($r = .49$) such that older children exhibited better combined auditory/visual attention scores. It appears that children acquire self-modulation and behavioral control as they age, which may make the norm-referencing of CPTs for adolescents and adults less precise. Future studies should help clarify this issue.

Given that CPTs have not consistently been found to relate to parent and teacher ratings of ADHD symptoms or to overall parent and teacher reports of impairment, there needs to be a serious examination into the costs versus the benefits of utilizing such measures during routine ADHD evaluations. Depending upon the model, the cost of purchasing a computerized test of attention can range from 500 to over 1,000 dollars. Clinicians must consider other cost-efficient alternatives that show signs of promising ecological validity and concordance with children’s day-to-day behaviors and functioning. In a study that looked at executive functions in adolescents with ADHD (Toplak, Bucciarelli, Jain, & Tannock, 2009), researchers found that only a small amount of unique variance in predicting ADHD status was attributable to performance measures, while a bulk of the variance was attributable to parent and teacher ratings on the Behavior Rating Inventory of Executive Functioning (BRIEF; Gioia, Isquith, Guy, &

Kenworthy, 2000). A growing body of evidence suggests that ratings scales that tap into executive processes (such as planning and organizational skills) are clinically relevant. Certainly ratings scales are less expensive and more efficient to administer in the context of ADHD evaluations. As an extension of the current study, one might consider the incremental validity of a measure like the BRIEF in predicting average levels of psychosocial impairment.

Limitations and Future Directions

The current study is not without its limitations. It would be desirable to carry out the investigation with a larger sample size. Despite this limitation, significant correlational findings did emerge between a number of collected measures. There were several moderate correlations that might have been significant with a larger sample. Significant main effects for parent and teacher ratings of ADHD and ODD were also found in the incremental validity analyses utilizing hierarchical regressions. The small effect sizes obtained for the clinic-based measures of child behavior (the HBRS and IVA CPT) suggest that even with many more participants, significant findings for these particular methods of capturing ADHD behavior would not be likely. The small sample size speaks to the logistical challenges of restricting the inclusion criteria to children who met diagnostic criteria for ADHD or ADHD plus ODD/CD. This methodological decision was made in order to ensure that the primary influence of overall impairment was ADHD/other disruptive disorder and not a learning, mood, or anxiety disorder. A fair number of individually screened children failed to meet inclusion criteria because of the presence of comorbid learning disabilities. Indeed, Pliszka, Carlson, and Swanson (1999) estimated that up to 25-35% of children with ADHD also have learning disabilities. Most children referred for evaluations are likely identified because of the

greater level of impairment than behavioral plus significant academic underachievement difficulties present. Despite the recruitment challenges, a larger sample of children who meet the specified inclusionary/exclusionary criteria would be helpful to better sort out the influence of variables such as medication status, ADHD type, and gender on impairment levels. The small sample made it impossible to examine impairment levels by group. Beyond the methodological consideration of sample size, it would be desirable to have a higher degree of control over factors such as the time frame for recruiting participants (e.g. limit participants to those seen during the middle of the school year so that all parent and teacher ratings as well as performance-based measures can be completed concurrently).

Another important limitation of this study relates to the idea of what Hunsley and Meyer (2003) describe as “the criterion problem” in incremental validity research. Generally, the criterion must be reliable. Along this vein, the authors note that aggregate variables make superior and more reliable criterion variables over individual indicators. For this reason, an average impairment index was selected as the dependent variable as opposed to individual domains of psychosocial impairment. Another important point the authors make is that relationships between predictor and criterion variables may be artificially elevated if they are from the same source. The same could be said if they are obtained by the same method (e.g. paper and pencil questionnaires). In the current study, both ADHD symptom measures and impairment measures were collected from parents and teachers. It is plausible that method variance may have contributed to some degree to the significant findings in the study. While this may have been the case, the obtained findings are precisely what one would

expect to find; namely that increased levels ADHD symptomatology are related to increased levels of impairment. It is also possible that the potential confound of method variance made it more difficult for the clinic-based measures of child behavior to demonstrate unique incremental validity. A future direction, then, would be to methodologically define either symptoms or impairment in a distinct manner. For example, an alternative approach of capturing ADHD symptoms might be for observers to quantify specific symptoms, such as the frequency of classroom interruptions and incidences of forgotten homework, both at home and at school over a period of time. The use of an observational system such as the COCADD (Atkins, Pelham, & Licht, 1988) would be one such data collection technique about which it would be helpful to acquire incremental validity information in the future.

A discussion of the criterion variable, impairment, raises issues regarding the role of this construct in diagnosing ADHD. Pelham, Fabiano, and Massetti (2005) discussed limitations of the most common methods of diagnosis (i.e. symptom checklists) by saying that “the symptom is not informative for treatment without knowledge of the impaired functioning that it reflects and its context” (p. 468). The authors argue that a focus on impairment, rather than symptoms, may help improve children’s functioning in the long run. The current study and other studies have found modest to moderate correlations between ADHD symptoms and psychosocial impairment. The modest associations suggest a great deal of unexplained variance in the construct of impairment. Researchers should continue to look into other potential factors that influence impairment. Another practical future direction is to identify the role that impairment ought to play in diagnostic decision-making in general. Evidence suggests

that the rates of ADHD diagnosis change substantially depending on the degree to which clinicians do or do not use formal measures of impairment (Gathje, Lewandowski, & Gordon, 2008). Without specific guidelines about how to incorporate the construct of impairment, diagnostic decision-making is likely to continue to vary by clinician.

Summary

In summary, the current findings revealed significant associations between parent and teacher reports of inattentive, hyperactive, and oppositional/defiant symptoms and impairment. Further, the general findings from this study suggest that the clinic-based measures used in this investigation did not add incrementally to information gained from parents and teachers in predicting ADHD-specific impairment. The small sample size and methodological considerations temper the generalizability of the findings; however, many of the specific effect sizes are consistent with those from other studies with larger sample sizes. One plausible explanation of why the clinic-based measures did not strongly relate to impairment is that children with ADHD tend to behave more appropriately in the context of one-on-one testing situations due to demand characteristics. The activities and tasks involved in comprehensive psychological evaluations are usually novel for the child, and the pace of presentation is fairly quick with an examiner who may differentially reinforce appropriate behavior. Also, when an examiner is present to redirect and engage a child, he or she may be less likely to wander from the task or to act out. Data suggest that when children do show inattentive, hyperactive, and impulsive behaviors in a more controlled setting such as the clinic (a lower base rate occurrence according to the literature), these symptoms should be heeded as true signs of difficulty. Clinicians' observations of off-task

behaviors during individual testing are predictive of social impairment across other situations as well, such as at school.

The current findings offer support for the notion that clinicians should rely heavily on symptom checklists as the most cost and time-efficient means of diagnosing ADHD. In their article on evidence-based assessment of ADHD, Pelham, Fabiano, and Massetti (2005), arrived at the above conclusion and conjectured that day-long, clinic-based ADHD evaluations may not provide incremental validity for treatment planning purposes above and beyond parent and teacher rating scales. The authors note that in addition to collecting information from parent and teachers about ADHD symptoms, a clinical interview or intake questionnaire is necessary to obtain the age of onset as well as to form a basis from which to rule in or rule out other disorders. They argue that beyond these core requirements, information about the incremental validity of available combinations of ADHD assessment approaches is sorely needed to help answer questions about cost-effectiveness and value. The results of the present study and other studies question the ecological validity, and indeed the incremental validity, of measures of clinic-based behavior such as the ones employed here. Taken together, the results call for a strong reliance on assessment measures and methods that tap the child's everyday attention, impulsivity and activity level. This translates into symptom checklists, real-world observation of behavior, and measures of impairment (Pelham, Fabiano, & Massetti). As indicated, experts assert that psychologists should be focusing *most* on measuring and quantifying impairment, given its relevance to selecting appropriate targets for behavior change in treatment and its high correspondence with long-term outcome. Continued exploration of what best accounts for and influences

functional impairment across home and school settings is an important research goal.

For example, the current study provides support for targeting comorbid oppositional

symptoms, as well as ADHD symptoms, given their strong, unique link to impairment.

Future research that sheds light on those aspects of child behavior that are most highly

associated with impairment, as well as the context in which these behaviors occur, will

be valuable to both the study and practice of ADHD assessment.

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BIOGRAPHICAL SKETCH

Lindsay McAlister Stewart was born in 1981 in Jacksonville, Florida. She received a Bachelor of Arts, with distinction, from the University of Virginia, where she double majored in psychology and Spanish. Lindsay earned a Master of Science in clinical psychology in 2005 from the University of Florida and went on to complete her pre-doctoral internship at the Kennedy Krieger Institute/Johns Hopkins School of Medicine during the 2007-2008 year. She and her husband currently reside in Atlanta, Georgia.