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The Validity of the ADHD Section of the Diagnostic Interview Schedule for Children

Ann M. McGrath
Western Michigan University

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**THE VALIDITY OF THE ADHD SECTION OF THE DIAGNOSTIC
INTERVIEW SCHEDULE FOR CHILDREN**

by

Ann M. McGrath

**A Dissertation
Submitted to the
Faculty of The Graduate College
in partial fulfillment of the
requirements for the
Degree of Doctor of Philosophy
Department of Psychology**

**Western Michigan University
Kalamazoo, Michigan
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THE VALIDITY OF THE ADHD SECTION OF THE DIAGNOSTIC INTERVIEW SCHEDULE FOR CHILDREN

Ann M. McGrath, Ph.D.

Western Michigan University, 1999

The purpose of this study was to learn more about the validity of the ADHD portion of the NIMH-DISC IV. In order to accomplish this goal, 58 youth participants were divided into three groups: (1) subjects who met criteria for ADHD based upon both the youth and the caretaker versions of the DISC; (2) subjects who met criteria for ADHD based upon the caretaker DISC, but not according to the youth DISC; and (3) subjects who did not meet criteria for ADHD according to either the youth or the caretaker DISC. Subjects in these groups were compared across parent checklists, teacher checklists, and adolescent checklists. Also, clinician diagnosis and several independent measures of behavior, such as a lab task, behavioral output as measured by an activity monitor, and a structured observation were compared across groups. Results indicated that both adult and youth report on the DISC agreed with clinician diagnosis, and that adult report, teacher report, and activity monitor data were most concurrent with DISC group placement.

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CHAPTER I

INTRODUCTION

Attention-Deficit/Hyperactivity Disorder (ADHD), one of the most common childhood diagnoses, is currently estimated to occur in at least 3–5% of school age children (APA, 1994) and accounts for up to half of the referrals to psychiatric clinics in North America (Cohen, Riccio, & Gonzalez, 1994). ADHD involves developmentally inappropriate degrees of inattention, impulsivity, and overactivity (Barkley, Anastopoulos, Guevremont, & Fletcher, 1991). Although the diagnostic criteria remain constant for this disorder throughout early childhood, adolescence, and adulthood, there is debate among professionals as to whether the symptoms of the disorder manifest similarly throughout these different phases of life, especially moving from childhood into adolescence (Barkley et al., 1991; Gittelman & Mannuzza, 1985). There is also debate as to what best characterizes the comorbidity with ADHD during the teen years (Barkley et al., 1991; Gittelman, Mannuzza, Shenker, & Bonagura, 1985). Because of these concerns, a thorough assessment of ADHD may be especially important during the adolescent phase of life.

In order to complete an assessment of ADHD during adolescence, most researchers call for the use of a multi-method, multi-informant process (Achenbach, McConaughy, & Howell, 1987; Adams, McCarthy, & Kelley, 1995; Barkley, 1987; DuPaul, Guevremont, & Barkley, 1991; Shelton & Barkley, 1994). This type of assessment usually includes parent, teacher, and child interviews, as well as parent

and teacher ratings of child behavior, laboratory measures, direct observation and child self-report forms (Barkley, 1987).

When an interview is to be conducted, a structured, standardized interview is recommended (Barkley, 1987). The Kiddie-Schedule for Affective Disorders and Schizophrenia (K-SADS; Puig-Antich & Chambers, 1978), the Diagnostic Interview for Children and Adolescents (DICA; Herjanic, Brown, & Wheatt, 1975), and the Diagnostic Interview Schedule for Children (DISC; Costello, Edelbrock, Kalas, Kessler, & Klaric, 1982) were all developed for use with adolescents and their parents to assess a large spectrum of difficulties, including ADHD and related behaviors. All three of these instruments were developed with a child form and an adult form of the structured interview.

The K-SADS was developed by researchers in childhood depression (Hodges, 1993). The authors of the K-SADS recommend that trained clinicians be used to administer the interview, unlike the DICA or the DISC, which can be administered by lay interviewers. Clinicians are recommended because the K-SADS requires that in addition to the interview the administrator consider all other available information and decide the appropriate weight to give to the youth and caretaker report before arriving at a diagnostic decision. Diagnoses generated by the K-SADS have been found to have acceptable agreement with clinician-generated diagnoses ($\kappa = .63$ for Conduct Disorder; none available for ADHD; Hodges, 1993).

The DICA, another structured diagnostic interview, was originally developed for use with pediatric and psychiatric samples (Hodges, 1993). It has been found to result in an over diagnosis of Oppositional Defiant Disorder when parent report is used, and an over diagnosis of Overanxious Disorder and Dysthymia when adolescent report is used (Boyle et al., 1993). Also, the diagnostic agreement between parent

and youth pairs has been found to be quite low ($\kappa = -.02$ for ADHD children ages 12–16 years, $\kappa = .34$ for ADHD children ages 6–11 years; Boyle et al., 1993). These authors state that equally poor concordance has been found in similar studies of parent/youth diagnostic agreement, and as such are not surprising here, but offer no specific hypotheses as to why their agreements are so low.

The DISC, which was originally developed for epidemiological research, has demonstrated adequate agreement with clinician diagnosis for both the adult interview ($\kappa = .53$ for ADHD) and for the child interview ($\kappa = .48$ for ADHD; Piacentini et al., 1993). Also, an ADHD diagnosis generated by the combined adult and youth report on the DISC has demonstrated adequate 2-week test-retest reliability ($\kappa = .68$ for clinic sample; $\kappa = .62$ for community sample; Jensen et al., 1995). It is the only instrument to receive the support of the National Institute of Mental Health, who renamed it the National Institute of Mental Health Diagnostic Interview Schedule for Children—4th edition (Shaffer, Fisher, & Lucas, 1997). For all of these reasons, the DISC is quickly becoming the structured diagnostic interview of choice in research and in clinical practice.

Several studies of the DISC have been conducted, including a 1995 study of its test-retest reliability (Jensen et al., 1995). These researchers studied the youth version, the caretaker version, and a version that combines both youth and caretaker report of the DISC 2.1 (Shaffer, Fischer, Piacentini, Schwab-Stone, & Wicks, 1989) with a group of 97 clinically referred and 278 community sampled children and one of their primary caretakers. In general, they found that the DISC combining youth and caretaker report yielded higher and more stable reliabilities than either the DISC based solely upon youth report or the DISC based solely on caretaker report. Therefore, the authors only report diagnostic category reliabilities for the DISC

combining youth and caretaker report. Also, because of their relatively small sample sizes in each diagnostic category, the researchers were only able to analyze test-retest reliability for the more common diagnostic categories, such as anxiety disorders, depression and/or dysthymia, ADHD, Oppositional Defiant Disorder, and Conduct Disorder. Reliability for each of these diagnostic categories ranged from .50 for anxiety disorders, .68 for ADHD, to .70 for depression and/or dysthymia.

Although these results indicate acceptable reliability of the DISC, the authors report that reliability is not better due to a phenomenon known as attenuation. Attenuation results when individuals who qualify for a diagnosis at one time no longer qualify for that diagnosis at a later date. The authors report that diagnostic attenuation tends to affect individuals near the diagnostic threshold, and individuals that are in community, rather than clinical, samples. The authors state that the causes of attenuation are unknown, but are hypothesized to be related to the cathartic effect of reporting a symptom, or to the individuals desire to shorten the interview by reporting the absence of a symptom. Either way, considering the phenomenon of diagnostic attenuation, the test-retest reliabilities that resulted from Shaffer et al. (1989) are surprisingly high.

Piacentini et al. (1993) studied the concurrent criterion validity of the DISC-R:III by comparing both the youth DISC and the caretaker DISC to the Child Assessment Form (CAF), a clinician-completed instrument that is informant specific and generates diagnoses. A sample of 74 adolescent-caretaker pairs between the ages of 11 and 17 years was used. Agreement between diagnoses generated by the caretaker DISC and diagnoses generated by the parent CAF ranged from .36 (MDE) to .60 (CD). Agreement between diagnoses generated by the youth DISC and diagnoses generated by the child CAF ranged from .21 (CD) to .48 (ADHD).

Agreement was even lower for the DISC based upon the combined youth and caretaker report (.46 for ADHD diagnosis). Specific to the diagnosis of ADHD, adults reported an average of 2.89 ADHD symptoms on the caretaker DISC; adolescents reported an average of 2.71 symptoms of ADHD on the youth DISC; and the DISC based upon the combined youth and caretaker report resulted in an average endorsement of 4.47 symptoms of ADHD.

The authors state that the somewhat low levels of agreement, even between parent and clinician, indicate the same type of attenuation effect mentioned above. Those individuals on the threshold were most likely to be given the diagnosis by one party, and to just miss it by another party, especially for ADHD and CD. The authors also report that using the DISC based upon both youth and caretaker report elevated the number of ADHD cases by 35% over either youth or caretaker report alone. However, the authors were not able to indicate whether these new cases were “true” cases of ADHD. Taking these effects into account, the authors conclude that over-reporting was a major problem for the youth DISC for all diagnoses, and all informants tended to over report the presence of ADHD and ODD.

Schwab-Stone et al. (1996) studied the agreement between the computerized version of the DISC 2.3 (Shaffer et al., 1996) and diagnoses based upon clinician ratings attained by unstructured diagnostic interviews. The authors studied five major categories (ADHD, ODD, CD, depressive disorder, and anxiety disorder) with a sample of 1,285 caretaker-youth pairs, with youth ages 9–17 years. For diagnoses derived from the caretaker DISC, the researchers found that agreement with clinician diagnoses was highest for ADHD and CD, ranging from .57 to .82. The authors state that agreement was highest for subjects who were more severely impaired. For the youth DISC, the authors found that agreements were low for all diagnostic

categories, except CD, which ranged from .52 to .57. Agreement between clinician diagnoses and the DISC based upon combined youth and caretaker report was moderate for the externalizing disorders (.49 to .70), and lower for the depressive disorders and anxiety disorders.

The low agreement between clinician diagnoses and diagnoses derived from the youth DISC suggest that diagnoses based on the youth DISC may be less valid than those based on the caretaker DISC. Diagnoses derived from the youth DISC demonstrated the highest agreement with clinician diagnoses for the diagnostic category of CD, and the lowest for the anxiety disorders. The authors state that “diagnoses based on the youth report appear less valid than those based on the parent report” (Schwab-Stone et al., 1996, p. 8), and conclude by stating that an adult informant is necessary to make a valid diagnosis especially for the diagnostic categories of ADHD and ODD.

Bidaut-Russell et al. (1995) studied some possible reasons for the discrepancies that often occur between the caretaker DISC and the youth DISC using the computerized version of DISC 3.0. A sample of 51 adolescent–parent pairs, with adolescents ages 12 to 18 years of age, were asked to complete a portion of the DISC composed of 12 questions. While they were responding to the 12 questions, adolescents and parents were also asked to state how they thought their parent/child would answer that question. Also, if they thought their parent/child would respond differently, they were to state a reason for the hypothesized difference (i.e., “my parent doesn’t know I did that”). Although the authors found no significant differences between adolescent and parent report on the 12 questions from the DISC, kappas did range from $-.02$ (trouble staying seated) to $.85$ (belonging to a gang). Overall, children were better at predicting that parent answers would be discrepant

for six questions, and parents were only superior for one question. Reasons given by the parent or youth for the discrepant answers generally indicated poor levels of communication between adolescents and their parents on the subject of problematic behaviors and emotions. Thus, it seems that as children age and become more independent, their caretakers, and possibly therefore clinicians, may have little access to many of the difficulties faced by the adolescent.

Other researchers have studied the agreement between diagnoses derived from the youth version of the DISC XIV.I and discharge diagnoses with a sample of hospitalized adolescents (Aronen, Noam, & Weinstein, 1993). These researchers used a sample of 163 inpatient adolescents between the ages of 12 and 15 years ($M = 14.1$ years). For the study, interviewers were kept blind to clinician diagnoses, and vice versa. Results indicate that the youth DISC resulted in a larger number of diagnoses per subject, and a wider variety of diagnoses, than clinician diagnoses. According to the youth DISC, each child received a mean of 3.4 diagnoses, while receiving only 1.67 by clinician at discharge. For ADHD, the youth DISC resulted in 27 diagnoses, and clinician discharge diagnoses only resulted in 13. The authors conclude by questioning the validity of the adolescent report on the DISC, suggesting that other informants be included in the assessment process. They also suggest that clinicians make an effort to use more comprehensive and structured interviews, such as the DISC, in order to increase the sensitivity and specificity of the diagnostic process.

Finally, the DISC 2.1 (Shaffer et al., 1989) has also been compared to other types of assessment measures, such as the Child Behavior Check List, the Child Depression Inventory and the Revised Children's Manifest Anxiety Scale (Jensen et al., 1996). Using a sample of 541 families with children ages 5 to 17, the authors

found that the highest number of diagnoses resulted from the DISC based upon combined youth and caretaker report, followed by the caretaker DISC, and then by the youth DISC. For ADHD, the authors found that 9.7% of children qualified for the diagnosis based upon the youth DISC, 25.4% based upon the caretaker DISC, and 30.1% according to the DISC based upon the combined youth and caretaker report. As for comparison to other measures, the authors found that the CBCL was comparable to the caretaker DISC, and that both were minimally related to the youth self-report measures of the CDI and the RCMAS.

These researchers also compared the DISC and the CBCL to derived measures that they termed “external validators.” The external validators were derived using factor analysis and included items such as: (a) service utilization (i.e., special education services); (b) evidence of behavioral impairment (i.e., history of attempts to hurt self); (c) self-reported symptomology on measures separate from the interview or CBCL (i.e., parental marital satisfaction); and (d) other psychosocial, demographic, and developmental factors generally determined to be related to child psychopathology in previous research, also termed “risk factors” (i.e., history of traumatic experience). Point-biserial correlations between these external validators and the categorical diagnoses or lack thereof for each of five diagnostic categories on each of the three forms of the DISC was then calculated. For the youth DISC, correlations with external validators ranged from .03 to .38. For the caretaker DISC, correlations ranged from .06 to .35. Finally, for the DISC based upon combined caretaker and youth report, correlations ranged from .02 to .38. Comparisons of the caretaker DISC and CBCL indicate that the two measures are comparable, at least as they compare to the external validators used here.

Although these researchers attempted to compare the DISC to external validators, the measures used were in fact more similar to risk factors than truly independent measures of child behavior. The external validators used in the above study were derived by factor analyzing demographic variables and checklist items such as use of previous mental health services or current marital satisfaction. However, truly independent samples of behavior, such as classroom activity level or performance on a continuous performance task, were not used. Previous researchers have stated the utility of direct observational procedures because they “are not as tainted by those biases which can arise in the use of methods which rely on personal opinions, as in interviews and rating scales” (DuPaul, Guevremont, & Barkley, 1991, p. 238). As such, the DISC has never been compared to discrete, independent, prospective samples of actual child behavior. Doing so would allow for the validation of the DISC not just in terms of agreement with other forms of self-report, but also in terms of agreement with actual child behavior samples.

The current study addressed this issue by first comparing the ADHD section of the 4th edition of the DISC (Shaffer, Fisher, & Lucas, 1997) to some commonly used assessment methods, such as parent checklists, teacher checklists, adolescent checklists, and clinician diagnosis, while also including several independent measures of behavior, such as a lab task, behavioral output as measured by an activity monitor, and a structured observation. In addition, this study compared three groups of subjects on these measures: (1) subjects who met criteria for ADHD based upon both the youth and the caretaker DISC; (2) subjects who met criteria for ADHD based upon the caretaker DISC, but not according to the youth DISC; and (3) subjects who did not meet criteria for ADHD according to either the youth or the caretaker DISC.

Differences between groups were assessed on all dependent variables in order to determine the effect of including youth report on the DISC. Also, when possible, measures were converted to a dichotomous score of suggesting ADHD, or not suggesting ADHD, and agreement between this and both youth and caretaker forms of the DISC was computed. Analyses also involved converting both the youth and caretaker DISCs to a continuous measure and computing agreement with all dependent measures. Agreement between current diagnostic status and youth and caretaker DISC was also calculated. Finally, a discriminant function analysis was also conducted involving all dependent variables in order to determine which variables or variable groups most closely align with group placement.

CHAPTER II

METHOD

Subjects

A total of 58 subjects between the ages of 12 and 17 were recruited from Father Flanagan's Boys' Home, in Boys Town, Nebraska. These children lived on the Boys Town campus in family style home environments with an adult married couple, one full-time assistant, and five to seven other youth. Thirty-eight of these subjects met current diagnostic criteria for Attention-Deficit/Hyperactivity Disorder (ADHD) according to at least one informant, and 20 composed a control group not meeting criteria for ADHD according to either informant. Forty-four participants were male and 14 were female. Forty of the participants were Caucasian, 9 were African-American, 5 were Hispanic, 3 were of mixed ethnicity, and 1 was Native American.

Children were excluded if they had an estimated IQ below 70 on the full scale according to any standardized intelligence test. The mean of all IQ scores was 97.31 ($SD = 12.70$), and no children had to be excluded due to the IQ cutoff. Also, children's psychotropic medication status was required to be kept constant throughout the study in order for participation to continue. Throughout the study 64% of the children did not take any medication, and the remaining 36% were on at least one psychotropic medication. Thirty-six percent of the children in Group 1, 73% of Group 2, and 80% of Group 3, did not take any psychotropic medication

throughout the duration of the study. In all cases medication status was documented as unchanged, thus no subjects were excluded on this basis.

Procedure

Children were recommended for participation by a specialist familiar with their case, at which time the main author visited their home and sought informed consent from the caretaker (Appendix A) and the youth (Appendix B). All adolescents invited to participate were assigned a subject number to allow for tracking the number of adolescents who refused to participate (2) as well as the number of drop-outs (0) and the number of subjects who completed the study (58). Adolescents, teachers, and family teachers received a detailed description of the study before giving informed consent or assent. Also, caretakers and teachers were required to have spent 1 month with the youth prior to participation.

Once consent and assent were obtained, all adolescents and caretakers completed the National Institute of Mental Health Diagnostic Interview Schedule for Children—4th edition (DISC; Shaffer, Fisher, & Lucas, 1997). The results of the ADHD section of this structured diagnostic interview resulted in the formation of three groups: (1) a group of 19 children who received a diagnosis of ADHD both on the youth DISC and the caretaker DISC interviews; (2) a group of 19 children who did not endorse sufficient symptoms on the youth DISC to result in a diagnosis of ADHD, but whose caretaker DISC interviews did result in an ADHD diagnosis; and (3) a group of 20 children who were below the thresholds for an ADHD according to both youth and caretaker.

Because it was hypothesized that it would be difficult for caretakers to accurately assess whether or not subjects exhibited difficulties with attention or

hyperactivity prior to age 7, this criterion was dropped as a requirement for participation in the study. However, it was assessed for both the youth DISC and the caretaker DISC.

Following the DISC, behavior checklists were distributed to the youth and caretaker. These checklists were completed in the homes of the participants and were returned to the main author within 1 week. All adolescents completed the Brown ADD Scale for Adolescents (Brown, 1996). One caretaker for each adolescent completed the Conners Parent Rating Scale–48 (Conners, 1989a). Checklists were also distributed to teachers and were completed in their classrooms and returned within 1 week. Teachers completed the Conners Teacher Rating Scale–28 (Conners, 1989b) and were required to have the child in their class for at least 1 month prior to participation.

Finally, one clinic appointment and three school observations were conducted. During the first part of the clinic appointment adolescents were asked to complete the Conners Continuous Performance Task (CPT; Conners, 1992), a 14-minute computerized test that asks participants to push the space bar when they see certain items on the computer screen. After completing the CPT, adolescents were observed in a classroom situation, using the Restricted Academic Situation (Fischer, Barkley, Edelbrock, & Smallish, 1990). One 15-minute observation was conducted during which the child was asked to complete a series of below level math problems, while in a room with several distracting objects. Five behaviors were coded during 30 25-second intervals.

The activity monitor observations composed the third direct measure of behavior. For this assessment adolescents wore an activity monitor on their dominant wrist for at least 3 hours on at least three separate occasions. The primary author met

students in the morning before school to distribute watches and observed as each child placed their monitor on the appropriate arm. At the end of the school day, the primary author returned to the school and collected the monitors. These three observations were conducted at school during periods when the child was supposed to be seated and not engaging in a great deal of gross motor activity. Additional information is provided below.

Finally, all adolescents were paid \$20 upon completing the study. Teachers and caretakers were not paid as their involvement was so brief.

Measures

The National Institutes of Mental Health Diagnostic Interview Schedule for Children–IV

The National Institutes of Mental Health Diagnostic Interview Schedule for Children–IV (DISC; Shaffer, Fisher, & Lucas, 1997) is a highly structured diagnostic interview that covers over 30 diagnoses listed in *DSM-III-R*, *DSM-IV*, and ICD-10. The interview was designed to be administered by “lay” interviewers, after only 3 or 4 days of training. Interviewers were required to read the question exactly as it appeared on the computer screen and to record whether the child responded “yes” or “no.” Interviewers were not allowed to answer child questions, except by offering to repeat the interview question. The interview had the capability to cover diagnoses in six main categories: Anxiety Disorders, Miscellaneous Disorders, Mood Disorders, Schizophrenia, Disruptive Behavior Disorders, and Alcohol and Substance Use Disorders. Diagnostic categories that can be covered include: Social Phobia, Separation Anxiety Disorder, Specific Phobia, Panic, Agoraphobia, Generalized Anxiety Disorder, Selective Mutism, Obsessive Compulsive Disorder, Post Traumatic

Stress Disorder, Bulimia/Anorexia, Elimination Disorders, Tic Disorders, Pica, Trichotillomania, Major Depressive Disorder/Dysthymic Disorder, Mania/Hypomania, Schizophrenia, ADHD, Oppositional Defiant Disorder, Conduct Disorder, Alcohol Abuse/Dependence, Tobacco Dependence, Marijuana Abuse/Dependence, Other Drug Abuse/Dependence. This study used a computerized version of the DISC that eased administration and scoring, reduced training time, and decreased administrator error. Each of the three diagnostic categories covered, ADHD, Oppositional Defiant Disorder and Conduct Disorder, began with a stem question, and if this item was endorsed, moved into more specific questions covering the diagnostic criteria for that category.

Interviews were conducted by the author and other graduate level psychology students who received formal DISC training from the National Coordinator of Special Projects for the DISC. Because the interview is so highly structured and computerized, researchers using the DISC do not typically assess for interrater agreement. Due to this precedent, and that fact that all interviewers were being directly supervised for procedural accuracy, interrater agreement on the DISC was also not assessed here. Data are reported in the form of positive and negative symptoms as well as positive and negative diagnoses. Only children who met criteria for the combined sub-type of ADHD participated in the study.

Brown ADD Scale for Adolescents

The Brown ADD Scale for Adolescents (Brown, 1996) is a paper and pencil measure that was developed to measure symptoms of ADHD in adolescents. It is intended for use with children 12 to 18 years of age and contains 40 items that ask youth to rate their behavior on a 4-point Likert scale. Items covered symptomology

for the past 6 months. Scores from the Brown resulted in one total score and five cluster scores (Activation, Attention, Effort, Affect, Memory). Test-retest reliability has been deemed satisfactory based upon a 2-week correlation of .87 (p not reported). Internal consistency has been reported to be strong based upon coefficient alphas ranging from .70 to .89 for the five clusters, with the total score Cronbach coefficient alpha reported to be .95. Discriminant validity was addressed in that the measure was able to significantly differentiate between a clinical sample diagnosed with ADD and a nonclinical sample ($p < .0001$). Data are reported in terms of T scores for the five scales and the one total score. The ADHD cutoff for this measure is reported to be a t score equal to or exceeding 60 on the total score.

Conners Parent Rating Scale—48

The Conners Parent Rating Scale—48 (CPRS; Conners, 1989a) was developed for use with parents to measure ADHD and related problem behaviors in children and adolescents. This form contains 48 items and is used for children ages 3 to 17 years of age asking parents to rate their child's behavior on a 4-point Likert scale. The checklist provided information on six subscales: Conduct Problems, Learning Problems, Psychosomatic Complaints, Impulsive-Hyperactive, Anxiety, and Hyperactivity Index. Interrater reliability for the CPRS has been found to range from .46 on the Psychosomatic factor to .57 on the Conduct Problem Factor, with a mean correlation of .51. No significant differences have been found between ratings completed by mothers and those completed by fathers. Construct validity has been reported in the form of correlations between mother ratings on this form and another similar form used in the literature, the Behavior Problems Checklist. Correlations were significant in several areas between the two forms, including ratings on the

Conduct Problem scales (.75), ratings on the Conduct and Hyperactivity scales (.82), and ratings on the Conduct and Learning Problems scales (.64). Data are reported in terms of *T* scores for each of the six subscales. The ADHD cutoff for this measure is reported to be a *t* score equal to or exceeding 70 on the Hyperactivity Index.

Conners Teacher Rating Scale–28

The Conners Teacher Rating Scale–28 (CTRS; Conners, 1989b) was developed for use with teachers to measure ADHD and related behavior problems in children and adolescents. This form is composed of 28 items to be used with children 3 to 17 years of age. This form asked teachers to rate the child's behavior on a 4-point Likert scale and provided information on four subscales: Cognitive Problems, Hyperactivity, Inattentive-Passive and Hyperactivity Index. Test-retest reliability has not been examined with this form, but a similar CTRS form obtained levels of .53 for Conduct Problems, .55 for Hyperactivity, and .37 for Antisocial over a 1-month test-retest period. Interrater reliability has been found to range from .70 between teachers and aides, to .45 for the Inattentive-Passive subscale between parents and teachers. Data are presented in the form of *T* scores for each of the four subscales. The ADHD cutoff for this measure is reported to be a *t* score equal to or exceeding 70 on the Hyperactivity Index.

Restricted Academic Situation

For the Restricted Academic Situation (RAS) (Fischer, Barkley, Edelbrock, & Smallish, 1990), the adolescent was given a packet of below-level math problems to complete while sitting alone in a therapy room. One-15 minute observation was conducted for each youth. Adolescents were asked to complete a large quantity of

math problems that were below their current grade level, ensuring enough work to keep them busy for the entire observation period. Math problems were determined to be below grade level via teacher report. A CD player was set in the room and played a previously recorded set of music, and some games and magazines were set around the room, out of reach of the child if they stayed seated. These served as mild distracters for the participants. The adolescent was videotaped for the entire 15-minute period through a video monitoring system in the room. The videotape was then coded for five behaviors: off task, fidgeting, vocalizing, playing with objects, and out of seat. Twenty-five-second intervals were observed, followed by 5 seconds for recording the presence/absence of each of the five behaviors at any time during the interval. As such, this was a partial-interval recording system. These procedures are very similar to those used by Barkley et al. (1991). In this study the RAS was able to discriminate ADHD from normal groups. These procedures have also shown excellent sensitivity to stimulant drug effects and significant test-retest reliability (.86) over a 2-week period (Barkley, Fischer, Newby, & Breen, 1988).

For this study, videotapes were coded by the author and a master's-level psychologist. The coder was trained using several sample video segments, and agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. The coder agreed with the main author at a level of 90% prior to beginning coding. Thirty percent of the tapes were assessed for interrater reliability. Data are reported in terms of percentage of intervals containing each behavior and an overall percentage of total intervals containing a behavior code; a frequency count was not kept.

Activity Monitor

This study used the ActiTrac made by IM Systems. The device is an ambulatory motion recorder that looks like a digital wristwatch. It contained a biaxial accelerometer sensor that was able to record motion in two planes. Data are recorded each minute in calibrated “milli-g” units of acceleration. Although the ActiTrac has been used extensively in animal and human sleep research, its use with the type of scale validation project here is novel. Other more primitive activity monitors, also called actometers, have been used previously in ADHD research (for review see Barkley, 1991). In general, previous research indicates that large samples of time, usually several hours, have demonstrated significant correlation with parent rating of activity level in the home. Smaller time samples, however, have proven ineffective.

ActiTracs were worn on the dominant wrist during regular classroom situations throughout the school day. Data from active periods such as gym, recess, or lunch, were removed from the analyses. Also, the first 2 hours of the first school day, and the first 1 hour of each successive day were removed from the analyses in order to allow for habituation to the device. Data are reported in terms of milli-g units of acceleration per minute for each subject.

The Conners Continuous Performance Test Computer Program

The Conners Continuous Performance Test (CPT) Computer Program (Conners, 1992) was designed to measure attention problems in individuals 6 years to adult. The Conners CPT is a vigilance test presented in a computer game format taking 14 minutes to complete. A series of letters were flashed on the computer monitor approximately every 5 seconds. The subject was asked to press the space bar

for every letter that appeared, except the letter X. CPTs have repeatedly demonstrated an ability to distinguish ADHD subjects from control subjects, and to have sensitivity to medication status. They have demonstrated significant correlations with lab analogue observations of attention, teacher and parent report, and activity monitor ratings (Barkley, 1991). Data are reported in terms of number and percentage of target hits, risk taking, sensitivity, standard error of reaction time for hits, overall reaction time, number and percentage of errors of omission, number and percentage of errors of commission, and an overall index. The overall index score is a weighted sum of all other indexes on the CPT. Scores of less than 8 on the overall index are indicative of a strong performance, scores of 8 to 11 of a satisfactory performance, and scores over 11 may suggest attention problems. The ADHD cutoff for this measure is reported to be a score equal to or exceeding 11 on the overall index.

CHAPTER III

RESULTS

Interrater Agreement

Interrater agreement was calculated for 30% of the video segments for the Restricted Academic Situation. Agreement for each interval was calculated first, and then was summed to attain the total agreement for each video segment. Agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100. The overall agreement was 92.33%. Agreement for off-task was 86%, for fidgeting 85.3%, for vocalizing 94.4%, for playing with objects 97.7%, and for out of seat 98.2%.

Demographic Variables and Comorbid Diagnoses

Preliminary analyses were conducted to detect any possible differences between groups for the demographic variables of gender, race, age of youth, amount of time living with caretakers, and current medication status (see Table 1). Pearson chi-squares indicated that there were no significant differences between groups on the variables of gender ($X^2 = .156, p = .93$) or race ($X^2 = 12.85, p = .12$). Analysis of variance for age indicated that the differences between groups were not significant $F(2, 55) = 1.19, p = .31$. Nonsignificant differences were also found for the amount of time each group had spent living with their caretakers $F(2, 55) = .73, p = .49$.

Table 1
Demographic Variables by Group

	Group		
	1	2	3
Number of males / females	14 / 5	15 / 4	15 / 5
Mean age / standard deviation	13.84 (2.22)	14.74 (1.73)	14.60 (1.82)
Mean number of days living with caretakers / standard deviation	237.42 (207.29)	203.47 (124.75)	279.55 (220.06)
Number of children receiving psychotropic medication	11	4	4

* $p < .01$.

Significant differences were found for the number of children in each group currently on some form of psychotropic medication $F(2,55) = 5.97, p = .004$.

Because ADHD is part of the Disruptive Behavior Disorder spectrum, children were also assessed for Oppositional Defiant Disorder (ODD) and Conduct Disorder (CD). These assessments were made using both the youth DISC and the caretaker DISC. Results of these assessments can be found in Table 2. Chi-square tests indicate that there were significant differences between groups for the occurrence of an ODD or CD diagnosis, with Group 1 attaining the highest degree of comorbidity. These differences were significant between groups for the ODD section of the child DISC ($\chi^2 = 13.03, p < .001$), for the ODD section of the caretaker DISC ($\chi^2 = 7.60, p < .05$), and for the CD section of the caretaker DISC ($\chi^2 = 6.38$,

$p < .05$). No significant different differences between groups were found for the CD section of the youth DISC ($X^2 = 3.98, p = .14$).

Table 2
Number of Comorbid Disruptive Behavior Diagnoses
(per Youth or Caretaker) by Group

	Group		
	1	2	3
Oppositional Defiant Disorder			
Youth**	10 ^a	1 ^b	3 ^b
Caretaker*	15 ^a	14 ^a	8 ^b
Conduct Disorder			
Youth	8	3	4
Caretaker*	14 ^a	7 ^b	8 ^b

Note. Letters in superscript indicate statistically significant differences between groups ($p < .05$) according to post-hoc Pearson chi-square analyses.

* $p < .05$. ** $p < .001$.

Dependent Variables

The National Institute of Mental Health Diagnostic Interview Schedule for Children-IV

Results indicated that all children who qualified for a diagnosis of ADHD based upon number of symptoms endorsed on the youth DISC, also endorsed the prior to age 7 criterion. However, there were four children whom caretakers endorsed as meeting symptom criteria but not meeting the prior to age 7 criterion. One of these subjects was a female from Group 1, one a male from Group 1, one a female from Group 2, and one a male from Group 2.

These 4 children were gathered into one group and compared to the other 54 children who participated in the study on all dependent variables. No significant differences were found between the groups on any of the dependent variables. (see Table 3). Thus, data for these children were included in all further data analyses.

Table 3
Means and Standard Deviations for Subjects Who Did and
Did Not Meet the Age of 7 Criteria

	Group	
	A (<i>n</i> = 4)	B (<i>n</i> = 54)
Number of ADHD symptoms endorsed on youth DISC	6.5 (4.65)	5.13 (5.26)
Number of ADHD symptoms endorsed on caretaker DISC	11.25 (2.99)	10.28 (5.69)
Brown—Total score	60.50 (3.70)	58.39 (8.79)
CPRS—Hyperactivity Index	61.75 (9.74)	71.81 (18.02)
CTRS—Hyperactivity Index	48.50 (5.57)	61.31 (14.80)
RAS—Mean of all codes	7.35 (6.03)	17.14 (13.68)
Activity Monitor—Mean of days	35.14 (9.24)	38.04 (7.23)
Conners CPT—Overall Index	8.28 (2.77)	10.14 (7.81)

Note. Group A is composed of children who did not meet the age of 7 criteria, but did meet all other diagnostic criteria for ADHD; *n* = 4. Group B is composed of all other children in the study; *n* = 54. Using a MANOVA and individual ANOVAs, no significant differences were found between groups.

Brown ADD Scale for Adolescents

The Brown resulted in five cluster scores and a total score for each youth. See Table 4 for means and standard deviations of this scale by group. A one-way

multivariate analysis of variance (MANOVA) was completed to assess differences between groups on the five subscales of the Brown, and a one-way analysis of variance (ANOVA) was completed to assess differences between groups on the total score. The results of the MANOVA were not significant $F(10, 102) = 1.31, p = .24$, but the results of the ANOVA were significant $F(2, 55) = 3.54, p < .05$.

Table 4
Brown Means and Standard Deviations by Group

	Group		
	1	2	3
Brown ADD Scales			
Activation	58.42 (7.74)	54.79 (6.12)	55.70 (8.32)
Attention	61.00 (8.99)	56.89 (8.26)	56.65 (8.65)
Effort	60.53 (7.19)	54.47 (7.25)	54.90 (7.51)
Affect	60.95 (9.50)	55.53 (7.58)	56.20 (8.06)
Memory	69.00 (12.96)	57.58 (8.75)	64.10 (13.62)
Total*	62.58 (7.43) ^a	56.00 (7.63) ^b	57.10 (9.28)

Note. Letters in superscript indicate statistically significant differences between groups ($p < .05$) according to Tukey HSD post-hoc analyses.
* $p < .05$.

Conners Parent Rating Scale-48

The CPRS resulted in six subscale scores, whose means and standard deviations by group can be found in Table 5. These scores were assessed for differences between groups using a one-way MANOVA. Because this analysis was significant $F(12, 100) = 2.01, p < .05$, individual analyses of variance were completed

for each subscale to determine which, if any, of the scales were significant. Significant differences between groups were found for the scales of Learning Problems $F(2, 55) = 5.35, p < .01$, Impulsive-Hyperactive $F(2, 55) = 8.24, p < .001$, and Hyperactivity Index $F(2, 55) = 9.40, p < .001$.

Table 5
CPRS Means and Standard Deviations by Group

CPRS Subscale	Group		
	1	2	3
Conduct Problems	74.32 (16.79)	70.37 (16.21)	61.35 (17.82)
Learning Problems*	73.68 (21.63) ^a	69.21 (13.32)	57.25 (12.43) ^b
Psychosomatic	57.74 (15.34)	58.42 (15.50)	53.85 (15.17)
Impulsive-Hyperactive**	70.84 (11.21) ^a	72.11 (17.05) ^a	56.00 (12.62) ^b
Anxiety	53.21 (13.29)	51.42 (12.85)	51.90 (11.35)
Hyperactivity Index**	79.37 (12.95) ^a	75.53 (15.61) ^a	59.10 (17.64) ^b

Note. Letters in superscript indicate statistically significant differences between groups ($p < .05$) according to Tukey HSD post-hoc analyses.

* $p < .01$. ** $p < .001$.

Conners Teacher Rating Scale-28

The CTRS resulted in four subscale scores, whose means and standard deviations by group can be found in Table 6. These scores were assessed for differences between groups using a one-way MANOVA. Because this analysis was significant $F(8, 104) = .58, p < .001$, individual analyses of variance were completed for each subscale to determine which, if any, of the scales were significant. Significant differences between groups were found for all four scales, including Conduct

Problems $F(2, 55) = 3.31, p < .05$, Hyperactivity $F(2, 55) = 6.80, p < .01$, Inattentive-Passive $F(2, 55) = 3.68, p < .05$, and Hyperactivity Index $F(2, 55) = 7.04, p < .01$.

Table 6
CTRS Means and Standard Deviations by Group

CTRS Subscales	Group		
	1	2	3
Conduct Problems*	66.79 (16.03)	67.05 (16.50)	55.60 (15.31)
Hyperactive**	65.37 (13.38) ^a	62.74 (15.77) ^a	50.85 (9.77) ^b
Inattentive-Passive*	62.74 (13.62)	54.11 (8.91)	54.05 (11.22)
Hyperactivity Index**	67.21 (14.70) ^a	62.84 (14.82) ^a	51.70 (10.15) ^b

Note. Letters in superscript indicate statistically significant differences between groups ($p < .05$) according to Tukey HSD post-hoc analyses.

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

Restricted Academic Situation

The RAS resulted in five coded behaviors and an overall sum of these behaviors. The means and standard deviations for these behaviors can be found in Table 7. The five behaviors were assessed to determine if there were any differences between groups using a one-way MANOVA, and the overall sum of behaviors was assessed for differences between groups using a one-way ANOVA. Results of the MANOVA were not significant $F(10, 102) = .74, p = .68$. Results of the ANOVA also were not significant $F(2, 55) = .12, p = .88$.

Table 7
RAS Means and Standard Deviations by Group

RAS Behaviors	Group		
	1	2	3
Off-task	32.58 (23.42)	22.79 (21.20)	22.45 (19.63)
Fidgeting	32.74 (27.17)	28.95 (25.01)	28.25 (27.18)
Vocalizing	9.74 (16.63)	16.47 (29.01)	20.85 (31.60)
Playing With Objects	7.68 (11.90)	5.05 (6.33)	6.10 (10.30)
Out of Seat	5.79 (9.65)	4.68 (11.47)	2.90 (7.32)
Total	17.71 (13.94)	15.59 (14.08)	16.11 (13.14)

Note. No significant differences were found between groups.

Activity Monitor

The Acti-Trac activity monitor resulted in a minute-by-minute measurement of youth activity. Total amount of activity during seated class time was summed for each child and then divided by the total number of minutes. This resulted in the mean activity per minute for each child for each of 3 school days assessed, which can be found in Table 8 along with the mean of the 3 days, and the highest of the 3 days. Two children were removed from this analysis due to the extreme nature of their scores. One child was a male from Group 1, and one was a female from Group 3. They were considered extreme because their scores were over two standard deviations beyond the mean for their group. After these outliers were removed, the scores for Days 1, 2, and 3 were assessed to determine if there were any differences between groups using a one-way MANOVA. Individual ANOVAs were conducted

for the mean of the 3 days, and for the highest of the 3 days. The MANOVA for Acti-Trac Days 1, 2, and 3 was not significant $F(6, 102)=1.42, p = .22$. However, the ANOVA for the mean of the 3 days was significant $F(2, 53) = 4.01, p < .05$, as was the ANOVA for the highest of the 3 days $F(2, 53) = 3.34, p < .05$.

Table 8
Activity Monitor Means and Standard Deviations by Group

	Group		
	1	2	3
Day 1	40.99 (7.73)	38.54 (9.03)	34.32 (6.12)
Day 2	40.94 (6.03)	37.39 (8.59)	34.99 (7.71)
Day 3	40.78 (5.66)	38.42 (7.61)	34.64 (9.19)
Mean of Days 1, 2, and 3*	40.90 (5.65) ^a	38.12 (7.34)	34.65 (7.03) ^b
Highest of Days 1, 2, and 3*	43.99 (6.92) ^a	42.33 (7.96)	37.95 (7.20) ^b

Note. Letters in superscript indicate statistically significant differences between groups ($p < .05$) according to Tukey HSD post-hoc analyses.

* $p < .05$.

The Conners Continuous Performance Test (CPT) Computer Program

The Conners CPT resulted in 12 subscale scores, the first 3 of which are raw numbers, and the remaining 9 of which are *T* scores, along with one overall index score. There were four children who responded to fewer than 30% of the target stimuli, and therefore were such extreme outliers that they were dropped from all analyses. Two were males from Group 2, one was a female from Group 1, and one was a male from Group 1. The means and standard deviations for all 12 CPT subscale scores and the overall index score, with outliers removed, can be found in

Table 9. The 12 scale scores were assessed to determine if there were any differences between groups using a one-way MANOVA. The overall index score was assessed using a one-way ANOVA. The MANOVA for scale scores was not significant $F(26, 78) = .95, p = .55$. The ANOVA on the overall index score was also not significant $F(2, 51) = .06, p = .94$.

Degree of Diagnostic Agreement Between Each Dependent Measure and Each DISC

Four of the dependent variables have cutoff scores that are suggested to be highly indicative of an ADHD diagnosis, including the Brown, the CPRS, the CTRS and the CPT. For this analysis the continuous scores on these four variables were changed into dichotomous scores of ADHD or no ADHD. Degree of agreement between diagnostic status as determined by each of the four dependent variables and diagnostic status as determined by both caretaker and youth DISC were compared using the Pearson chi-square. Results (see Table 10) indicate significant agreement between the Brown and youth DISC ($X^2 = 5.43, p < .05$), between the CPRS and the caretaker DISC ($X^2 = 5.02, p < .05$), and between the CTRS and the caretaker DISC ($X^2 = 6.11, p < .05$).

Dimensional Symptom Agreement Between Each Dependent Variable and Each DISC

For these analyses, number of symptoms endorsed on the ADHD section of the DISC was used, resulting in a continuous form of data for both the youth and the caretaker DISC. Then, this information was compared to the continuous measures on the other dependent variables using Pearson correlations (see Table 11). Using the Bonferroni approach to control for Type I error across the 12 correlations, a p value

Table 9
CPT Means and Standard Deviations by Group

	Group		
	1	2	3
Raw scores			
Number of Hits	312.29 (18.26)	315.76 (7.69)	310.40 (14.32)
Number of Omissions	11.70 (18.26)	8.23 (7.69)	13.6 (14.32)
Number of Commissions	19.88 (6.82)	19.76 (5.75)	21.3 (8.18)
T scores			
Hit Rate	51.81 (16.28)	49.37 (15.40)	51.80 (16.33)
Hit Rate Standard Error	62.57 (12.28)	65.81 (14.27)	63.69 (16.05)
Variability of Standard Errors	59.04 (11.37)	61.57 (13.37)	60.79 (19.25)
Attentiveness	56.98 (8.63)	57.90 (7.73)	61.27 (8.71)
Risk Taking	63.86 (20.62)	61.82 (18.32)	71.28 (17.76)
Hit Rate Block Change	68.14 (22.70)	67.70 (30.40)	61.72 (14.35)
Hit Standard Error Block Change	58.78 (12.03)	59.34 (14.67)	51.10 (16.80)
Hit Rate ISI ^a Change	66.19 (16.71)	72.06 (22.18)	70.61 (18.17)
Hit Standard Error ISI ^a Change	60.62 (13.61)	63.03 (15.56)	55.97 (13.96)
Overall Index Score	10.33 (7.03)	10.07 (7.78)	10.95 (8.31)

Note. No significant differences were found between groups.

^aInterstimulus interval.

of less than .004 ($.05/12 = .004$) was required for significance. There were significant correlations between the youth and caretaker DISCs ($r = .42, p < .001$), between the Brown and the youth DISC ($r = .56, p < .001$), between the CPRS and the caretaker

DISC ($r = .72, p < .001$), and between the CTRS and the caretaker DISC ($r = .55, p < .001$).

Table 10
Degree of Categorical Agreement Between Dependent Variables
and Each Form of the DISC

Dependent Variable	DISC	
	Youth	Caretaker
Brown	.29*	.09
CPRS	.17	.29*
CTRS	.20	.23*
Conners CPT	-.10	-.18

Note. Degree of agreement calculated using the Kappa statistic.

* $p < .05$.

Agreement With Diagnostic Status

Prior to being admitted to Boys Town, all children are required to have a complete psychological evaluation, which is reviewed and stored in their permanent file. For this study, files were reviewed, and all diagnostic information recorded. If a child was diagnosed with ADHD (any type) in their admission file, this variable was coded as positive; if no diagnosis of ADHD was noted, the variable was coded as negative. For analyses, agreement between prior diagnosis of ADHD were compared to DISC results, for both the youth DISC and the caretaker DISC, using the kappa statistic (Cohen, 1960). Analyses indicated that there was significant agreement

between file diagnosis and youth DISC ($\kappa = .31, p < .01$), and between file diagnosis and caretaker DISC ($\kappa = .43, p < .001$).

Table 11
Degree of Dimensional Agreement Between Dependent Variables
and Each Form of the DISC

Dependent Variable	DISC	
	Youth	Caretaker
Caretaker DISC	.42*	
Brown—Total score	.56*	.21
CPRS—Hyperactivity Index	.30	.72*
CTRS—Hyperactivity Index	.33	.55*
RAS—Mean of all codes	.06	.27
Activity Monitor—Mean of three days	.19	.34
Conners CPT—Overall Index	-.04	.03

Note. Degree of agreement calculated using the Pearson product-moment correlation.

* $p < .001$.

Discriminant Function Analysis

Finally, a discriminant function analysis was conducted to determine if all of the variables could be combined to correctly predict group membership. According to Tabachnick and Fidell (1983), “the major purpose of discriminant function analysis is to predict group membership on the basis of a variety of predictor variables” (p. 292).

After the data were screened to be sure they met the assumptions for the analysis, one score from each variable was chosen for the analysis. Scores were chosen because they were a mean or sum of all other scores on the variable. The following scores were used in the analysis: Brown total score, CPRS—Hyperactivity Index, CTRS—Hyperactivity Index, RAS mean, Acti-Trac mean, and CPT Overall Index Score. The overall Wilks' lambda was significant, $\Lambda = .60$, $X^2(12, N = 58) = 26.72$, $p < .01$, indicating that overall the predictors differentiated among the three subject groups. However, the residual Wilks' lambda was not significant, $\Lambda = .90$, $X^2(5, N = 58) = 4.99$, $p = .42$, indicating that after partialing out the effects of the first discriminant function, the second discriminant function did not differentiate significantly among the three subject groups.

Next, the within-groups correlations between the predictors and the resulting discriminant function and the standardized weights were determined (see Table 12). From these analysis, it seems probable that this discriminant function represents an adult dimension, as the correlations for caretaker and teacher report are the strongest for this function.

The means on the discriminant function could be interpreted as consistent with this assumption. The means on the function were smallest for Group 3 ($M = -.92$), higher for Group 2 ($M = .24$), and highest for Group 1 ($M = .73$). This could mean that adult report is more important to consider as the probability of an ADHD diagnosis increases.

Finally, the adequacy of the derived function was assessed (see Table 13) and indicated that the function was able to classify 62% of the cases correctly ($\kappa = .40$, $p < .001$). The kappa, which takes into account chance agreement, indicated moderately accurate prediction.

Table 12

Relationship Between Dependent Variables and the Discriminant Function

	Discriminant Function	
	Correlation Coefficients	Standardized Coefficients
Brown—Total Score	.31	.22
CPRS—Hyperactivity Index	.81	.64
CTRS—Hyperactivity Index	.71	.48
RAS—Mean of all codes	.05	-.15
Activity Monitor—Mean of three days	.38	.14
Conners CPT—Overall Index	-.11	-.22

Table 13

Discriminant Function Group Placement Compared to DISC Group Placement

DISC Group Placement	Discriminant Function Analysis Group Placement		
	1	2	3
1	12 (63.2)	4 (21.1)	3 (15.8)
2	3 (15.8)	10 (52.6)	6 (31.6)
3	3 (15.0)	3 (15.0)	14 (70.0)

Note. Data are presented in the form of number of subjects, with percentages in parentheses.

CHAPTER IV

DISCUSSION

Given that the DISC is one of the most common child diagnostic interviews in use today, the importance of assessing the validity of its ADHD section is self-evident. In order to accomplish this goal eight main analyses were conducted.

First, three groups of children were compared in their degree of comorbid disruptive behavior disorder diagnoses. It was not surprising to find that Group 1 attained the highest level of comorbidity for ODD according to both the youth and the caretaker DISC. Given that this group was composed of children who endorsed an ADHD diagnosis and whose caretakers endorsed an ADHD diagnosis, it was not surprising to find that children in this group were also more likely to report, and to have their caretakers report, difficulties in the ODD area. These findings mirror those of other researchers who have also found that meeting diagnostic criteria for ADHD increases the chances of meeting diagnostic criteria for one of the other disruptive behavior diagnoses (Jensen, Martin, & Cantwell, 1997).

However, it was somewhat surprising to discover that for the diagnosis of CD on the youth DISC there were no significant differences between groups. This could be due to the sample used here in that conduct type problems frequently lead to a referral to this residential program. The reason that only the youth DISC and not the caretaker DISC indicated these conduct problems is likely due to the fact that the diagnosis requires the assessment of behaviors for one year prior to assessment. Frequently youth have more accurate access to this pre-placement information than

their current caretakers. Time with caretaker data indicated that most children had been with their caretakers for a mean of 200 days, leaving 165 days that were supposed to be included in the assessment period to which caretakers likely did not have direct access.

Second, the age of 7 criterion for ADHD was examined. There were 4 children whose caretakers did not endorse the age of 7 criterion but did endorse significant symptomology to indicate a diagnosis of ADHD. These 4 children were compared to the remaining 54 on all dependent measures and on the number of ADHD symptoms endorsed but no significant differences were detected. This could indicate that the age of 7 criterion is not necessary for a diagnosis of ADHD, at least as measured by the common assessment measures used here. Other researchers have also suggested that this age criterion may be unnecessary in making a valid ADHD diagnosis (Barkley & Biederman, 1997). However, it is also important to note that the sample used here was composed of children currently in out of home placement. It is likely that caretakers had varying access to information regarding the child's behavior at the age of 7. Therefore, the information upon which each caretaker based their decision to endorse or not endorse the age of 7 criterion for each child varied widely and was not controlled.

Third, the three subject groups were compared across some commonly used assessment methods such as adolescent checklists, caretaker checklists, and teacher checklists. On the Brown ADD Scale total score, it was interesting to note that significant differences were obtained between Groups 1 and 2, but not between 1 and 3. This indicated that children in Groups 2 and 3, who did not endorse a diagnosis of ADHD, also did not endorse significant symptomatology on the Brown. However, it also indicated that children in Group 2, who did not endorse a diagnosis of ADHD,

but whose caretakers did, attained even lower mean scores on the Brown than the control group (Group 3). Therefore, the results here suggested that there may have been two groups of children who met diagnostic criteria for ADHD according to their caretakers; those youth who also endorsed a diagnosis of ADHD, and those youth who underreported symptomology, resulting in even lower self-report scores than the clinical control group. These results are similar to those attained by Volpe, DuPaul, Loney, and Salisbury (1999), which indicated that children whose caretakers endorsed an ADHD diagnosis but who themselves did not tended to have higher mean lie scale scores on the Revised Children's Manifest Anxiety Scale.

On the caretaker checklist, the CPRS, significant differences between groups were attained for the overall analysis, and for three individual scales. Two of the three scales that resulted in significant differences between groups (Impulsive-Hyperactive and Hyperactivity Index) were expected, and differences fell where expected, between Groups 1 and 2 and Group 3. However, significant differences were found on the Learning Problems scale between Groups 1 and 3 and were not anticipated. After looking at the individual scale items in a post-hoc analysis, however, the four items that composed this scale could be seen as suggestive of an ADHD diagnosis. The individual items were: "difficulty in learning," "fails to finish things," "distractibility or attention span a problem," and "easily frustrated in efforts."

On the teacher checklist, the CTRS, significant differences between groups were found for all four individual scales. However, the most significant differences were found for the Hyperactive and Hyperactivity Index scales, with Groups 1 and 2 being significantly different from Group 3. These results indicated that teacher report on these forms tended to align more closely with caretaker report on the DISC than with youth report on the DISC. These findings are similar to those found elsewhere

(Loeber, Green, Lahey, & Stouthamer-Loeber, 1991), indicating that teacher report tends to align closely with parent or caretaker report. The fact, however, that teachers agreed so significantly with caretaker report is somewhat surprising, and indicated that children who were diagnosed with ADHD on the DISC by their caretaker were significantly more likely to receive an elevated score from their classroom teacher on the CTRS. However, it is also important to note that caretakers and schoolteachers undergo similar training at the residential facility used in this study. It is possible that the similarities in the training could have contributed to the high level of agreement.

For the fourth analysis, three actual measures of youth behavior were compared across the three groups to determine if group placement aligned with performance on any of these variables. The first measure of youth behavior was the Restricted Academic Situation. The analysis of this measure resulted in no significant differences between groups on any of the five behaviors measured, or on the total score. In fact, for the behavior of vocalizing, findings ran contrary to expectations in that Group 2 engaged in a higher mean rate of vocalization than Group 1, and Group 3 engaged in a higher mean rate of vocalization than Group 2. This indicated that rate of self-vocalization during an academic situation may not be reflective of ADHD diagnostic status. For two additional behaviors (off-task and fidgeting) there were slight differences between Groups 2 and 3, indicating that performance on these variables tended to align more closely with youth diagnostic report on the DISC than with caretaker diagnostic report on the DISC. These results are similar to those attained elsewhere indicating that academic situations frequently are not able to distinguish between adult identified ADHD children and youth identified ADHD children (Volpe et al., 1999).

The second actual measure of youth behavior, the activity monitor, did indicate significant differences between groups. Differences were found between Groups 1 and 3 when a mean of all activity was compared. These results indicated that children in Group 1 engaged in significantly more activity than those in Group 3. Therefore, when both the adult and youth indicated a diagnosis of ADHD on the DISC, it was significantly more likely that these children engaged in more activity throughout their school day, when several school days were compared.

The third actual measure of youth behavior, the CPT, did not indicate any significant differences between groups. Post-hoc visual analysis of individual group mean scores indicated that in many cases trends are not even in the expected direction. For example, on the number of hits (the number of times the child strikes the space bar when they are supposed to do so), Group 3 attained the lowest mean score. Also, Group 3 attained the highest scores on the number of omissions and the number of commissions, which are supposedly indicative of attention and impulsivity difficulties. These results indicated that the clinical control group used here performed more poorly on this measure than did either of the ADHD groups.

For the fifth analysis, degree of categorical agreement between youth and caretaker report on the DISC and four dependent variables was calculated. These analyses indicated that youth report of a diagnosis of ADHD on the DISC correlated significantly with youth report on the Brown. Also, caretaker report of a diagnosis of ADHD on the DISC correlated significantly with caretaker report on the CPRS. However, analyses also indicated that teacher report on the CTRS correlated significantly with caretaker report of a diagnosis of ADHD on the DISC. This finding also supports the hypothesis mentioned above that teacher report is more closely aligned with parent or caretaker report than with youth report.

When degree of dimensional agreement was calculated between the seven dependent variables and number of symptoms endorsed on the ADHD section of each form of the DISC for the sixth analysis, several significant results were obtained. First, a significant correlation was found between number of ADHD symptoms endorsed on the youth DISC and number of ADHD symptoms endorsed on the caretaker DISC. This indicated that when number of positive symptoms are compared, rather than diagnostic status, there is significant agreement between youth and caretaker report.

Also, a significant correlation was found between number of ADHD symptoms endorsed on the youth DISC and total score on the Brown. Given the significant categorical agreement between these measures mentioned previously, it was not surprising to find that there was also significant dimensional agreement. Given this, it was also not surprising to find significant correlations between number of ADHD symptoms endorsed on the caretaker DISC and total score on the CPRS, and between number of ADHD symptoms endorsed on the caretaker DISC and total score on the CTRS. It was also interesting to note that no significant correlations were found between number of ADHD symptoms endorsed on either form of the DISC and any of the three independent measures of youth behavior. This indicated that youth performance on these variables did not correlate, even slightly, with number of ADHD symptoms endorsed on the DISC by either the youth or the caretaker.

The seventh analysis involved a comparison of current ADHD diagnostic status and youth and caretaker report on the DISC. The validity of the DISC was supported by the statistically significant agreement between DISC diagnostic status and diagnostic history. Thus, when compared to ADHD diagnostic history, both the

youth and the caretaker DISC diagnoses agreed significantly. Therefore, it seems that the DISC was measuring the same, or similar, behaviors that were clinically relevant to a psychologist when making a diagnostic decision. These results contradict those reported elsewhere indicating extremely low concordance for the diagnosis of ADHD between the DISC and clinician diagnosis ($\kappa = .09$; Pellegrino, Singh & Carmanico, 1999).

The eighth and final analysis involved obtaining a discriminant function of all dependent measures. The obtained discriminant function was most highly correlated with caretaker report on the CPRS, teacher report on the CTRS, and scores on the activity monitor. This indicated that a combination of these scores were most useful when determining group placement. When the obtained discriminant function was then used to determine group placement, 67% of all cases were classified correctly. This indicated that a combination of the CPRS, CTRS, and activity monitor scores were able to correctly classify 67% of all cases in the study. Therefore, it seems that a combination of caretaker report, teacher report, and activity monitor data agree most highly with group placement, which was determined by caretaker and youth report on the DISC.

Taken together, the obtained results indicate that the ADHD section of both the youth DISC and the caretaker DISC are valid indicators of ADHD diagnostic status. Both forms agree with current diagnostic status obtained by independent psychologists and psychiatrists. Also, the ADHD section of the youth DISC agreed significantly with another youth self-report measure, and the ADHD section of the caretaker DISC agreed significantly with another caretaker self-report measure. This indicates that when using the DISC it may not be necessary to include these other measures. However, when using the other measures it is still important to include a

diagnostic interview, such as the DISC, because they assess for a much broader arena of psychopathology than any single checklist report measures.

Also, the fact that significant differences were obtained between groups on the activity monitor indicates that the DISC is a valid measure of youth activity level as it occurs in the school environment. The fact that significant differences were not obtained with the two other behavior measures is not surprising, given their history of difficulty distinguishing between ADHD and clinical control groups (Barkley, 1991).

In sum, the current study has several strengths. First, adolescent and caretaker report on the DISC were compared to commonly used ADHD assessment measures. Second, this study went beyond past research by also including several measures of actual youth behavior when assessing the validity of the DISC. Third, a clinical rather than a community control group was used. This allowed for assessment of differences between children diagnosed with ADHD and children not diagnosed with ADHD, all of whom were diagnosed with a variety of other disruptive behavior disorders. Therefore, the only central difference between groups was rate of ADHD diagnosis. Finally, unlike several other studies in the literature, this one targeted the inclusion of females in our sample. There has been an argument in the ADHD literature that researchers have done a poor job of including females in their samples, and thus our inclusion of this gender in all three subject groups is a definite strength.

However, the current study also had several limitations. First, a fourth group of children, children who endorsed a diagnosis of ADHD on the DISC but whose caretakers did not, was not included. This group was not included due to the practical limitation of time, in that it was hypothesized that it would take a great deal of time to find such a group of children in the population used here. As it turned out, there were four children who met criteria for this category within the 5-month data

collection period. Including this group would have assessed the validity of the DISC along yet another dimension, but was not possible here.

Another limitation involved the administration of the DISC. As previously stated, the DISC is composed of at least 24 sections which are all usually administered consecutively. However, for the current study, only 3 sections of the DISC were administered; the ADHD section, the ODD section, and the CD section. When given in its entirety, the youth or caretaker DISC typically takes over 1 hour, but for this study typically took about 20 minutes. Thus, the procedures used here differ from those used in typical clinical practice, and this difference could have affected these results in some way.

Appendix A
Family-Teacher Consent Form

WESTERN MICHIGAN UNIVERSITY
 Approved for use for one year from this date:
 H. S. I. R. B.
 NOV 25 1998
 x *Sybil*
 HSIRB Chair

Western Michigan University
 Department of Psychology
 Do Adolescent Self-Report Scales predict ADHD diagnostic status?
 (Family-teacher consent form)

Principal Investigator:

C. Richard Spates, Ph.D. Western Michigan University

Co-Student Investigator:

Ann M. McGrath, M.A.

We are inviting you and a child in your care to participate in a research project entitled "A Study of the Validity of the ADHD Portion of the NIMH DISC IV." The goal of the research project is to learn more about adolescent self-report as a means of diagnosing Attention-Deficit Hyperactivity Disorder. What we would like to do is to ask you to complete a short interview and questionnaire about a child in your care. The child in your care will be asked to complete a short interview a paper and pencil questionnaire, a short computer test, some math problems, and to wear a small watch-like device for three days at school.

There could be several potential benefits to participating in this project, including learning more about Attention Deficit-Hyperactivity Disorder. We can identify no risks to you or the child in your care, above and beyond those that typically occur when completing paper and pencil measures. Participating or not participating will have no effect on the services you or the child in your care are entitled to at Boys Town. The child in your care will receive \$20 for completing the research project which will be directly deposited into their Boys Town bank account.

All data will be stored in a manner that will protect the confidentiality of you and the child in your care. Your names will not appear anywhere on the questionnaires or other forms. You will be assigned a code number and the master list containing the names and code numbers will be available only to the Principal Investigator and Co-Student Investigator. After the data have been collected and analyzed, the master lists will be destroyed. All other data will be destroyed after five years.

You may withdraw yourself or the child in your care at any time from this study without any negative effect on other services to your child. If you have any questions or concerns about this study, you may contact either Ann M. McGrath (616-387-8307), or C. Richard Spates (616-387-8332). You may also contact the Chair of the Human Subjects Institutional Review board at Western Michigan University (616-387-8293) or the Vice President for Research at Western Michigan University (616-387-8298) with any concerns that you have.

PLEASE COMPLETE THE NEXT PAGE IF YOU WISH TO PARTICIPATE.

WESTERN MICHIGAN UNIVERSITY
H. S. I. R. B.
Approved for use for one year from this date:

NOV 25 1998

x *Sylvia Culp*
HSIRB Chair

PLEASE READ EACH STATEMENT AND CHECK YES IF YOU AGREE TO THE ITEM.
IF YOU CHECK NO TO ANY STATEMENT, YOU WILL NOT PARTICIPATE IN THE STUDY.

1. I agree to participate in an evaluation project designed to study the validity of adolescent self-report. YES _____ NO _____
2. I agree to complete a diagnostic interview. YES _____ NO _____
3. I agree to complete a paper and pencil questionnaire. YES _____ NO _____
4. I may experience some mild distress from completing the interview and questionnaire. If such distress were to occur, I agree to inform the researchers, and appropriate therapeutic support or a referral to another clinic would be offered. YES _____ NO _____
5. If I have any questions, I agree to ask them now or call Ann M. McGrath, M.A. at (402)498-3251. YES _____ NO _____
6. I understand that all information collected will be kept strictly confidential. YES _____ NO _____
7. I can and do voluntarily give permission for me and _____ (name of child) to participate in this program. YES _____ NO _____

As in all research, there may be unforeseen risks to you or the child in your care. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be made available to you or the child in your care except as otherwise stated in this consent form.

Please sign below if you consent for yourself and the child in your care to participate in this project.

Signature

Date

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner of both pages of this consent form. Subjects should not sign this document if the corners do not show a stamped date and signature.

Signature of Researcher

Date

Appendix B
Adolescent Assent Form

WESTERN MICHIGAN UNIVERSITY
 H. S. I. R. B.
 Approved for use for one year from this date:
 NOV 25 1998
Sylvia Culp
 HSIRB Chair

Western Michigan University
 Department of Psychology
 Do Adolescent Self-Report Scales predict ADHD diagnostic status?
 (Adolescent assent form)

Principal Investigator:

C. Richard Spates, Ph.D. Western Michigan University

Co-Student Investigator:

Ann M. McGrath, M.A.

We are inviting you to be in a research project entitled "A Study of the Validity of the ADHD portion of the NIMH DISC IV." The project's goal is to learn more about adolescent self-report to diagnose Attention-Deficit Hyperactivity Disorder. What we would like to do is to ask you to complete an interview, a paper and pencil questionnaire, a short computer test, some math problems, and to wear a small watch-like device for three days at school.

There could be several potential benefits to participating in this project, including learning more about Attention Deficit-Hyperactivity Disorder and yourself. We can identify no risks to you, above and beyond those that people usually face when completing measures like these. Participating or not participating will have no effect on the services you are entitled to at Boys Town. If you complete the study, you will receive \$20 compensation which will be deposited directly into your Boys Town account.

All data will be stored in a manner that will protect your confidentiality. Your name will not appear anywhere on the questionnaire, videotape, or any other forms. This means that you will be assigned a code number and the master list containing the names and code numbers will be available only to the Principal Investigator and Co-Student Investigator. After the data have been collected and analyzed, the master lists will be destroyed. All other data will be destroyed after five years.

You may withdraw at any time from this study without any negative effects. If you have any questions or concerns about this study, you may contact either Ann M. McGrath (402)498-3251, or C. Richard Spates (616-387-8332). You may also contact the Chair of the Human Subjects Institutional Review board at Western Michigan University (616-387-8293) or the Vice President for Research at Western Michigan University (616-387-8298) with any concerns that you have.

PLEASE COMPLETE THE NEXT PAGE IF YOU WISH TO PARTICIPATE.

WESTERN MICHIGAN UNIVERSITY
H. S. I. R. B.
Approved for use for one year from this date:

NOV 25 1998

Sylvia Culp
HSIRB Chair

PLEASE READ EACH STATEMENT AND CHECK YES IF YOU AGREE TO THE ITEM.
IF YOU CHECK NO TO ANY STATEMENT, YOU WILL NOT PARTICIPATE IN THE STUDY.

1. I agree to participate in a project designed to study adolescent self-report. YES ___ NO ___
2. I agree to complete a diagnostic interview. YES ___ NO ___
3. I agree to complete a short questionnaire. YES ___ NO ___
4. I agree to complete several math problems while I am being videotaped and observed through a one way mirror. YES ___ NO ___
5. I agree to complete a short computer test during which I will have to watch a computer screen and push buttons. YES ___ NO ___
6. I agree to wear a small watch-like device at school on three separate occasions. I will also have my teachers sign a sheet verifying that I am wearing the wrist and ankle devices during class. YES ___ NO ___
7. I may experience some mild distress from completing these instruments. If such distress were to occur, I agree to inform the researcher, and appropriate therapeutic support or a referral to another clinic will be offered. YES ___ NO ___
8. If I have any questions, I agree to ask them now, or to call Ann M. McGrath, M.A., at (402)498-3251. YES ___ NO ___
9. I understand that all information collected will be kept strictly confidential. YES ___ NO ___

As in all research, there may be unforeseen risks to you. If an accidental injury occurs, appropriate emergency measures will be taken; however, no compensation or additional treatment will be made available to you except as otherwise stated in this consent form. Please sign below if you assent to participate in the research project.

Signature

Date

This consent document has been approved for use for one year by the Human Subjects Institutional Review Board (HSIRB) as indicated by the stamped date and signature of the board chair in the upper right corner of both pages of this document. Subjects should not sign this document if the corners do not show a stamped date and signature.

Signature of Researcher

Date

Appendix C

Approval Letter From the Human Subjects Institutional Review Board

WESTERN MICHIGAN UNIVERSITY

Date: 25 November 1998

To: Richard Spates, Principal Investigator
Ann McGrath, Student Investigator for dissertation

From: Sylvia Culp, Chair *Sylvia Culp Chair*

Re: HSIRB Project Number 98-10-20

This letter will serve as confirmation that your research project entitled "A Study of the Validity of the ADHD Portion of the NIMH-DISC-IV" has been **approved** under the **full** category of review by the Human Subjects Institutional Review Board. The conditions and duration of this approval are specified in the Policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note that you may **only** conduct this research exactly in the form it was approved. You must seek specific board approval for any changes in this project. You must also seek reapproval if the project extends beyond the termination date noted below. In addition if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the HSIRB for consultation.

The Board wishes you success in the pursuit of your research goals.

Approval Termination: 13 November 1999

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