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ABSTRACT

The best procedure for the diagnosis of Attention-Deficit/Hyperactivity Disorder (ADHD) remains fragmented. The diagnosis is frequently based on anecdotal information and rating scales completed by parents and teachers. A major drawback to a more objective diagnosis has been the absence of standardized test data generated by the child client. The most promising objective test appears to be a modification of the Continuous Performance Test (CPT). Advocates of the continuous performance type test claim the ability to differentiate ADHD children from non-ADHD children. This study of high-risk children ages 5 years 1 month to 7 years 8 months (n=54) examined the relationship between the omission and commission scores of the CPT and scores from two commonly used parent-teacher report measures. The individual subtest scores from the Conners Parent Rating Scale (CPRS) and the ADD-H Comprehensive Teacher's Rating Scale (ACTeRS) were factored with the omission and commission error scores from the CPT. The impulsive/hyperactivity scale (CPRS), the hyperactivity index (CPRS), the attention scale (ACTeRS), and the hyperactivity scale (ACTeRS) are often used to diagnose ADHD, therefore the construct validity of the CPT could be assessed by the resulting factor structure. Overall, the CPT appears promising as an objective measure of attention and impulsivity in children; however, why it is more closely associated with the parent ratings than teacher ratings needs further study. (Contains 22 references.) (Author/TS)

Relationship of the CPT and Parent-Teacher Report Measures of Attention Deficit Disorder

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Abstract

The best procedure for the diagnosis of Attention-Deficit\ Hyperactivity Disorder (ADHD) remains fragmented. The diagnosis is frequently based on anecdotal information and rating scales completed by parents and teachers. A major drawback to a more objective diagnosis has been the absence of standardized test data generated by the child client. The most promising objective test appears to be a modification of the Continuous Performance Test (CPT). This instrument records two types of errors: omission and commission. Omission errors are recorded when the child does not respond in the presence of a target stimulus. Commission errors occur when a child responds to a nontarget stimulus. Advocates of the continuous performance type test claim the ability to differentiate ADHD children from non-ADHD children. Limited research exists, however, that compares the CPT to rating scales specifically used in the diagnosis of ADHD in a mixed sample of children. This research examined the relationship between the omission and commission scores of the CPT and scores from two commonly used parent-teacher report measures. The individual subtest scores from the Conners Parent Rating Scale (CPRS) and the ADD-H Comprehensive Teacher's Rating Scale(ACTeRS) were factored with the omission and commission error scores from the CPT. The

impulsive/hyperactivity scale (CPRS), the hyperactivity index (CPRS), the attention scale (ACTeRS), and the hyperactivity scale (ACTeRS) are often used to diagnose ADHD, therefore, the construct validity of the CPT could be assessed by the resulting factor structure. Subjects were 54 high-risk infants who ranged in age from 5 years 1 month, to 7 years 8 months. The decision to use such a population was based on a review of related literature which suggests that 35-40 percent of high-risk children will likely experience neuropsychological, educational and attentional difficulties. A principle components factor analysis was conducted using the CPT, CPRS and ACTeRS scores. Following the initial identification of factors a promax rotation was performed based on the assumption of correlated items. The CPT was most closely associated with measures of impulsivity ($r = .624$) and hyperactivity ($r = .692$) provided by the CPRS. This finding was congruent with the CPT's designation as a measure of ADHD and suggestive of a positive and significant relationship between an objective measure of behavior as the CPT and parent perception of behavior (CPRS). Little association was detected between the ACTeRS scale ($r = .012$) and CPT omission and commission scores. Overall, the CPT appears promising as an objective measure of attention and impulsivity in children, however, why it is more closely associated with the parent ratings than teacher ratings needs further study.

Relationship of the CPT and Parent-Teacher Report Measures of Attention Deficit Disorder

One of the most frequent referrals to mental health clinics, physicians, and psychologists is for evaluation of children with low attention spans and impulsive behavior who are suspected to have attention deficit disorder (ADD) with or without hyperactivity (Greenhill, 1989). This disorder, estimated to effect approximately three to four percent of the student population (American Psychiatric Association, 1987), has undergone many conceptual revisions and adjustments during the past several decades. Originally identified as "minimal brain damage" or "minimal brain dysfunction", children who exhibited inattentive and hyperactive behavior were viewed as suffering from an impairment of the central nervous system (Strauss & Lehtinen, 1947). Failing to stand up under the scrutiny of investigation, the diagnostic categories of "minimal brain damage" and "minimal brain dysfunction" were later replaced in favor of what was thought to be a more accurate behavioral description of the disorder "hyperactive child syndrome" (American Psychiatric Association, 1968).

Introduction of the *Diagnostic Manual of Mental Disorder, Third Edition* (DSM-III; American Psychiatric Association, 1980) provided the first guidelines for evaluation of the multiple behavioral components associated with ADD: lack of sustained

attention, impulsivity, and motor hyperactivity. The DSM-III proposed a division of the global diagnosis of ADD into two separate diagnostic categories: Attention Deficit Disorder with Hyperactivity and Attention Deficit Disorder without Hyperactivity. This division was based on the growing realization of the existence of two similar yet separate categories of ADD (Frick & Lahey, 1991).

The current version of the DSM, the DSM-IV (American Psychiatric Association, 1994) created four subtypes for the category of Attention- Deficit/ Hyperactivity Disorder (ADHD): ADHD, Combined Type, ADHD, predominantly Inattentive Type, ADHD predominantly Hyperactive-Impulsive Type and ADHD, Not Otherwise Specified (NOS). The ADHD, Combined Type represents those children with significant attentional and impulsive/ hyperactivity difficulties. The ADHD, predominantly Inattentive Type diagnosis is for children with attentional difficulties, but with no significant difficultly with activity level or impulse control. The ADHD predominantly Hyperactive-Impulsive Type was designed for children with activity and impulse problems whose ability to attend was not significantly impaired. This change from the DSM-III-R was precipitated by current research which revealed that attention is not necessarily the only sufficient symptom of the diagnosis, as suggested by previous research. The ADHD, NOS category was added in the DSM-IV to account for research which suggests there are other dimensions yet to be defined and thoroughly researched.

Numerous studies have documented difficulties inherit with viewing individuals with ADD as members of an homogeneous population. Perhaps the most notable of these difficulties is that some children among this population appear to behave differently than others. Stated simply, those children who exhibit inattentive behavior and those who exhibit hyperactive behavior are typically viewed by raters as qualitatively different. Quay (1986), through a factor analysis of teacher rating scales, found that items measuring attention deficits and those pertaining to motor hyperactivity loaded on separate factors. Likewise, Lahey, et al. (1988), using both clinic-referred and nonreferred samples, discovered that teacher ratings of ADD behavior using the DSM-III criteria also produced two separate factors: inattention and hyperactivity. These results were supported by Hart et al. (1990) in a replication of the work by Lahey, et al. (1988).

As a result of diagnostic confusion and purely behavioral criteria, there is little uniformity regarding appropriate components of the evaluation process, other than the necessity of clinical interviews and data collection from multiple sources. Typically, in an attempt to evaluate actions at home and at school, measures of behavior are obtained from both parent(s) and teacher(s) (Roberston, 1987). Rating scales such as the Conners Parent Behavior Rating Scale (Conners, 1989), the Conners Teacher Rating Scale (Conners, 1991), or the ADD-H Comprehensive Teacher Rating Scale (Ullman,

Sleator, & Sprague, 1986; ACTeRS) are frequently used. Measures of intelligence and academic achievement are also recommended to rule out the possibility of a specific learning disability which might effect a child's ability or motivation to attend or control impulsive behavior.

A significant problem with reliance on scores from parent and teacher reports as diagnostic criteria is the low level of correlation which is often found between parent and teacher measures (Achenbach, McConaughy, & Howell, 1987; Schaughency & Rothlind, 1991). As noted by Sattler (1990), a lack of reliability between these measures appears to be primarily the result of varying levels of experience, expectations and tolerance on the part of parents and teachers. Children who display restlessness and overactivity may be viewed as inattentive and impulsive by one person and as normal by another. An objective measure of attention and impulsivity would facilitate an accurate differential diagnosis between children with normal, ADHD, Combined Type, ADHD, Inattentive Type, ADHD, Impulsive\Hyperactive Type, and ADHD, NOS behaviors.

One test format which has shown increasing promise in measuring attention and impulsivity objectively is the Continuous Performance Test (CPT). First described by Rosvold, Mirsky, Saranson, and Beck (1956), this instrument records two types of errors: omission errors and commission errors. Omission errors are

recorded when a child does not respond in the presence of a target stimulus. Commission errors occur when a child responds to a non-target stimulus. The vast majority of research conducted with CPT measures has been with children thought to have attention difficulties similar to ADD with or without concurrent hyperactivity or impulse problems (van der Meere & Sergeant, 1988). An analysis of scores achieved on continuous performance tests by children diagnosed with ADD suggests that omission errors are associated with inattention and commission errors with impulsivity (Raggio & Whitten, 1992).

There are now several versions of continuous performance type tests available. One such test is the Raggio Evaluation of Attention Deficit Disorder (READD) (Raggio, 1991), a microcomputer version of the CPT. Although not currently commercially available, the READD was standardized with 361 normal children ages 6 to 13 years and 271 children 5 to 9 years referred for learning problems and attentional problems deficit. The referred children were tested in a child development clinic in a regional medical center. The gender and race of all the children were not recorded.

The purpose of the current study was to determine the relationship between the raw omission and commission scores provided by the READD and scores from two commonly used parent-teacher report measures. The Conduct Problem, Learning, Psychosomatic, Impulsivity/Hyperactivity, Anxiety, and

Hyperactivity Index scores from the CPRS and the Attention, Hyperactivity, Social Skills, and Oppositional scores from the ACTeRS were factored with the omission and commission scores from the READD. The Impulsivity/Hyperactivity scale (CPRS), the Hyperactivity Index (CPRS), the Attention scale (ACTeRS), and the Hyperactivity scale (ACTeRS) are often used to diagnose ADD, therefore the construct validity of the READD could be assessed by the resulting factor structure.

Method

Subjects

Subjects were randomly selected from a pool of children (N = 212) 5 to 7 years old (born between January 1983 and November 1985) who had previously been identified as high-risk infants (n = 54). The children were seen as infants in the Neonatal Follow-up Clinic at a University Regional Medical Center in the southern United States for at least one of the following medical risk factors: low birth weight (less than 1500 grams); high birth weight (greater than 4500 grams); hyperbilirubinemia; septicemia; respiratory distress; arrhythmias; ventricular hemorrhaging; prematurity (gestation less than 28 weeks), 5-minute APGAR scores of less than 4, or any other medical situation which kept the infant in the neonatal intensive care nursery for more than 8 hours.

A high-risk population was chosen for the focus of this study in order to provide a more complete comparison of the measures of attention deficit disorder. Approximately 20% of the subjects participating in this study had previously been diagnosed with attention deficit disorder. This large percentage of identified individuals, combined with the fact that 35 - 40% of a high-risk cohort of children will likely experience neuropsychological or educational difficulties (Astbury, Orgill, Bajuk, & Yu, 1990; Hunt, Tooley, & Harvin, 1982), provided an excellent opportunity to compare an objective measure of impulsive and inattentive behavior with parent and teacher perception of those same behaviors. The final sample contained 26 males and 28 females between the ages of 5 years 1 month and 7 years 8 months ($\underline{M}$ = 6.1, $\underline{SD}$ = .7). The children's gestational ages ranged from 24 to 40 weeks with an average length of 29.0 weeks ($\underline{SD}$ = 3.2 weeks). Birth weight ranged from 610 grams to 3150 grams with the average birth weight being 1136.89 grams ($\underline{SD}$ = 426.69 grams). There were 27 Caucasian children and 27 African American Children in the group.

Procedure

Each of the 54 children in the final sample completed the READD on a standard Apple II/E computer equipped with a monochrome monitor. The Conners Parent Rating Scale (CPRS), a behavior checklist with 48 items, was completed by a parent of each

child. The ADD-H Comprehensive Teacher Rating Scale (ACTeRS), a behavior checklist with 24 items, was completed by the primary teacher of each child.

Results

A principal-components factor analysis was conducted using the READD, CPRS, and ACTeRS scores. The analysis revealed a multi-factor structure, with the first four factors accounting for the majority (72.4%) of variance (eigen values = 3.85, 2.09, 1.48, and 1.28). The eigen values of the remaining factors ranged from .86 to .12, suggesting the provision of little additional information. As a result, further analytical procedures focused solely on the four factors with an eigen value greater than 1.00.

Following the initial identification of factors, a promax rotation was performed based on the assumption of correlated items. The resulting rotated factor pattern matrix indicated that Factor 1 contained READD commission scores, READD omission scores, and the Hyperactivity Index, Impulsivity/Hyperactivity scale, and Conduct Problem scale from the CPRS. Factor 2 contained both the Oppositional scale and Hyperactivity scale from the ACTeRS as well as the CPRS Conduct Problem scale. Factor 3 was comprised of the ACTeRS Social Skills scale, the ACTeRS Attention scale, and the CPRS Psychosomatic scale. Finally, Factor 4 contained the CPRS scales of Anxiety, Psychosomatic, and Learning.

Discussion

A review of the results provided by the analysis of the READD, CPRS, and ACTeRS indicated that each of the four factors contained relatively distinct groupings. Correlations among the factors ranged from .11 to -.23, with none of the correlations approaching significance.

Factor 1 was labeled the Impulsive/Hyperactive Factor and accounted for 32.1% of the variance between scores. Factor 1 contained primary loadings on the parent report measures of impulsivity and hyperactivity and objective measures of attention and impulsivity. There was also a significant secondary loading from the parent report measure of conduct problems. Overall, Factor 1 suggests a relationship between parent report of impulsivity and conduct problems with objective measures of attention and impulsivity.

Factor 2, the Oppositional Difficulties Factor contained primary loadings from teacher reports of oppositional behavior and hyperactivity along with parent reports of conduct problems. This factor suggests that within this population of at-risk children, hyperactive behavior as recorded by teachers is closely correlated with oppositional and conduct problems. Factor 2 accounted for approximately 17.4% of the variance.

Factor 3 was comprised of teacher perception of social skills and attention as well as parent perception of psychosomatic complaints. Factor 3 accounted for approximately 12.3% of the variance and was labeled the Social Attention and Health Perception Factor. It is likely that the high-risk nature of the population in the current study affected the pattern of this factor. The children who participated in this study, as a result of their handicapping conditions (40% were considered neuropsychological impaired or suspect), may have had a higher incidence rate of true physical complaints which paralleled their attention difficulties. In addition to physical concerns, attention difficulties or neuropsychological impairment may have also effected their social skills

Factor 4 was comprised of parent perception of anxiety, psychosomatic complaints, and learning as measured by the CPRS. Factor 4 was defined as an Anxiety factor and accounted for 10.6% of the variance between scores. Items in this factor were negatively correlated and appeared indicative of a possible relationship between psychosomatic complaints, anxiety, and learning ability. Again, this relationship may be due to a higher incidence rate of true physical complaints and learning difficulties in this at-risk population resulting in heightened parental perception of anxiety in comparison to a normal population.

In summary, the omission and commission scores of the READD were most closely associated with measures of impulsivity

and hyperactivity provided by the CPRS. Inclusion of the omission and commission scores of the READD in Factor 1 suggests that the measures of ADD provided by the READD were associated with parental perception of impulsive and hyperactive behavior. This finding seems consistent with the READD's designation as a measure of ADD (Raggio and Whitten, 1992) and suggests a positive and significant relationship between an objective measure of behavior (READD) and parent perception of behavior (CPRS).

Surprisingly, little association was detected between the ACTeRS scales and READD omission and commission scores. Neither the ACTeRS Hyperactivity scale nor the ACTeRS Attention scale was grouped with the error scales of the READD nor with the Hyperactivity scales of the CPRS. Grouping of the ACTeRS Hyperactivity and Oppositional scales with the CPRS scale of Conduct Problem suggests that teacher perception of hyperactive behavior may be more closely associated with defiant or aberrant behavior rather than impulsive or inattentive behavior as measured by the READD. Although a definitive explanation for this result cannot be reached in this study, there are several possibilities, including: a) there is a difference between student impulsivity and attention and teacher perception of impulsivity and attention, b) there is a difference between impulsivity and attention as measured by the READD and impulsivity and attention as measured by the ACTeRS , or c) there is a difference between impulsivity and

attention as measured by the CPRS and impulsivity and attention as measured by the ACTeRS. Since the measures of ADD used in this study were completed by either the child, parent, or teacher (READD, CPRS, and ACTeRS respectively) further research is needed to account for respondent and test effects.

Overall, the READD appears promising as an objective measure of attention and impulsivity in children defined as at-risk at birth. The inclusion of norms for ADHD children will also be a benefit to practitioners in the field.

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