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TEST REVIEW

Behavior Rating Inventory of Executive Function

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Child neuropsychologists are often asked to determine whether a child experiencing difficulties in the academic setting has a specific learning disability, attentional deficit, memory impairment, or some combination of these problems. There is less recognition by referral sources that another explanation might be contributory, i.e., presence of impaired executive function. Children with neurological disorders are also subject to the types of behavioral problems correctly subsumed under the broad construct ''executive function''. Therefore, there is a need to reliably obtain valid information that assists in the differential diagnosis and treatment planning for these children. Practitioners now recognize and assess discrete behaviors that reflect executive function problems despite the absence of formal recognition of an executive function disability, e.g., in the Diagnostic and Statistical Manual of Mental Disorders-Fourth Edition.

To date, the professional attempting to understand the child's executive function competence in the real-world setting has been at a disadvantage despite a growing literature on theory and behavioral expression of executive function problems (Denckla, 1989; 1994; Lyon & Krasnegor, 1996; Stuss & Benson, 1986; Welsh & Pennington, 1988; Welsh, Pennington, & Grossier, 1991). Available standardized test instruments, including behavioral scales and questionnaires, do not capture the qualitative aspects of a full range of these problems sufficiently well or fail to assess aspects of this domain entirely. Further, the important supplemental history-taking that is essential for a comprehensive evaluation is itself limited when the interviewer neglects to ask about central executive function behavioral features. An existing shortcoming quantifying a broad range of executive function components has been eliminated by the publication of the Behavior Rating Inventory of Executive Function (BRIEF), a test that has normative data for children aged 5 to 18 years.

The BRIEF is the end result of the collaboration of four neuropsychologists who over the last several years have meticulously planned, researched and experimentally validated a questionnaire appropriate for parent, caregiver and teacher. Early scientific presentations suggested that this instrument held much promise, and the pre-publication research use of the questionnaire by non-author professionals resulted in considerable enthusiasm for this undertaking. Publication of the BRIEF by Psychological Assessment Resources, Inc. now makes it possible for others to appreciate the additional informative data about executive function that can be obtained and incorporated as part of a screening, comprehensive child evaluation, or research protocol.

Psychological Assessment Resources, Inc. has produced a user-friendly Professional Manual and set of test materials. The BRIEF questionnaire package arrives with the Professional Manual, and packages of an 86 question Parent Form, a

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Parent Form Scoring Summary, an 86 question Teacher Form and a Teacher Form Scoring Summary. The answer sheets use a three-point scale (Never, Sometimes, Often) and respondents with at least a fifth grade education will find it easy to comply with the straightforward instructions. Each questionnaire form takes approximately 10 to 15 minutes to complete and has a hidden carbon copy that simplifies later addition of item scores within each scale for computation of *T* scores.

Questions were selected for inclusion in the BRIEF that interrater reliability correlations and item-total correlations found to have the highest probability of enlightening the clinician. The items selected for the forms were chosen for their relevance across the age range. Principal components analysis identified eight subdomains of executive function. The Inhibit, Shift, and Emotional Control subdomains together result in an additional composite Behavioral Regulation Index (BRI). The subdomains Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor provide a composite Metacognition Index. The BRI and MI are also combined to obtain an overall Global Executive Composite (GEC). A Table of base rate data (frequency of absolute *T* score differences) for the parent and teacher normative sample is provided to help determine if a statistically significant BRI-MI difference negates the usefulness of the GEC score as a summary measure of executive dysfunction. It is recommended that the BRI index elevations be reviewed first and their influence considered for each individual independently since behavioral regulation underlies metacognitive problem solving.

Scoring instructions are printed on one side of a summary sheet along with directions to obtain a score for two validity scales, the Negativity Scale (Acceptable, Elevated or Highly Elevated) and the Inconsistency Scale (Acceptable, Questionable or Inconsistent). These raw difference scores are included to assist in detecting bias associated with rating scales. The other side has a profile form for graphing T scores for each scale relative to the normative sample. Tables conveniently provide T scores, percentile ranks and 90% Confidence Interval values for each scale by gender for four age groupings, i.e., 5 to 7 years, 8 to 10 years, and 14 to 18 years.

Standardization

The normative sample is comprised of 1419 Parent Forms (815 girls and 604 boys) and 720 Teacher Forms (403 boys and 317 boys). Inclusion criteria were 1) the child between 5 and 18 years of age and without a history of special education or psychotropic medication usage, and 2) no more than 10% of questionnaire items with missing responses. Twenty-five State of Maryland public and private schools were sampled and the geographic distributions were 26.5% urban, 59% suburban, and 14.5% rural. A small group of ratings of normal control adolescents from a traumatic brain injury study in Ohio was included. A full socioeconomic status distribution is represented and actual and census-weighted ethnicity and gender distributions of the normative sample are reported for five ethnic/racial groups, i.e., White, African American, Hispanic, Asian/Pacific Islander, and Native American/Eskimo.

Parent educational level, socioeconomic status, and ethnic groups were analyzed and proved not to be major factors in interpretation. There was equivalence between mother and father respondents and no major effect of teacher's length of time knowing the student.

Reliability and Validity

Reliability studies are satisfactory. The Cronbach α coefficient measure of internal consistency ranged from .80–.98 for parent and teacher form and clinical and normative samples. Parent-teacher interrater agreement was only moderate but was indicated to be consistent with expectation for different environmental settings, $r = .32$ (range: .15–50). The authors discuss two of the lowered correlations, Initiate and Organization of Materials with respect to the environment differences between home and school, but they omit interpretation of two additional lowered parent-teacher correlations, Emotional Control and Shift. Likely, this oversight will be corrected in the next edition. Test-retest reliability correlation across clinical scales for a Parent Form normative subsample was $r = .81$ (range: .76–.85) for an average interval of two weeks. BRI, MCI, GEC

retest correlations were .84, .88, .86 respectively. Parent Form clinical subsample correlation was $r = .79$ (range: .72–.84), with BRI, MCI, GEC retest correlations of .80, .83, .81 respectively for a mean interval of 3 weeks. Teacher Form normative subsample correlation was $r = .87$ (range: .83–.92), and BRI, MCI, GEC retest correlations were .92, .90, .91 respectively, with a mean interval of 3.5 weeks. Test-retest *T* score differences showed *T* score stability over a 2 to 3 week interval, supporting use of the BRIEF for repeat administration.

The author's theoretical assumption that executive function is not entirely independent or mutually exclusive of other psychological or cognitive processes appears supported by their validity data. A multitrait-multimethod matrix to examine convergent and discriminant validity resulted in interesting scale and summary index correlations with other partially related and unrelated measures of attention or other behaviors. The other measures for which data are presented are ADHD-Rating Scale-IV (DuPaul, Power, Anastopoulos, and Reid, 1998), Child Behavior Checklist (Achenbach, 1991a), Behavior Assessment for Children (Reynolds and Kamphaus, 1992), Conners' Rating Scale (Conners, 1989), and Teacher's Report Form (Achenbach, 1991b). Together, these data reinforce the contribution of the BRIEF to behavioral analysis and subtyping. For example, the pattern of correlation between the BRIEF and ADHD-IV found MCI scales to be more strongly related to inattention, whereas BRI scales were more strongly related to impulsivity and hyperactivity.

A section on predictive validity and the clinical utility of the BRIEF for children with ADHD is included. Diagnostic group membership was examined using logistic regression analyses. These found that children with ADHD-Inattentive or ADHD-Combined diagnoses received significantly higher ratings from parents and teachers than control children on the Working Memory scale. The WM scale did not distinguish between ADHD subtypes of ADHD-Inattentive and ADHD-Combined. In contrast, the Inhibit scale analyses proved useful in distinguishing children with ADHD-C from ADHD-I or controls on the parent and teacher forms in 65–68% of cases. Sensitivity and specificity data are presented in four Tables, for Parent Form and Teacher Form and for the WM and Inhibit scales. Recommended cutoff levels are discussed in the text.

CONCLUSION

The clinical and empirical importance of this measure are substantial. The authors cite their own and others' preliminary studies of clinical subgroups and provide clinical interpretation for six sample data sets to support their contention that the scales have clinical utility in distinguishing diagnostic subgroups, including subgroups of Attentional Deficit Hyperactivity Disorder (ADHD) and Pervasive Developmental Disorder. Data are also provided from preliminary studies of other clinical populations, including Tourette's disorder, high functioning autism, low birth weight, reading disorder, traumatic brain injury, phenylketonuria, frontal lobe lesions and mental retardation. The authors emphasize the importance of using this instrument in context with other measures and in evaluating domain-specific aspects of behavior to fully understand the significance of the obtained findings about self regulated problem solving and social functioning. The need to examine individual item responses as well as profiles is rightly stressed. Toward that end two additional Tables are provided that list item descriptions and their original scale for questions that have clinical usefulness but did not make it into the final version after statistical analyses.

Versions for preschoolers and another for adolescents are in development. The latter addition has great promise for comparisons of parent and teacher impressions with the self-report of the adolescent directly. With this latter addition, the acknowledged limited number of 18 year olds in the normative sample is expected to increase.

The authors are generous in their Acknowledgements. Included among those is reference to this reviewer's early contribution to categorizing 131 items into scales. It was a pleasure to add in a small way to the emergence of an important new instrument that has the potential to add substantially to the clinical assessment and

empiric study of executive function in children. This instrument has ease of administration and scoring, a thorough Professional Manual, solid statistical support for its use, and great promise for adding useful and critical information that informs the debate about executive function as a unitary or multidimensional construct. It should add important information to the delineation of etiology and implementation of individualized interventions for children with a variety of diagnostic entities.

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