School Psychology Review,
2007, Volume 36, No. 2, pp. 217–236

Consultation-Based Academic Intervention for Children With Attention Deficit Hyperactivity Disorder: School Functioning Outcomes

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Abstract. This study evaluated the effectiveness of two consultation-based models for designing academic interventions to enhance the educational functioning of children with attention deficit hyperactivity disorder. Children (N = 167) meeting *Diagnostic and Statistical Manual* (4th ed.—text revision; American Psychiatric Association, 2000) criteria for attention deficit hyperactivity disorder were randomly assigned to one of two consultation groups: intensive data-based academic intervention (interventions designed using a data-based decision-making model that involved ongoing feedback to teachers) and traditional data-based academic intervention (interventions designed based on consultant–teacher collaboration, representing "consultation as usual"). Teachers implemented academic interventions over 15 months. Academic outcomes (e.g., curriculum-based assessment, report card grade, and individual goal attainment) were assessed on four occasions (baseline, 3 months, 12 months, and 15 months). Hierarchical linear modeling analyses indicated significant positive growth for 9 of the 10 dependent variables; however, trajectories did not differ significantly across consultation groups. Implications for practice and future research are discussed.

The preparation of the manuscript was supported by National Institute of Mental Health Grant R01-MH62941. The authors gratefully acknowledge the efforts of all teachers and students who participated in this project as well as Lisa Marie Angello, Andrea Deatline-Buchman, Anuja Divatia, Lauren Dullum, Rebecca Eng, Karen Hailstones, Jilda Hodges, Jayne Leh, Stacy Martin, Jennifer Mautone, Erin Post, Eve Puhalla, Hillary Rogers, Timothy Scholten, Cotie Strong, Deanna Tipton, and Yan Ping Xin, who served as research assistants for this study.

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The 2001 reauthorization of the Elementary and Secondary Education Act, No Child Left Behind, reflects the federal government's commitment to and reinforcement of state accountability systems with the intent to improve school functioning outcomes for all students. Further, the concept of "scientifically based research" has received increased attention in an effort to address the low levels of achievement among students with disabilities, minority students (i.e., African American, Native American, and Latino), limited English proficient students, and students of low socioeconomic status. In particular, closing the achievement gap for children with learning and behavior difficulties (e.g., attention deficit hyperactivity disorder [ADHD]), who are at risk for school failure, is especially critical.

ADHD is a chronic disorder characterized by developmentally inappropriate levels of inattention and/or hyperactivity-impulsivity that affects about 3–10% of school-age children (American Psychiatric Association, 2000). In fact, the strong association between the behavioral symptoms (i.e., inattention, impulsivity, and overactivity) of ADHD and concurrent or later academic underachievement has been demonstrated across many investigations (e.g., Barkley, DuPaul, & McMurray, 1990; DuPaul et al., 2004). Converging evidence suggests that samples of children with ADHD encounter significant academic difficulties (e.g., failing grades, failure to complete assignments; American Psychiatric Association, 2000; DuPaul & Stoner, 2003) that persist throughout their school years and continue into college (Barkley, Fischer, Edelbrock, & Smallish, 1990; Mannuzza, Gittelman-Klein, Bessler, Malloy, & LaPadula, 1993; Montague, Enders, & Castro, 2005). Evidently, children with ADHD typically function approximately 1 standard deviation below their classmates on standardized achievement tests (for review, see DuPaul & Stoner, 2003; Hinshaw, 1992). Not surprisingly, children with ADHD are at higher than average risk for grade retention and school dropout (Barkley, 2006).

Although numerous investigations have addressed the behavioral symptoms of ADHD, relatively few studies have focused directly on ameliorating the academic problems that children with ADHD may have with respect to reading and math skills that are critical for success as an adult (Wirt et al., 2004). To date, the vast majority of treatment outcome studies have exclusively addressed symptom reduction rather than enhancement of academic functioning. This research has shown that the most effective treatments for ADHD include psychostimulant medication (e.g., methylphenidate) and contingency management strategies (Barkley, 2006; Multimodal Treatment of Children with ADHD [MTA] Cooperative Group, 1999). Interestingly, results from previous group treatment outcome studies suggest that effect sizes associated with behavioral interventions for classroom disruptive behavior are in the moderate range, whereas only small effects are found for interventions addressing academic problems in this population (DuPaul & Eckert, 1997). In addition, although stimulants and other medications may improve productivity on academic tasks, long-term outcome studies indicate that stimulants have negligible effects on educational achievement. For example, findings from the MTA study indicated small, statistically nonsignificant effect sizes (ES ranges from 0.0 to 0.20) for reading and mathematics achievement when children received carefully titrated psychotropic medication either alone or in combination with psychosocial treatment at 14 months (MTA Cooperative Group, 1999) or 24 months (MTA Cooperative Group, 2004) after initiation of treatment.

Over the past decade, studies using single-subject research designs have provided initial support for the effectiveness of various academic interventions for children with ADHD (DuPaul & Eckert, 1997; DuPaul & Stoner, 2003). For example, a study by DuPaul, Ervin, Hook, and McGoey (1998) established the benefits of ClassWide Peer Tutoring for 18 students with ADHD who were placed in first- through fifth-grade general education classrooms. ClassWide Peer Tutoring not only led to reductions in these students' off-task behavior, but also improved their academic performance. Results showed clinically significant improvements in academic skills, with moderate to large effects for math and spelling as measured by brief classroom-based assessments. Also, studies of computer-assisted instruction have demonstrated clinically significant gains in oral reading fluency (Clarfield & Stoner, 2005) and scores on curriculum-based measurement (CBM) mathematics probes (Mautone, DuPaul, & Jitendra, 2005; Ota & DuPaul, 2002) for small samples of children with ADHD. These studies have used either classroom-based measurements (Tindal & Marston, 1990) or CBMs that assess student academic competence and progress and are typically used to make instructional decisions (Fuchs, Fuchs, & Courey, 2005). Research regarding the effectiveness of these interventions with large samples in the context of a group research design has not been conducted to date. Further, previous studies have used single (e.g., curriculum-based assessments) rather than multiple measures to assess academic competence and progress. The importance of multiple measures to understand student performance is well documented (e.g., Gersten, Baker, & Lloyd, 2000). Although norm-referenced, standardized achievement tests are important measures of academic success, these measures typically are not used in determining student academic progress. Alternatively, measures that are used on a regular basis in school settings (e.g., report card grades) or informal teacher measures (e.g., ratings of teacher perceptions of a student's progress-to-target behavior) that evaluate student improvement in specific areas addressed by intervention have not been included in prior studies with this population.

In summary, previous research regarding the effects of academic interventions on the achievement of children with ADHD is limited by the following: (a) small samples; (b) interventions implemented over relatively short time periods (e.g., several weeks or months); (c) use of single academic measures of student progress over time; and (d) use of a "one size fits all" approach, wherein all participants receive the identical intervention regardless of differences in academic profiles. Further, prior studies have not involved classroom teachers in the design, planning, and implementation of interventions even though they are critical to the implementation and integrity of classroom-based academic interventions. Involving classroom teachers in all phases of the intervention is important for several reasons. They are likely to implement with integrity an intervention that they believe has beneficial effects for their students. Also, the viability of treatment plans is increased when teachers are invested in them.

In most public school settings, teachers work in collaboration with others, such as a consultant (e.g., school psychologist), to plan classroom interventions, with the teacher selecting a specific treatment strategy, presumably based on both perceived effectiveness and feasibility of the various intervention options. A data-based consultation decision-making model (Daly, Witt, Martens, & Dool, 1997; Sheridan, Kratochwill, & Bergan, 1996) is known to improve educational outcomes. This consultation model entails classroom teachers working with consultants to develop individualized interventions based on initial performance data, which consider student strengths and weaknesses as well as important contextual variables (e.g., antecedent and consequent events prompting and maintaining behaviors) related to the target behavior. In addition, consultants monitor treatment implementation and provide teachers with feedback designed to enhance intervention fidelity.

Unfortunately, the literature is mixed with regard to the effectiveness of a data-based, decision-making consultation model. For example, findings from some studies indicate large, positive effects for this model (Sheridan, Eagle, Cowan, & Mickelson, 2001; Sheridan, Welch, & Ormi, 1996); however, most investigations of data-based consultation outcomes have not used control groups. In one of the few studies employing a control group, Beavers, Kratochwill, and Braden (2004) showed no advantage of the data-based consultation model over a traditional, less individualized approach in designing interventions for children with reading difficulties. Unfortunately, conclusions based on the Beavers et al. study are limited given the relatively small sample size ($N = 32$) and the lack of focus on students with ADHD. Interestingly, the use of a data-based consultation model is not common among school psychologists (Bramlett, Murphy, Johnson, & Wallingsford, 2002; Constenbader, Swartz, & Petrix, 1992). Further, when school psychologists report using a consultation model in schools, only 37% follow all stages of the model and less than 50% use empirical research to select interventions and collect evaluation data to assess academic outcomes (Bramlett et al., 2002). Clearly, "consultation as usual" as it is applied in actual school settings typically does not follow the recommended practice of designing academic interventions based on empirical data. Thus, it is important to compare consultation models that incorporate academic interventions derived from evidence-based practices and differ with regard to intensive or customary level of data utilization in selecting interventions for children with ADHD.

The purpose of this study was to compare the effects of two different models of school-based consultation on the academic functioning of a large sample of students with ADHD. One approach involved consultation using customary or traditional levels of data utilization, wherein teachers selected academic interventions proposed by a school psychologist or special educator based on perceived effectiveness and feasibility, with minimal follow-up once interventions had been implemented. The other consultation approach, which was deemed intensive in data utilization, involved the selection and development of academic interventions based on data collected by the consultant regarding individual student skills and present classroom conditions. Teachers also were provided with feedback regarding treatment integrity and interventions were modified based on outcome data. Potential interventions (e.g., peer tutoring, direct instruction, and computer-assisted instruction) used in both groups were empirically supported by prior single subject research studies. It was hypothesized that the children receiving individualized academic interventions would exhibit greater growth in academic achievement as measured by report card grades, CBM mathematics and reading tests, and teacher ratings of changes in target skills than would children whose interventions were selected in the context of a typical school-based consultation model.

Method

Student Participants

Participants included 175 children (133 boys, 42 girls; mean age = 104.3 months, *SD* = 14.7) attending first through fourth grade in public elementary schools located in urban, rural, and suburban settings in eastern Pennsylvania. Children who were experiencing significant difficulties with ADHD symptoms and academic achievement were referred to the project by their classroom teachers. The sample consisted of primarily White children (58%; 26.9% Hispanic; 11.4% Black) and families were in the lower middle class and middle class range based on the Hollingshead index (Hollingshead, 1975), with a mean index score of 48.0 (*SD* = 24.8).

The sample for this study included children with ADHD who were experiencing achievement problems in either math or reading, according to teacher report. Further, these children met strict research diagnostic criteria for ADHD. To be identified as a child with ADHD, both parent and teacher ratings on the ADHD Rating Scale—IV (DuPaul, Ervin et al., 1998) exceeded the 90th percentile on either the Inattention or Hyperactive-Impulsivity subscales using appropriate age and gender norms. In addition, children met *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.—text revision, DSM-IV-TR; American Psychiatric Association, 2000) criteria for one of the three ADHD subtypes based on parent interviews using the National Institute of Mental Health Diagnostic Interview Schedule for Children—IV (Shaffer, Fisher, & Lucas, 1998). Children with all three ADHD subtypes were included, with the majority (65%) being the combined type. The sample included children with comorbid oppositional defiant disorder (38%) and conduct disorder (15%). A total of 51 students (29.1%) were receiving part-time special education services, while 50 children (28.5%) were receiving psychotropic medication. Some students were receiving more than one type of psychotropic medication, which included psychostimulants ($n = 38$), antidepressants ($n = 8$), and other medications ($n = 26$).

The final sample, however, comprised 167 students (127 boys and 40 girls), because three students moved to schools out of the area before intervention could begin, two teachers decided not to participate given their preference for behavioral rather than academic interventions targeted in the study, two parents withdrew their initial consent for consultation with their child's teacher, and one student moved to a school that declined participation. The majority ($n = 132$; 79.04%) of the remaining 167 students were randomly assigned to one of two educational consultation groups: intensive data-based academic intervention (IDAI; $n = 81$; 61 boys) and traditional data-based academic intervention (TDAI; $n = 86$; 66 boys) and received intervention in reading ($n = 126$) and/or mathematics ($n = 95$).[1] Table 1 presents demographic data separately for consultation groups within both math and reading samples The two groups did not differ with respect to gender, ethnicity, medication, educational placement, socioeconomic status, ADHD subtype, and comorbid oppositional defiant disorder or conduct disorder diagnosis. The mean age ($p < .01$) and grade ($p < .05$) for children in the IDAI group was significantly greater than that for children in the TDAI condition, for the math sample only. In the reading sample, the father's occupation was significantly higher for the IDAI group ($p < .01$).

It must be noted that 50 of the 167 students did not receive consultation services during their second year of participation (Semesters 2 and 3) for various reasons (e.g., teacher or parent declining consultation services). However, given the intent-to-treat methodology, assessment data for these participants were collected and included in all analyses. Data for 18 additional students were missing, because assessment information was not collected and/or students did not receive consultation services for some of the abovementioned reasons. At the same time, group membership was not cited as a reason to decline consultation services in the study. The χ^2 analyses revealed no significant differences between consultation models for either the type of services received (consultation, data collection only, nothing) or the reason for refusal.

Teacher Participants

A total of 204 teachers across 52 schools participated in this study. Teachers were primarily female (87.7%) and White (96.5%) and held either a bachelor's degree (48.01%) or master's degree (51.98%). Most were general education teachers, with 14.4% identified as teachers in special education classrooms. Once a student in a teacher's classroom was randomly assigned to a consultation model, all other student participants in that classroom were assigned to that group as well. The rationale for this was to avoid confusion resulting from a teacher being asked to participate simultaneously in two different models of consultation as well as working with more than one consultant. It must be noted that 27 teachers (13.2% of total teachers) worked with multiple students. In 13 of these teachers' classrooms, students were first randomized to TDAI. Students were randomly assigned to IDAI in the other 14 teachers' classrooms. As a result, the placement of 35 students (i.e., 20.96%) in a treatment group was mandatory; 13 students were in a TDAI classroom and 22 students were in an IDAI classroom. Given the number of schools and our status as consultants and guests, we could not control for future classroom placement (i.e., second academic year). Fifteen (7.35%) of the 204 teachers, however, worked with consultants from both models at some point in the study. On only one occasion did a teacher work with consultants from both models simultaneously. After eliminating the 15 teachers who received both consultation model services, χ^2 analyses revealed no significant differences between the groups on gender, ethnicity, or highest degree earned. The IDAI consultants, however, did work with more male teachers ($n = 17$) than did the TDAI [$n = 5$; $\chi^2(1) = 8.15$, $p <. 05$].

Consultant Participants

Eleven school psychology and special education doctoral students served as consultants in the study and were assigned to either

Table 1
Demographic and Diagnostic Characteristics by Academic Intervention and Treatment Group

	Math			Reading		
Measure	IDAI	TDAI	t or χ^2	IDAI	TDAI	t or χ^2
Age, months	110.64 (14.13)	102.53 (12.40)	−2.96**	103.36 (14.97)	102.12 (14.38)	−0.47
Grade	3.07 (0.99)	2.60 (0.90)	−2.41*	2.45 (1.13)	2.44 (1.03)	−0.04
Male, %	71.10	69.40	0.03	77.60	77.60	0.00
White, %	60.00	55.10	2.28	63.80	53.70	5.73
Father's occupation	39.27 (30.69)	29.47 (21.93)	−1.62	43.47 (28.40)	29.47 (25.66)	−2.67**
Mother's occupation	34.63 (24.50)	39.44 (25.18)	0.85	41.60 (27.51)	34.63 (24.63)	−1.36
ADHD combined, %	73.30	67.30	0.40	55.20	71.60	3.66
ADHD inattentive, %	22.20	26.50	0.24	32.80	20.90	2.25
ADHD hyperactive impulsive, %	4.40	6.10	0.13	12.10	7.50	0.76
ODD, %	44.40	40.80	0.13	12.10	7.50	0.76
CD, %	22.20	12.20	0.20	19.00	10.40	1.83
Receiving special education, %	42.22	34.69	0.56	27.59	34.33	0.66
Receiving psychotropic medication, %	33.30	38.80	0.30	25.90	28.40	0.10

Note. Data are presented as means and standard deviations or as percentages, as indicated. ADHD = attention deficit hyperactivity disorder; ODD = oppositional defiant disorder; CD = conduct disorder; TDAI = traditional data-based academic intervention; IDAI = intensive data-based academic intervention.
* $p < .05$.
** $p < .01$.

the TDAI or IDAI consultation groups. It must be noted that throughout the course of the study, consultants remained with the assigned group (TDAI or IDAI). Each consultant, who had either completed or was completing relevant coursework in consultation and school-based intervention, was supervised by the first and second authors. At the start of the study, the mean age of consultants in the TDAI group was 24.00 (SD = 1.83) years and that of the IDAI group was 26.20 (SD = 3.19) years. Both groups were primarily female (TDAI = 85.7%; IDAI = 80.0%) and none were of a minority ethnic group. Students and their teachers were yoked to a TDAI or IDAI consultant after they had been randomly assigned to a specific consultation group, and whenever possible retained the same consultant throughout the study.

Screening Measures

The ADHD Rating Scale—IV (DuPaul, Power et al., 1998) is a behavior rating scale that includes items directly related to the 18 symptoms of ADHD based on the DSM-IV-TR (American Psychiatric Association, 2000). Home and school versions are available for completion by parents and teachers, respectively. Items are scored on a scale of 0 (*never or rarely*) to 3 (*very often*). Normative data based on age and gender are available, and the psychometric properties of this instrument are well established (DuPaul, Power et al., 1998).

The Computerized NIMH Diagnostic Interview Schedule for Children (Parent Version, CDISC 4.0; Shaffer et al., 1998) is a structured diagnostic interview administered using computer software. Parents report current (present state) symptoms and symptoms over the past year on this interview. A trained interviewer (i.e., doctoral student in school psychology) administered the Disruptive Behavior Disorders module either in person or by phone. The entire CDISC was not administered because of time constraints (i.e., Disruptive Behavior Disorder module took approximately 1 hr to complete) and because the focus of the treatment outcome study was on externalizing difficulties (as well as academic achievement). The research project coordinator, who was a master's level psychologist, trained interviewers. Diagnostic decisions based on this interview have been found to be highly reliable (Shaffer et al., 1998). All CDISC 4.0 interviews were audiotaped, and a second trained interviewer (i.e., doctoral student in school psychology) reviewed a random subsample (21%) of interviews to assess inter-diagnostician agreement. Agreement was 100% across all interviews with respect to overall diagnosis and subtype designation.

Dependent Measures

Dependent measures included CBM reading and mathematics tests, individualized academic goal attainment or progress of target behavior (POTB) scores, and report card grades. CBM measures and report card grades were collected on four occasions (baseline, 3 months, 12 months, and 15 months) across two school years. In contrast, POTB data were collected on nine occasions during the study to provide pre-, mid-, and postintervention assessments between baseline and 3 months, 3 and 12 months, and 12 and 15 months.

Words correct per minute and digits correct from the CBM reading and mathematics measures served as indicators of academic achievement in reading and mathematics. Student progress in reading was monitored using passages developed by the Children's Educational Services, Inc. (Deno, Deno, & Marston, 1987). Before the start of the academic interventions, each student was screened using CBM reading passages to determine his or her instructional grade level (see Deno et al., 1987). Once a student's instructional level was established, progress in reading was assessed at each assessment phase using a CBM instructional grade level passage test and another CBM reading test based on the next higher grade level passage. Passage levels were adjusted at each assessment period based on student performance. That is, if a student performed at a first-grade instructional level at baseline, that student would complete both first- and second-grade probes at the 3-month assessment. Performance at this assessment was examined to determine grade level passages for the next assessment. Thus, if the student performed at an instructional level on the second-grade passage at 3 months, he or she would be given a second- and third-grade passage at the next assessment, and so forth. The instructional grade level at each assessment phase was used as the dependent variable in these analyses. During the CBM passage reading assessment, children were asked to read an excerpt of connected text in 1 min. Reading performance was determined by scoring the total number of words read correctly per minute (i.e., WCPM). Correlations for criterion-related validity of oral reading fluency (ORF) with published norm-referenced reading achievement tests range from .73 to .91, with most coefficients above .80 (Marston, 1989). Investigations of both alternate-form and test–retest reliability of ORF report coefficients of .92–.97, with most estimates above .90. Interrater agreement coefficients have been found to be .99 (Marston, 1989).

Student progress in mathematics computation was evaluated using basic math computation probes (Fuchs, Hamlett, & Fuchs, 1998). Similar to the CBM reading measure, each student was screened before the start of the academic interventions to determine his or her instructional grade level using established norms. Progress in mathematics was assessed at each assessment phase using a CBM instructional grade level math computation test and another CBM math computation test based on the next higher grade level. Not unlike CBM reading tests, probe levels were adjusted at each assessment period based on student progress. The instructional level at each assessment was used as the dependent variable for this investigation. Each CBM computation test included 25 problems that represented the sample of items found in a specific grade level curriculum, which may involve problem types that require adding, subtracting, multiplying, and dividing whole numbers, fractions, and decimals. Performance was scored as total number of digits correct in a fixed time (i.e., 2 min for Grades 1–3, and 4 min for Grades 4 and 5). This assessment system is known to have adequate reliability and validity (see Fuchs et al., 1998).

Ratings of teacher perceptions of a student's POTB were used as a measure of goal attainment scaling (Kiresuk, Smith, & Cardillo, 1994), which has been validated and used previously in consultation research to evaluate client improvement (e.g., Busse, Kratochwill, & Elliott, 1995; Grissom, Erchul, & Sheridan, 2003; Sheridan et al., 2001). In this study, consultants worked with teachers at the beginning of each assessment phase to ensure that targeted academic goals were objective, measurable, and stated in a positive fashion. Examples of goals included the number of words read correctly in a minute, number of mathematics problems completed in a given time period, and the score on a school-specific assessment that the teacher monitored on a frequent basis. Given the critical role of teachers in making instructional decisions about student performance, assessments or monitoring systems used by individual teachers and schools served as the basis for rating student progress on academic goals. Teachers then made POTB ratings regarding the frequency of student demonstration of the specific academic goal using a 4-point rating scale that ranged from 0 (*never*) to + 3 (*very often*). Ratings of the targeted academic goals were collected pre-, mid-, and postintervention, resulting in nine ratings across three assessment phases. Considering student performance and teacher choice were the basis for goal determination, each assessment period began with distinct targeted academic goals. Each set of pre-, mid-, and postintervention ratings were therefore used as dependent variables in separate analyses.

Student report card grades in reading and mathematics were converted to numerical scores ranging from 1 (*F*) to 5 (*A*). Grades in reading and mathematics represented student performance in the classroom. In the first year of participation, grades from the second marking period were used at pretreatment and fourth marking period grades were used for Assessment 1 (3 months). To remain consistent, the second and fourth marking period grades were also used the following year to indicate performance at Assessments 2 (12 months) and 3 (15 months).

Procedures

Data collection. Following receipt of written parental consent, baseline data collection of all dependent measures took place over approximately a 1-month period during the middle of the school year (December to February). CBM reading and mathematics test data were collected on three additional occasions (3 months, 12 months, and 15 months) across 2 school years. Trained graduate students in school psychology, special education, and counseling psychology served as research assistants and administered the CBM mathematics and reading measures using standardized procedures. The research assistants were blind to the purpose of the study and to the group membership of participating children. Classroom teachers provided consultants with the pre-, mid-, and postintervention ratings of student POTB (i.e., three POTB ratings per assessment phase). Student report card grades were collected from schools at the end of each academic year. Parents signed separate release of information forms, allowing project staff to collect this information.

Both treatment groups. Consultation was provided beginning in the second half of the year (approximately February) and continued through the next year, if the participant's second-year teacher was willing. Overall, the consultation procedure lasted approximately 15 months. Several elements of consultation were common across both TDAI and IDAI groups. First, following the identification of a student and teacher as participants, the consultant assigned to the case scheduled a meeting with the teacher to provide information regarding ADHD and its effects on school performance. Teachers were given two resource materials—an overview chapter on ADHD, taken from Pfiffner (1996), and a handout from the National Association of School Psychologists entitled *ADHD Students in the Classroom: Strategies for Teachers* (Brock, 1998)—and their contents were reviewed. Second, the initial and second interviews with the teachers by either TDAI or IDAI consultants were audiotaped and procedural integrity was determined using a checklist of interview steps. Feedback was provided to the consultant on any steps not completed adequately (i.e., if integrity $<100\%$).

Third, consultants in both groups collaborated with classroom teachers to design academic interventions, with teachers eventually selecting the intervention(s) that they believed was most appropriate for their classroom and each student's needs. Next, consultants designed specific intervention plans that detailed the instructional steps and provided teachers with the necessary materials to implement the selected interventions.

Fourth, both groups used a range of interventions including teacher-mediated, peer-mediated, computer-assisted, and self-mediated strategies (DuPaul & Stoner, 2003). An examination of the percentage use of the different intervention types revealed no significant differences with regard to teacher-meditated [$\chi^2(1) = 0.003$], peer-mediated [$\chi^2(1) = 2.42$], computer-assisted [$\chi^2(1) = 0.17$], and self-mediated [$\chi^2(1) = 0.63$] interventions. Teachers were the most common mediator for both groups, with 84.9% of TDAI and 86.2% of IDAI participants receiving at least one teacher-mediated intervention across the 15-month period. Peer-mediated interventions were the second most common (TDAI = 52.3%; IDAI = 64.8%), followed by self-mediated (TDAI = 15.1%; IDAI = 19.9%) and computer assisted (TDAI = 5.8%; IDAI = 7.4%).

Fifth, interventions for both groups focused on math and/or reading skills depending on the difficulties exhibited by specific children. Sixth, the TDAI and IDAI consultation groups had access to the same intervention materials and all interventions were supported by empirical research, most typically in the area of learning disabilities. Common reading interventions for both groups included repeated readings (O'Shea, Sindelar, & O'Shea, 1985; Samuels, 1979; Tingstrom, Edwards, & Olmi, 1995), listening passage preview (Rathvon, 1999), collaborative strategic reading (Vaughn & Klingner, 1999), and story mapping (Idol, 1987). In the area of mathematics, interventions such as cover–copy–compare

(Skinner, Turco, Beatty, & Rasavage, 1989), reciprocal peer tutoring (Fantuzzo, King, & Heller, 1992), classwide student tutoring teams (Harper & Maheady, 1999), and schema-based problem solving (Jitendra & Hoff, 1996; Jitendra, Hoff, & Beck, 1999) were found in both groups. Finally, intervention integrity was monitored at least three times per intervention phase in both groups and treatment acceptability was assessed as well (see DuPaul et al., 2006). IDAI teachers implemented interventions with significantly ($p < .01$) greater integrity (math, $M = 92.3\%$; reading, $M = 93.1\%$) than did TDAI teachers (math, $M = 60.1\%$; reading, $M = 57.1\%$). Alternatively, the two groups did not differ with respect to treatment acceptability, which was uniformly high in both conditions.

TDAI. The design of academic interventions in the TDAI group was based on teacher choice (i.e., "consultation as usual" control condition). Following the ADHD informational session, teachers were informed of the procedures involved in the consultation process and what they could expect regarding the number and duration of future meetings. Such meetings consisted of two consultation interviews, with additional meetings scheduled as needed. The TDAI consultation group was designed to be a close approximation to what typically takes place in the school setting.

During the initial interview, academic areas of concern were identified, current performance was discussed, and goals for intervention were determined. The consultants set up a time for a second interview in which they returned with a menu of empirically supported intervention options addressing the goals targeted in the initial interview. After explaining each intervention, teachers chose the intervention(s) and consultants provided the necessary resources (intervention plan, materials) to implement the intervention(s). Weekly contact with teachers was arranged by phone or e-mail for the teachers to provide updates and address questions or concerns. Data on student progress were not collected and any changes in intervention were based solely on teacher report. Intervention integrity was monitored (using checklists reflecting the steps of the intervention plan) by a TDAI consultant not assigned to the case, and neither the teacher nor the consultant responsible for designing the intervention were provided with feedback regarding integrity, progress, or outcomes.

The above procedure was implemented for each teacher involved in the consultation process. When a child changed teachers (i.e., advancing to the next grade level), the procedure was repeated. Master's level psychologists completed procedural integrity of the initial and second interviews. Approximately 20% of the audiotapes were randomly chosen, resulting in 95.7% integrity for the initial interview and 97.6% integrity for the second. Feedback regarding treatment integrity was provided to the consultant by the supervisor.

IDAI. The design of academic interventions in the IDAI group was based on assessment data using a consultative problem-solving model involving three consultant–teacher interviews (Bergan & Kratochwill, 1990). During the Problem Identification Interview (PII), consultants in the IDAI group identified academic areas of concern, antecedent conditions, student's response to these conditions, as well as consequent conditions. Patterns to academic behavior problems were also identified; goals were set and prioritized. Teachers and consultants then agreed on additional observational procedures.

Before conducting the Problem Analysis Interview (PAI), consultants in the IDAI treatment groups conducted functional academic assessments of the classroom to obtain information regarding teacher routines, behaviors, and procedures as well as student and peer behaviors (e.g., Daly et al., 1997). Consultants also reviewed student work products in comparison to peers and completed a basic skills assessment using curriculum-based assessment data in the content areas of reading and math. Once these observation and assessment procedures were completed, consultants conducted the PAI with the teacher. In this meeting, specific interventions were discussed based on teacher input as well as direct observation and assessment data. After explaining

Table 2
Means and Standard Deviations for CBM and Report Card Grade

Measure	TDAI BL	TDAI 3 Months	TDAI 12 Months	TDAI 15 Months	IDAI BL	IDAI 3 Months	IDAI 12 Months	IDAI 15 Months
CBM instruct. level–math	1.00 (0.71)	1.04 (0.74)	1.44 (0.85)	1.78 (0.97)	1.27 (0.66)	1.26 (0.66)	1.69 (0.89)	2.03 (1.05)
CBM instruct. level–reading	1.85 (1.58)	2.20 (1.72)	2.80 (1.91)	3.30 (1.90)	1.72 (1.57)	2.18 (1.97)	3.31 (1.78)	3.36 (1.86)
Report card grade –math	3.07 (1.01)	3.14 (1.02)	3.29 (0.94)	3.45 (0.98)	3.19 (0.94)	3.32 (0.91)	3.50 (1.14)	3.46 (1.26)
Report card grade –reading	3.00 (0.89)	3.39 (0.93)	3.36 (0.96)	3.66 (0.88)	3.16 (1.08)	3.34 (0.99)	3.62 (0.83)	3.62 (1.00)

Note. TDAI = traditional data-based academic intervention; BL = baseline; IDAI = intensive data-based academic intervention; CBM = curriculum-based measurement. Instruct = instructional.

each intervention and teachers chose the intervention(s), consultants not only provided the necessary resources (intervention plan, materials) to implement the intervention(s) as in the TDAI group, but also trained teachers and students, if necessary, on the steps of the intervention. In contrast to the TDAI group, progress monitoring data were collected on a weekly basis by either the teacher or the consultant. The type of data collected was based on the goals and academic subject targeted and included such procedures as curriculum-based probes in beginning reading skills, oral reading fluency, and/or math fluency, as well as comprehension and problem-solving skills when appropriate.

In contrast to the TDAI group, the consultants responsible for the interventions conducted integrity checks (using checklists reflecting the steps of the intervention plan) and provided teachers with feedback that was tied to the intervention plan on a biweekly basis. A treatment evaluation interview was also conducted approximately 4 weeks into the intervention. Consultants used visual analysis of the graphed displays of the progress monitoring data to determine the level of progress made (i.e., mastery, no progress, adequate progress, inadequate progress, motivation problems; Browder et al., 1989). It was then determined whether it was appropriate to leave the plan in place, intensify or simplify the intervention, provide for improved antecedents, change the intervention, redefine the goals, or retrain the teacher and/or students in the procedures.

This procedure was implemented for each teacher involved in the consultation process, including a discussion of past performance and progress in the project with additional teachers. Further, the second author determined procedural integrity of the interview. Approximately 20% of the audiotapes were randomly chosen, resulting in 94.8% integrity for the PII and 96.6% integrity for the PAI. Procedural integrity was also completed on audiotapes of the treatment evaluation interviews and was found to be 91.3%. Feedback regarding treatment integrity was provided to the consultant by the second author.

Results

Means and standard deviations for all dependent measures are presented for CBM and report card grades (Table 2) and POTB ratings (Table 3). Separate hierarchical linear modeling analyses for each dependent variable were conducted to assess possible differences

Table 3
Means and Standard Deviations for Progress of Target Behaviors

Measure	TDAI Pretreatment	TDAI Midtreatment	TDAI Posttreatment	IDAI Pretreatment	IDAI Midtreatment	IDAI Posttreatment
POTB Assessment Phase 1 (math)	0.51 (0.48)	1.43 (0.79)	1.88 (0.94)	0.81 (0.43)	1.62 (0.77)	1.75 (0.86)
POTB Assessment Phase 2 (math)	0.37 (0.54)	1.05 (0.53)	1.55 (0.84)	0.77 (0.44)	1.47 (0.63)	1.89 (0.85)
POTB Assessment Phase 3 (math)	0.63 (0.54)	1.28 (0.87)	1.76 (1.16)	1.03 (0.88)	1.56 (0.93)	1.87 (0.94)
POTB Assessment Phase 1 (reading)	0.84 (0.54)	1.59 (0.76)	1.92 (0.87)	0.71 (0.50)	1.53 (0.70)	1.74 (0.74)
POTB Assessment Phase 2 (reading)	0.51 (0.45)	1.40 (0.73)	1.74 (0.80)	0.86 (0.67)	1.67 (0.75)	1.77 (0.70)
POTB Assessment Phase 3 (reading)	1.45 (0.85)	1.80 (0.86)	2.06 (1.03)	1.55 (0.57)	1.95 (0.71)	2.10 (0.75)

Note. TDAI = traditional data-based academic intervention; IDAI = intensive data-based academic intervention; POTB = progress of target behavior.

in intercept (baseline value) and slope (academic growth) between the two consultation groups (using an intent to treat methodology). For CBM and report card grades, intercepts and slopes represented trajectories over a 15-month period (i.e., one data point per assessment phase). Alternatively, because POTB data were collected three times per assessment phase, hierarchical linear modeling analyses were conducted within each assessment phase. For all analyses, at Level 1, individual trajectories (i.e., intercept [baseline value] and slope) were calculated for each participant. At Level 2, group level parameters of individual change were examined, including mean initial performance for TDAI (γ_{00}), difference in mean initial performance between TDAI and IDAI (γ_{01}), mean growth rate (per assessment period) for TDAI (γ_{10}), and difference in mean growth rate between TDAI and IDAI (γ_{11}).[2]

Because participants in the IDAI math sample were significantly older than the children in the TDAI math sample, age in months was used as a Level 2 covariate for math analyses only. Although there also was a significant difference in grade level between math intervention groups, grade was not added as a covariate because it is an ordinal variable and was highly correlated ($\eta^2 = 0.85$) with age. In similar fashion, because paternal occupation was significantly higher in the IDAI group for the reading sample, paternal occupation was used as a Level 2 covariate for reading analyses of POTB data. Paternal occupation was not included as a covariate for analyses of CBM reading level or reading report card grades because this potential covariate was not significantly related to scores on these dependent measures.

Table 4
Hierarchical Linear Modeling Analyses of Mathematics Achievement Outcomes

Measure	TDAI Intercept	Δ Intercept (IDAI)	TDAI Slope	Δ Slope (IDAI)
CBM instructional level	0.98***	0.12	0.31***	−0.07
Report card grade	3.02***	0.19	0.10	0.01
POTB Phase 1	0.60***	0.35**	0.67***	−0.20
POTB Phase 2	0.42**	0.53**	0.56***	0.00
POTB Phase 3	0.84**	0.19	0.61***	−0.19

Note. TDAI = traditional data-based academic intervention; IDAI = intensive data-based academic intervention; POTB = progress of target behavior.
** $p < .01$.
*** $p < .001$.

For all dependent measures, γ_{00} was statistically significant ($p < .05$), indicating that the TDAI group started out at a nonzero level of performance (see Tables 4 and 5). For all but four measures, γ_{01} was not statistically significant; thus, there was no significant difference in initial performance between the two treatment groups. Statistically significant ($p < .05$) group differences in intercept were found for POTB in both math and reading (Phases 1 and 2). Specifically, IDAI group scores were greater than TDAI scores. Although statistically significant ($p = <.01$ to $<.001$), positive growth was obtained for 9 of the 10 dependent variables (not significant for math report card), the two consultation groups did not differ in rate of growth for any measure.

To estimate the magnitude of change, within-group effect sizes were calculated using the formula ($M_{15\text{-mos}} - M_{BL}$)/(pooled *SD*),[3] which accounted for the correlation between pre- and postintervention scores. Thus, these effect sizes represent change over baseline functioning in standard deviation units (Cohen, 1988; see Table 6). Effect sizes were in the small range (ES $\leq$ 0.50) for report card grade in math (both groups) and reading (IDAI only). Alternatively, a moderate effect size (0.50 $<$ ES $<$ 0.80) was obtained for report card grade in reading (TDAI only). Finally, large effect sizes (ES $\geq$ 0.80) were found for CBM instructional level in both math and reading, as well as all POTB scores (both groups).

Discussion

This study compared the effects of two different consultation models (TDAI and IDAI) on the academic achievement of children with ADHD. Specifically, we examined school functioning as measured by CBM assessments, report card grades, and individual goal attainment (i.e., POTB). The results indicated that the two consultation groups did not differ with respect to growth on any of the academic measures.

At the same time, the finding about a positive outcome for the TDAI group on the POTB combined with the fact that interventions designed through the IDAI approach were implemented with greater integrity than those designed through the TDAI approach is not consistent with research that clearly indicates a link between treatment integrity and outcome (Witt & Elliott, 1985). One explanation for the finding may be that TDAI teachers, on average, implemented academic strategies with a sufficient level of integrity to produce positive outcomes. The level of integrity with the TDAI intervention was greater than 50% integrity, which is higher than pre-

Table 5
Hierarchical Linear Modeling Analyses of Reading Achievement Outcomes

Measure	TDAI Intercept	Δ Intercept (IDAI)	TDAI Slope	Δ Slope (IDAI)
CBM instructional level	1.53***	0.11	0.62***	0.03
Report card grade	3.05***	0.13	0.20**	−0.03
POTB Phase 1	0.59***	0.25*	0.74***	−0.17
POTB Phase 2	0.61***	0.50**	0.59***	−0.15
POTB Phase 3	1.56***	0.04	0.29**	0.00

Note. TDAI = traditional data-based academic intervention; IDAI = intensive data-based academic intervention; POTB = progress of target behavior.
* $p < .05$.
** $p < .01$.
*** $p < .001$.

vious findings for behavioral interventions under similar no-feedback conditions (Noell et al., 2005).

In general, both TDAI and IDAI models of consultation were comparable in terms of their effect on the academic achievement of students with ADHD. That is, positive growth trajectories were evident on the majority of measures across a 15-month period. The exception was report card grade in mathematics, which did not indicate a significant growth rate over time. Overall, these positive trajectories are encouraging, given that children with ADHD typically experience significant academic difficulties over time as a function of the interaction between their symptoms and increased academic challenges across grade levels. Although it is unclear whether these slopes are educationally significant given the lack of prior research with this sample over an extended period, the finding of growth on commonly used measures of school functioning appears to have social validity. These positive trajectories for academic achievement are particularly noteworthy given the more typical maintenance or worsening of achievement difficulties of this population through the school years (Barkley, Fischeret al., 1990; Lambert, 1988; Latimer et al., 2003; Mannuzza, Gittelman-Klein, Bessler, Malloy, & LaPadula, 1993) as well as the relative intractability of academic problems in response to treatment among children with both ADHD symptoms and academic difficulties (MTA Cooperative Group, 1999; Rabiner, Malone, & the Conduct Problems Prevention Research Group, 2004). For example, in the MTA study (MTA Cooperative Group, 1999), slopes (over a 14-month period) for reading achievement test scores ranged from 0 (community treatment control group) to 0.20 (combined treatment group), whereas slopes for math achievement ranged from 0.13 (community treatment control group) to 0.20 (medication management and behavioral treatment groups). These slopes represent very small effects in the context of achievement test standard scores having a mean of 100 and a standard deviation of 15. In contrast, slopes for CBM and POTB in the present study were larger and represented greater effects given the much smaller range of possible scores on these measures relative to an achievement test.

An examination of effect sizes representing change over a 15-month period indicated large effects (0.80 to 1.49) across both groups for CBM mathematics and reading instructional levels and POTB. These effects are considerably larger than the effects (0 to 0.58) for norm-referenced, standardized measures of mathematics and reading achievement (see DuPaul et al., 2006). The difference in effect sizes between these two types of measures may be explained in part by the fact that CBM

Table 6
Effect Sizes for Change from Baseline to 15 Months

Measure	TDAI	IDAI
CBM instructional level (math)	1.08	0.94
Report card grade (math)	0.25	0.28
POTB Phase 1 (math)	1.24	0.94
POTB Phase 2 (math)	1.19	1.13
POTB Phase 3 (math)	1.25	0.86
CBM instructional level (reading)	1.36	1.48
Report card grade (reading)	0.55	0.25
POTB Phase 1 (reading)	1.49	1.16
POTB Phase 2 (reading)	1.46	1.34
POTB Phase 3 (reading)	0.08	0.94

Note. TDAI = traditional data-based academic intervention; IDAI = intensive data-based academic intervention; CBM = curriculum-based measurement; POTB = progress of target behavior.

measures are more sensitive to short-term academic skill change than standardized, norm-referenced assessments (Shapiro, 2004). The effects in this study also compare favorably with effects (0.73–0.94) for achievement found by Hechtman et al. (2004). However, their study examined the effects of stimulant medication and/or multimodal psychosocial treatment rather than interventions that specifically targeted academic skills. Further, their sample demonstrated higher levels of baseline functioning (i.e., baseline academic achievement scores averaged >100, with very few participants scoring in the below average range) when compared to the participants of the present study.

In contrast, a small effect was found for math report card grades for both groups. On the report card grade for reading, the effect was small for the IDAI group and medium for the TDAI group. A plausible hypothesis is that report card grades are relatively stable across time (Guskey, 2005). Further, it may be the case that the mathematics skills targeted for intervention in both groups did not match the content addressed in the classroom. Because students in this study were those with serious academic deficits and were functioning below grade level as reported by their teachers, the majority of interventions in mathematics targeted remediation of basic skills (e.g., facts, operations) that were prerequisites for doing more complex math. However, grades in mathematics were based on information covered in grade level content (e.g., graphing) that may not have been mastered by these students. On the other hand, the medium effect size for the TDAI group for reading report card grade is particularly noteworthy. The focus primarily on reading for the majority of students in the study combined with the implementation of effective and varied research-based interventions may have accounted for the positive change. Fluency in basic reading is robust enough to affect many areas (e.g., comprehension), unlike basic mathematics skills, which are necessary but not sufficient for higher order skills, such as reasoning and problem solving. However, it is unclear why this change was not as large for students in the IDAI group, who also received empirically based reading interventions.

In summary, the equivalence in treatment effects for the two consultation models in this study is discrepant from prior reviews of data-based consultation (e.g., Sheridan, Welch, et al., 1996). Most prior investigations have examined behavior change at an individual level with no between-group comparisons that included a control condition. Alternatively, our finding is similar to outcomes found for assessment-based behavioral consultation in one of the few studies to include a control group (Beavers et al., 2004). Specifically, Beavers and colleagues found no difference in treatment effects for reading difficulties between a consultation approach using functional assessment and consultation without specific functional assessment data. Further, it should be noted that the TDAI group in the present study was similar to the IDAI condition in most aspects and differed primarily with regard to intensity of data utilization. In fact, the TDAI condition included all the typical stages of consultation such as structured consultation interviews, implementation of empirically supported interventions, and assessment of outcomes.

Limitations and Directions for Future Research

Results of the present study must be interpreted in light of several limitations. First, because of a lack of a no-treatment control group (because of ethical concerns about withholding academic interventions from children over an extended period of time), it is impossible to draw conclusions about whether one or both consultation models were effective. Future studies addressing the extent to which the two consultation models compare to a no-treatment control group should clarify the extent to which the treatments are effective. At the same time, it is important to note that changes in academic skills obtained in this study were greater in magnitude than those found in prior school-based intervention studies (DuPaul & Eckert, 1997). In addition, future research involving a comparison to a group of nonstruggling, non-ADHD students is needed to demonstrate normalization of slope. Second, participants in this study had to meet diagnostic criteria for ADHD as well as exhibit significant impairment in academic achievement on the basis of teacher reports. As such, these results may have limited external validity and may not generalize to the ADHD population as a whole. However, the present sample most likely represents the population of children with ADHD who require academic interventions (i.e., a significant majority of the ADHD population), because diagnosis of ADHD is based, in part, on symptoms associated with significant academic and/or social impairment (American Psychiatric Association, 2000).

Third, because different teachers across semesters implemented the treatment, we do not know whether findings would differ when the same teachers, who are familiar with the procedures, implement the treatment. Clearly, additional research that investigates such comparisons is required. Fourth, the use of instructional level data rather than words correct per minute in reading or digits correct in mathematics is not optimal given that the instructional level scale has a restricted range of values, limiting its sensitivity to change. Future research should consistently monitor instructional reading text or mathematics skills at the following year's grade level to make the assessment strategy more sensitive to change in student performance. Finally, an intent to treat design was used wherein all available data (including from those who dropped out of active treatment) were used for all statistical analyses. It is possible that clearer differences in outcomes between groups would be evident if data were restricted to treatment completers. From this study, it is unclear whether the between-conditions comparisons were influenced by attrition effects. Because at least one-third of the sample did not receive consultation services in the second year, it is critical that subsequent analyses are conducted to investigate the effects of attrition on outcomes.

Implications for Practice

Despite the limitations, results of the current study suggest several important implications for school psychologists and practitioners. The most obvious implication is that practitioners must emphasize the use of instructional methods based on evidence-based practices. That empirically valid strategies employed in both consultation groups were generally equivalent with regard to their effectiveness in addressing the academic performance deficits of children with ADHD is consistent with the response to intervention model in that a large number of children can be maintained with effective teaching strategies (Fuchs & Fuchs, 2006). Recent research in response to intervention suggests that only a small group of children may need more intensive services at the classroom (20%) and individual levels (2%; Burns, Appleton, & Stehouwer, 2005). Thus, the more intensive, ongoing consultation support (i.e., IDAI) may be needed only for a select group of children with ADHD rather than all children with ADHD.

Another implication is the need to consider the challenges of working with meager school resources. Consequently, the choice of either type of consultation should be guided by cost-effectiveness and teacher preference. It may be that a comprehensive, data-based model as employed in the IDAI condition may not be necessary if the TDAI approach that is less intensive can also bring about effective growth in academic skills.

Conclusions

In an age of accountability, schools are under increased pressure to improve student outcomes. Identifying effective instructional practices that enhance school functioning of children with high needs (e.g., ADHD) is essential. The consultation approaches in this study hold promise in meeting the goal of closing the achievement gap for these students. Contrary to the original hypothesis, results of the current study suggested that both IDAI and TDAI are comparable in improving the academic performance of students with ADHD. Even though an a priori power analysis suggested that the sample size was adequate, it is recommended that additional study of these two approaches be conducted with a larger sample size to increase confidence in the results. In addition, future research should examine possible differences in outcomes over longer periods of time. Finally, it is important to explore the conditions under which the TDAI consultation approach is sufficient and to identify the conditions in which more intensive IDAI consultation strategies are necessary.

Supplementary Material

For additional materials about the interventions described in this article, go to http://lehigh.edu/~inpass/inpass.html.

Footnotes

[1]These two samples have 54 cases in common (i.e., students who received both reading and math interventions).

[2]Following the notation of Raudenbush and Bryk (2002), hierarchical linear modeling with repeated measures first attempts to model each subject's performance over time (t) on a given dependent variable (Y) as

$$Y_{it} = \beta_{i0} + \beta_{i1}t + r_{it}$$

It then attempts to model the growth parameters (the β values) in terms of treatment (W) as

$$\beta_{0j} = \gamma_{00} + \gamma_{01}W_j + u_{0j}$$

$$\beta_{1j} = \gamma_{10} + \gamma_{11}W_j + u_{1j}$$

In the present study, time (t) was coded starting at 0 in the pretreatment phase and increasing by 1 in subsequent treatment phases. Consequently, for subject i, β_{i0} represents initial performance level and β_{i1} represents rate of growth per assessment period. The treatment variable (W) was coded 0 for the TDAI condition and 1 for the IDAI condition. Consequently, γ_{00} represents mean initial status for the TDAI condition, γ_{01} represents incremental initial status for the IDAI condition, γ_{10} represents mean growth rate per assessment period for the TDAI condition, and γ_{11} represents incremental growth rate per assessment period for the IDAI condition. Tests of significance for the γ parameters were of primary interest in the present study.

[3]The formula used for the denominator was the square root of the following term: The variance at baseline plus the variance at 15 months minus twice the correlation between baseline and 15 months times the product of the two standard deviations (Cohen, 1988).

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Date Received: July 5, 2006
Date Accepted: November 28, 2006
Action Editor: Thomas Power ■

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