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Multisetting Assessment-Based Intervention for Young Children at Risk for Attention Deficit Hyperactivity Disorder: Initial Effects on Academic and Behavioral Functioning

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Abstract. Recent research suggests that symptoms of attention deficit hyperactivity disorder may begin to emerge in children at a very young age. Given that early onset is associated with more deleterious outcomes, early intervention is imperative. In the current study, we evaluated the effectiveness of two different interventions with children aged 3–5 years. A multicomponent intervention combined parent education and individualized assessment-based intervention in home and preschool or day care settings was compared with a parent education intervention consisting of parent education alone. Both interventions resulted in significant improvements measured by standardized assessments of behavior and preacademic skills. There were no significant differences between the intervention groups 1 year postintervention. Implications for further research and practice are discussed.

Attention deficit hyperactivity disorder (ADHD) is common among school-age children, with a prevalence rate of 3–5%. Although issues such as rapid developmental changes between the ages of 2 and 6 make diagnosis of preschool-age children somewhat

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tenuous (Lahey et al., 1998), recent research related to the prevalence and etiology provides evidence that symptoms of ADHD emerge at a very young age (Egger, Kondo, & Andold, 2006; Spira & Fischel, 2005; Wolraich, 2006). For example, in a comprehensive evaluation of published research with children age 2–5, Egger et al. (2006) found that ADHD symptoms, consistent with the *Diagnostic and Statistical Manual of Mental Disorders* (4th ed.; DSM-IV; American Psychiatric Association, 2000) criteria, can be reliably assessed, are associated with significant impairment, and occur outside of the normative range for preschool-age children. Further, the ADHD-related characteristics seen in younger children mirror those of older children with respect to prevalence rates, subtypes, and gender differences, offering added support for an accurate nosology. Additional evidence can be seen in a longitudinal study by Lahey and colleagues (Lahey et al., 1998), who found that preschool children diagnosed with ADHD continued to show functional impairment at a follow-up assessment 3 years later and that symptom severity was the most significant marker of persistence into middle childhood. Together, this research strongly supports the idea of early emergence of a constellation of symptoms characteristic of ADHD atypical of most preschool-age children.

As with older children, detrimental effects of ADHD can be seen at an early age. For instance, in a large-scale study of 126 preschoolers with ADHD and an identical number of matched control children, Lahey and colleagues (1998) found significant impairment in global functioning, peer relations, and preacademic skills. Further, over 40% had been suspended from a preschool or day care setting and almost 16% had been expelled. Nearly 50% of the parents reported reluctance or unwillingness to take their child out to a store or restaurant because of behavior problems. Thus, although early labeling may not be advantageous, these findings boldly underscore the need for early identification and intervention.

Unfortunately, to date, little can be said about the nature and effectiveness of early intervention for children with and at risk for ADHD. Although both psychotropic medications and behavioral intervention have been extensively and systematically evaluated in school-age children with ADHD (e.g., MTA Cooperative Group, 1999), similarly rigorous and large-scale evaluations are absent among young children (for a review, see Barkley, 2006). In spite of the absence of efficacy data, research suggests that medication use, particularly methylphenidate hydrochloride (MPH), has increased dramatically among preschool-age children (e.g., Rappley, 2006). This is perhaps most clearly illustrated through data from large and nationally representative groups of children, aged 2–4, insured by managed care and Medicaid. Such data show a 1.7- to 3.1-fold increase in MPH use with these very young children across the previous decade (Zito et al., 2000).

In spite of the dramatic increase in medication use, safety and efficacy concerns are pervasive and prescription remains off label. That is, use is not approved for this young age group. To date, the few studies evaluating MPH with preschool-age children (i.e., under 6 years) are limited by small sample sizes, short treatment durations, and the use of parents as sole informants (Kollins & Greenhill, 2006). In fact, existing studies suggest that the nature and severity of side effects may differ and be more intensive when compared with older children (Kollins & Greenhill, 2006). An additional concern is that little is known about the effects of medications on the developing brain as well as long-term side effects (Moll, Rothenberger, Ruther, & Huther, 2002; Rappley, 2006).

An extensive multisite evaluation of MPH among children age 36–66 months (referred to as the Preschool ADHD Treatment Study), coordinated by Columbia/New York State Psychiatric Institute, was recently completed. The results of the Preschool ADHD Treatment Study study indicated the following: (a) relatively low dosages of MPH lead to significant reductions in ADHD symptoms in young children (Greenhill et al., 2006), (b) a higher percentage of young children relative to children of elementary school age experience significant adverse events associated with

MPH (Wigal et al., 2006), and (c) height and weight growth rates may be reduced for some young children treated with MPH (Swanson et al., 2006). Clearly the use of psychostimulants for treating ADHD in early childhood requires consideration of risks relative to potential positive effects. Further, there is broad consensus, echoed by the Preschool ADHD Treatment Study researchers and consistent with guidelines established by the American Academy of Child and Adolescent Psychiatry and the American Academy of Pediatrics, that behavioral intervention and a structured preschool experience should be the initial course of action before even considering medication use (Kollins & Greenhill, 2006; Rappley, 2002).

Fortunately, preliminary research suggests promising outcomes of psychosocial interventions introduced at an early age (e.g., McGoey, DuPaul, Eckert, Volpe, & Van Brakle, 2005). Data indicate that such interventions may result in immediate reductions in problem behaviors and reduce the negative sequelae of ADHD-related problems. The purpose of the current study was to further refine and evaluate the effectiveness of psychosocial interventions for young children with or at risk for ADHD. This relatively large-scale project was conducted across a 5-year period. Using a randomized design, we compared two interventions, one consisting exclusively of group-based parent education (PE) and the other a multicomponent intervention (MCI) consisting of group-based parent education and individualized assessment-based interventions designed for the home and preschool or day care settings.

A packaged and generic parent education program was used with the PE group. This type of intervention has shown some success in addressing behavior problems, but has not been evaluated thoroughly with young children having ADHD symptoms. The PE group also controlled for attention effects, which may have hindered conclusions in the case of significant intervention outcomes compared with a control group alone. The MCI group intervention consisted of parent education targeting all domains known to be affected by symptoms of ADHD (behavior, academic skills, safety). Additional components relied on current best practice for addressing behavior problems, including functional assessment-based intervention developed for both preschool and home settings (e.g., Newcomer & Lewis, 2004). Thus, the two groups differed with respect to specificity of parent education (generic vs. specific to ADHD symptomology) and individualization of the interventions (MCI receiving individualized procedures). It was hypothesized that both groups would show improvement in behavioral, social, and preacademic functioning, with the group receiving individualized assessment-based interventions (MCI) showing significantly more growth across all areas of functioning.

Method

Participants and Setting

Recruitment procedures. Recruitment and enrollment took place across 4 years. To recruit participants, brochures with general project information, including characteristics of children at risk for ADHD, were sent every 6 months to all pediatricians' offices, preschools, and day cares within a 30-mile radius of Lehigh University. Follow-up calls were made within 1 month to ascertain interest in the project. If requested, written information about the project was sent to the pediatrician or preschool or day care director to deliver to parents of potential participants. As a result of these efforts, the project received a total of 536 parent contacts.

Screening procedures. When parents contacted the project office, an initial telephone interview was completed. First, preschool or day care attendance was confirmed. To participate, children were required to attend an early childhood center (preschool or center-type day care) at least 2 days per week. Next, information was requested related to the presence of child behavior problems. If the parent indicated that the child engaged in hyperactive- and impulsive-type behavior (i.e., extremely active, problems keeping attention, easily distracted, acts quickly without think-

ing, and fidgets and squirms often), a three-stage screening process was initiated. During the first stage, parents and teachers completed respective versions of the Conners Rating Scales—Revised (Conners, 1997) to confirm whether ADHD symptoms were present. Children who received a standard score of 65 or above (i.e., 1.5 standard deviations above the mean) on at least one subscale pertaining to symptoms of ADHD (e.g., hyperactive, hyperactive-impulsive, inattentive) on both the parent and teacher versions moved to the next stage.

The purpose of the second stage was to exclude children with autism, developmental disabilities, and conduct disorder, as well as to further assess ADHD and oppositional defiant disorder symptoms. All assessments were administered during a telephone interview by graduate students in school psychology, special education, or counseling psychology who received training on administration of each of the measures. To rule out autism, the Checklist for Autism in Toddlers (Robins, Fein, Barton, & Green, 2001) was administered. If the parent answered "yes" to at least two or more questions, the Gilliam Autism Rating Scale (Gilliam, 1995) was next administered and any child receiving an "autism quotient" above 121 was excluded. Remaining parents were administered the Diagnostic Interview Schedule for Children (DISC; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000) and the Children's Global Assessment Scale (Shaffer et al., 1983) to determine the child's level of impairment. Children who had a Children's Global Assessment Scale above 80 were excluded for absence of impairment. In addition, diagnostic criteria for one of the three ADHD subtypes had to be met on the DISC. Children who met criteria for conduct disorder on the DISC also were excluded. Finally, the child's cognitive abilities were assessed with the Differential Abilities Scale (Elliott, 1990). Children with a standard score below 80 on the Differential Abilities Scale were excluded because of the possibility of developmental disabilities.

Of the 536 referrals, a total of 152 children passed through all screening phases and received parent consent to participate. Unfortunately, data from 17 were later excluded because of scoring errors detected during data checks or medical or psychiatric conditions discovered during the course of the study. Thus, data are reported for 135 participants. Seventy-one of the participants were randomly assigned to the MCI group and 64 were assigned to the PE group.

Participant description. At entry, the 135 participants ranged in age from 3 to 5 years ($M = 4$; $SD = 0.69$). Thirty-three participants (23.9%) were 3 years, 66 (51.5%) were 4 years, and 36 (24.6%) were 5 years old. One hundred six (78.4%) were male and 29 (21.6%) female. Ninety-five (71.4%) were Caucasian, 19 (14.3%) Hispanic, 4 (3%) African American, 15 (11.3%) other (e.g., biracial), and 2 (1.5%) were of unspecified ethnicity.

With respect to family characteristics, parents of 90 (66.7%) children were married. The remaining parents were either living together ($n = 18$; 13.3%), separated ($n = 8$; 5.9%), or single ($n = 10$; 7.4%). Data were unavailable for 9 (6.7%) parents. Regarding the highest education level of a parent or parent dyad, 31.9% of parents reported having some college education, whereas 25.9% graduated from college and 14.1% had advanced graduate degrees or professional certification. Eighteen and a half percent were high school graduates, 3% did not complete high school, and data were unavailable for 6.7%. Highest working status in household was full time ($n = 118$; 87.4%), whereas 2 (1.5%) worked part time. Six (4.5%) were not employed, either by choice, by inability to obtain work, or because of a disability. Employment status was derived from the Hollingshead scale (Hollingshead & Redlich, 1958). Of those employed, administration or personnel ($n = 30$; 22.2%) and clerical or sales work ($n = 27$; 20%) were the most common occupations. This was followed by business management ($n = 25$; 18.5%), skilled manual employment ($n = 17$; 12.6%), and higher executive ($n = 15$; 11.1%). Five (3.7%) reported being machine operators and 1 (0.7%) was an unskilled

Table 1
Demographic and Diagnostic Characteristics by Treatment Group

Measure	MCI	PE	t or χ^2
Age, months	53.2 (8.9)	54.1 (7.8)	−0.56
Male, %	76.0	80.6	0.44
White, %	68.9	69.2	2.81
Parents' highest occupation	1.2 (0.8)	1.1 (0.7)	0.49
Parents' highest education	4.1 (0.9)	4.4 (1.2)	−1.57
ADHD combined, %	66.2	60.6	0.51
ADHD inattentive, %	9.1	12.7	0.49
ADHD hyperactive-impulsive, %	29.9	26.8	0.18
ODD, %	76.6	76.1	0.01
Receiving psychotropic medication, %	9.9	10.3	0.01

Note. Data are presented as means and standard deviations or as percentages, as indicated. MCI = multicomponent intervention; PE = parent education; ADHD = attention deficit hyperactivity disorder; ODD = oppositional defiant disorder.

employee. Eleven percent did not report their occupation.

To evaluate possible group differences at baseline, t tests or χ^2 analyses were conducted (see Table 1 for demographic data). Results indicated no significant group differences in child age, gender, parent occupation, parent education, ADHD subtype, presence of oppositional defiant disorder, or receipt of psychotropic medication.

Setting. Interventions for participants in the MCI group took place in both the home and preschool or day care settings. The preschool or day care settings included both public and private facilities (i.e., Head Start, school district early intervention programs, home-based day care centers, university-based programs, and early childhood centers). Both groups received parent training classes at a convenient public or private location (e.g., school, church, or hospital). All participants enrolled in the project at kindergarten attended public schools.

Overview of Dependent Measures

Several dependent measures were used to evaluate the effects of the intervention. Although some of the measures have been developed for use with older children, the data collected are being used for a larger longitudinal study. Thus, the specific instruments were selected to keep measurement consistent for comparative purposes across time. Dependent measures were collected to assess possible treatment effects on two broad domains of functioning (i.e., behavior and academic) because these areas typically are impaired significantly by the presence of ADHD symptoms (for a review, see Barkley, 2006).

Measures of Behavioral Functioning

Child Behavior Checklist (CBCL) and Teacher's Report Form (TRF). The CBCL (for 4- to 18-year-olds; Achenbach, 1991a) and the TRF (for 5- to 18-year-olds; Achenbach, 1991b) are among the most common measures used in studies of child social, emotional, and behavior problems, consisting of 118 and 113 specific problem items, respectively. These items are rated on a 3-point scale: 0 = *not true*, 1 = *somewhat or sometimes true*, 2 = *very true or often true*. The CBCL and TRF generate Internalizing, Externalizing, and Total Problem scales in addition to eight syndrome scales (Withdrawn, Somatic Complaints, Anxious/Depressed, Social Problems, Thought Problems, Attention Problems, Delinquent Behavior, Aggressive Behavior).

The scales of both instruments were generated using principal components analysis. The internal consistency, test–retest stability, and concurrent validity of the CBCL and TRF have been well demonstrated (Achenbach, 1991a, 1991b).

Conners' Rating Scales—Revised Long Form (CRS-R). The parent and teacher versions of the CRS-R consist of 80 and 59 items respectively, and are appropriate for the assessment of children and adolescents 3 to 17 years old (Conners, 1997). These two measures have 13 subscales in common, including the 6-item Oppositional scale used in this study given that noncompliant and oppositional behavior was a typical target for intervention. This subscale was one of 7 scales on the long forms of the CRS-R that were derived via factor analysis. Like other scales of the CRS-R, the Oppositional scale has exemplary psychometric characteristics. It should be noted, however, that the stability of the Oppositional scale over 6–8 weeks appears somewhat better for the teacher (.86) completed form compared to the parent completed form (.57).

Social Skills Rating System—Parent Form (SSRS-P) and Teacher Form (SSRS-T). The Elementary version of both the SSRS-P and SSRS-T (Gresham & Elliott, 1990) consist of 55 and 57 items, respectively, and are intended for use with children in kindergarten through sixth grade. Both measures assess the domains of social skills, problem behaviors, and academic competence. Items are rated on a 3-point scale: 0 = *Never*, 1 = *Sometimes*, 2 = *Very Often*. Four out of the five social skills subscales on the SSRS-P (Cooperation, Assertion, Self-Control, and Responsibility) and the three social skills subscales of the SSRS-T (Cooperation, Assertion, and Self-Control) served as dependent variables in the current study. The internal consistency, test–retest reliability, and concurrent validity of the Elementary form of the SSRS-T are adequate (Gresham & Elliott, 1990).

Measures of Preacademic Functioning

Dynamic Indicators of Basic Early Literacy Skills (DIBELS). The DIBELS (Kaminski & Good, 1996) is a set of standardized, individually administered measures designed to assess early literacy skills. Three tasks from the DIBELS were used as dependent measures in the current study. Letter Naming Fluency involves presenting children with a page of upper- and lowercase letters and asking them to name as many letters as they can in 1 min. Initial Sound Fluency takes about 3 min to administer. Children are presented with four pictures at a time. The examiner names each picture, and then asks the child to identify the picture beginning with a specific phoneme, which is produced orally by the examiner. Next, the child is asked to produce the beginning sound for an orally presented word that matches one of the given pictures. The Initial Sound Fluency score consists of the number of sounds identified or produced correctly per minute. Phoneme Segmentation Fluency takes about 2 min to administer. During Phoneme Segmentation Fluency the examiner orally presents words comprised of three or four phonemes. Children are asked to orally produce the individual phonemes for each word. For example, the examiner says "cat," and the student says "/c/ /a/ /t/." One point is awarded for each phoneme produced correctly. After the student responds, the examiner presents another word until 2 min have elapsed. The Phoneme Segmentation Fluency score consists of the number of correct phonemes produced in 1 min. The aforementioned DIBELS measures have demonstrated adequate reliability and validity in samples of young children (Kaminski & Good, 1996), but are less appropriate for first-grade students who have already begun to read.

Bracken Basic Concepts Scale—Revised (BBCS-R). The BBCS-R (Bracken, 1998) assesses the understanding of basic concepts in young children between the ages of 2 years, 6 months, to 7 years, 11 months. During the test, the examiner presents pictures and the

child is asked to identify concepts within subtest categories by pointing. These concepts include colors, letters, numbers, sizes, comparisons of objects, shapes, direction/position, expressions of emotions in others (social awareness), texture, quantity, and time. The first six subtests compose the School Readiness Composite, which includes the skills typically taught in preparation for formal education. The School Readiness Composite assesses conceptual and receptive language abilities, and was used as a dependent measure in this study. The internal consistency and test–retest reliability of the BBSC-R are adequate. Strong correlations between the BBSC-R and the Wechsler Preschool and Primary Scale of Intelligence—Revised, the Differential Abilities Scale cognitive assessment, and the Stanford Binet: IV demonstrate adequate content validity (Bracken, 1998).

Procedures

Assessment and data collection. All assessments were completed at baseline (project entry) and every 6 months thereafter. Parents and teachers completed the assessments (CBCL, TRF, CRS-R, SSRS), which were either hand delivered or mailed, along with a self-addressed stamped envelope. When the completed assessment was received, the parent or teacher was compensated $50.

Data collectors administered the DIBELS and BBCS-R to children in a quiet area of the preschool or day care, if possible, or in the home. Data collectors were graduate students in school psychology or special education who were naïve to the purposes of the study and blind to group membership of the children. Before administering the assessments, data collectors read through administration manuals, observed at least three administrations, and were checked for accuracy during a mock administration.

All assessments were scored by data collectors. Scoring accuracy was checked on 30% of the assessments by having a second individual independently score each. Data were then entered into a database. Accuracy of data entry was evaluated on 30% of assessments by a second individual, who compared the raw data to each entered item, correcting errors. Very few scoring or data entry errors were identified.

Intervention overview. Participants who met eligibility criteria were randomly assigned to either a MCI or a PE group using a computer-generated random-numbers table. To avoid potential confounds because of intervention carryover, newly enrolled participants who attended the same preschool as a prior participant were assigned to the same intervention group as the earlier participant. This occurred only in the MCI group, with 3 participants. No additional procedures were used for group assignment (e.g., stratification) and no significant group differences were found on key variables (e.g., ADHD subtype, comorbid oppositional defiant disorder, gender, age) that might influence intervention outcomes (see Results section).

As participants were enrolled and assigned to intervention conditions, they were grouped into cohorts for parent education. To avoid delay of intervention, cohorts were formed approximately every 3 months. Consequently, cohort size differed depending on rate of referral and enrollment in the prior 3 months, ranging from 4 to 24 parents. Each cohort was assigned a consultant. Consultants were advanced doctoral students in school psychology, special education, or counseling psychology and were responsible for delivering all intervention components to children and parents in their cohort. All consultants completed a week-long community-based training on group facilitation. In addition, consultants for the PE group received training to implement the parent education program, Early Childhood Systematic Training for Effective Parenting (Dinkmeyer, McKay, Dinkmeyer, Dinkmeyer, & McKay, 1997). MCI consultants had prior graduate coursework related to behavioral assessment, intervention, and consultation. All consultants reviewed procedural manuals related to the project and were initially supervised by one of the principal investigators.

MCI. Participants in this group received intervention focused on three domains (behavior problems, preacademic readiness skills, and child safety), delivered in both home and preschool or day care settings. Intervention components included parent education classes, individualized assessment-based intervention in the home, and individualized assessment-based intervention in the preschool or day care.

Parent education consisted of 20 sessions, delivered across 12 months. Sessions were scheduled at a time mutually convenient for each parent cohort, typically in the evening or occasionally on weekends. Each session was 2 hr in duration. To increase the probability of attendance, transportation was available if needed, child care was provided for enrolled children and their siblings, and snacks were supplied during the session. Across all families, the mean percentage of sessions attended was 37 (*SD* = 36.15; range = 0–100%). Session attendance data are unavailable for 3 families. When parents were unable to attend a session, attempts were made to individually deliver the content in their home. If this could not be scheduled, the session materials were mailed to the parent.

Session format included didactic presentation of core content facilitated by PowerPoint slides. In addition, video-clip illustrations, parent discussion, modeling, and role-play were interspersed throughout the session. To ensure sessions were led in an acceptable style (e.g., parent questions answered accurately, adequate pacing) and content was adhered to, the initial session was observed and feedback provided by one of the principal investigators (first two authors) or by a consultant who had successfully completed education with a prior cohort. In addition, all sessions were audiotaped and 17.1% were randomly selected for review using a computer-generated random-numbers table. One of the principal investigators evaluated the selected audiotapes for general delivery style and procedural integrity. To assess procedural integrity, checklists were developed at the initiation of the project listing all topics, subtopics, and activities that were to be included in each session. Checklists contained 13–34 scoreable items. Mean session integrity was 96.4% (range = 42–100%). When a session was scored with less than 90% integrity, the investigator provided specific feedback to the consultant regarding the information that was omitted and modifications that should be made. Low fidelity occurred on a single occasion with a cohort, attended by only two parents, in which one parent was extremely difficult to keep on topic.

The content of the parent education sessions included behavior management, preacademics, and child safety (see Table 2). General behavior management strategies were taught during 11 of sessions using the Community Parent Education (Cunningham, Bremnerm, & Secord, 1998) curriculum. The Community Parent Education curriculum is an empirically validated parent education program with instruction focusing on general parenting skills as well as strategies to increase compliance (e.g., when–then statements, attending and rewards, transitional warnings, time-out). Nine additional sessions were added to supplement and expand the Community Parent Education curriculum. Two initial sessions provided an overview of the research project and an introduction to ADHD (e.g., characteristics, prevalence, history, basic interventions). Three sessions were devoted to a description of functional assessment (antecedents and consequences to behavior), introduction to collecting antecedent, behavior, and consequence data, and practice summarizing data and identifying related variables for intervention development. Another session provided instruction in practices to avoid accidental injuries (e.g., child proofing and car seat safety). Finally, preacademics was the topic of two sessions. These sessions included early literacy and numeracy expectations as well as prescribed activities to develop early literacy and numeracy skills. Parents were provided packets with written descriptions of preacademic activities from the Ladders to Literacy curriculum (Notari-Syverson, O'Conner, & Vadasy, 1998) and other resources. The final session involved summarizing main points and reviewing future expectations.

Table 2
Session Topics for Multicomponent Intervention Group and Parent Education Group

MCI	PE
Opening (Purpose and Overview)	Opening (Purpose and Overview)
Introduction to ADHD	Introduction to ADHD
Attending and Rewards	Understanding Your Child's Behavior (STEP)
Functional Behavioral Assessment I: Finding the Problem	Home Safety
Functional Behavioral Assessment II: Identifying Patterns	Self-Esteem (STEP)
Functional Behavioral Assessment III: Developing a Plan	Parent Self-Care
Home Safety	Healthy Child Overview
Teaching Early Literacy	Listening and Talking (STEP)
Teaching Early Numeracy	Learning to Cooperate (STEP)
Balanced Attending and Planned Ignoring	Preparing Your Child for School
Transitional Warnings and When-Then Statements	Discipline (STEP)
Planning Ahead I	School Readiness
Time Out from Reinforcement	Discipline Discussion
Point Systems I	Language Development
Point Systems II	Social and Emotional Development (STEP)
Planning Ahead II	Cognitive Development
Home-School Communication	Healthy Child Overview (part 2)
Problem Solving	Review and Application of STEP Sessions
Transitioning to Kindergarten	Review and Application of all Sessions
Closing	Closing

Note. MCI = multicomponent intervention group; PE = parent education group; ADHD = attention deficit hyperactivity disorder; STEP = Systematic Training for Effective Parenting.

The second intervention component consisted of assessment-based intervention for the home that was individually developed for each participant by the consultant in collaboration with the family. Home interventions were initiated after the third session of parent education (functional assessment and data collection), so that parents had exposure to collecting assessment data. The process began with the consultant conducting the Problem Identification Interview (Kratochwill & Bergen, 1990) with the parent. The interview solicited information about behavioral priorities, operational definitions of behavior problems, antecedents and consequences to problem behavior, child interests and rewards, and past interventions.

Subsequent to the interview, parents were asked to collect 1–2 weeks of direct observation data using an antecedent, behavior, and consequence data format. Around the same time, consultants conducted a naturalistic direct observation in the home, generally lasting 2–4 hr. Incidents of problem behavior were coded, along with observed antecedents and consequences. Finally, an analogue brief functional analysis was conducted in the home, similar to that described by Northup and colleagues (Northup et al., 1996). Specifically, four 5-min sessions were presented in random order. Sessions consisted of a control (play), task, low adult attention, and restricted access to a toy or activity. Contingent on problem behavior, reinforcement respective to the

assessment condition was provided (i.e., escape, attention, or access). Sessions with high rates of problem behavior were repeated, alternated with sessions with low rates of problem behavior. All sessions were conducted by the child's parent, with prompting and coaching from the consultant. Sessions were videotaped and scored at a later time.

After completing the above assessments, the data were summarized to determine the variables (antecedents, consequences, and function) related to problem behavior. The consultant met with the parent(s) and they jointly reviewed the assessment data. Based on the assessment data, the consultant recommended related interventions consisting of antecedent or preventative interventions, replacement behaviors, and responses to problem behavior. The consultant and the parent(s) then agreed on an intervention plan that was likely to be effective, reflected parent preferences, and viewed by the parent as feasible to implement. Table 3 provides examples of interventions used in the home. Home plans were developed for 60% of families needing intervention. At the time home plans were initiated, the behavior of two children had improved such that intervention was not necessary. Parents were coached on how to implement the interventions using instruction, modeling, practice, and feedback. Thereafter, consultants visited the home monthly during the remainder of the initial year of project enrollment to check for implementation difficulties or to fine-tune the plan. On occasion, if a parent reported a plan was not effective, additional home visits were scheduled during which time the plan was modified.

The third intervention component was assessment-based intervention in the preschool or day care setting. To begin, the consultant completed the Problem Identification Interview (Kratochwill & Bergen, 1990) with the preschool teacher or primary day care provider. Subsequently, the consultant conducted direct observations in the preschool for several hours daily across 2–5 days. Antecedents, behaviors, and consequences were noted as well as situations associated with appropriate behavior.

Table 3
Selected Interventions for Home and School

Antecedent interventions
Provide engaging, novel activities when attention is unavailable
Embed choice into activities
Teach positively stated rules and follow through
Use timers and transitional warnings to increase predictability
Replacement behaviors
Teach the child to request peer and teacher attention
Teach the child to request a break from activities
Teach specific social skills (e.g., sharing)
Teach to wait for preferred items or attention
Responses to behavior
Specific praise and/or preferred rewards for appropriate behavior
Token systems
Removal of preferred item for a specified time period
Planned ignoring paired with immediate attention for appropriate behavior

Similar to the home, data were summarized and shared with teachers and day care providers. Subsequently, the consultant recommended interventions and a multicomponent school-based intervention plan was collaboratively developed to accommodate staff preferences and implementation feasibility. When necessary, teachers and day care providers were taught to implement the plan in the same manner as parents, using instruction, modeling, practice, and feedback. In approximately 30% of the classrooms, observations indicated that practices were not developmentally appropriate (e.g., activity length exceeded the attention span of young children) or structure and consistency were lacking. In these situations, classwide interventions were recommended (e.g., shorten activities, adhere to a schedule) prior to initiating individualized interventions. Examples of school-based interventions are provided in Table 3. School plans were developed for 82% of participants need-

ing intervention in that setting. Plans were not applicable for 5 participants because they were enrolled in highly structured preschools and exhibited few behavior problems, in spite of teacher report of problem behaviors rendering them eligible for project participation. An additional participant was removed from his preschool, so a plan could not be developed. Thus, 18% of participants did not receive a school plan. Similar to parents, consultants visited the school monthly (more often if necessary) to assess intervention implementation and revise the plan, if needed. Overall, 5 participants (7%) in the MCI group received no intervention from the project (i.e., no parent education, home plan, or school plan).

PE. Intervention in the form of parent education sessions was provided to this group. This group was included to control for nonspecific effects of generic parent information and attention from a therapist. In addition, it would have been ethically questionable to include a no-treatment control group over an extended period for children with significant difficulties. Parent education also consisted of 20 sessions, 2 hr each. Because intervention was delivered to the MCI group across 18 months (including a maintenance phase not described in this article), parent education sessions for the PE group were distributed across a similar amount of time. To maintain parent participation, sessions were initially held monthly during Year 1, then every 6 weeks thereafter.

General procedures were identical to the MCI group with respect to the provision of transportation, child care, and snacks. In the case of missed sessions, content was delivered to parents in the same manner as the MCI group. Session format also consisted of didactic presentation using PowerPoint slides, video clip illustrations, discussion, modeling, and role-play. Procedural integrity was assessed during 16.1% sessions via audiotapes in a manner identical to the MCI group. Mean integrity was 97% (range = 78–100%).

Session content focused on general issues in the area of child development and parenting. The first two sessions were identical to the MCI group (Introduction and ADHD overview). Six subsequent sessions relied on the Early Childhood Systematic Training for Effective Parenting (Dinkmeyer et al., 1997) sessions pertaining to child rearing, with topics such as understanding child behavior, discipline, social-emotional development, and self-esteem. The remainder of the sessions focused on topics such as child health and nutrition, cognitive and language development, safety, parent self-care, and preparation for school. The mean percentage of sessions attended was 29 (SD = 30.83; range = 0–100%). Sixteen families (25%) attended no parent education sessions; however, of those, 3 families received instruction in the home and the additional 13 families received materials from every session.

Results

Means and standard deviations for all dependent measures are presented for both intervention groups in Table 4. Separate hierarchical linear modeling analyses for each dependent variable were used to assess possible differences in 1-year trajectories between the two intervention groups. An intent to treat methodology was used wherein all available data were used from each participant regardless of how much intervention was received. 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 MCI (γ_{00}), difference in mean initial performance between MCI and PE (γ_{01}), mean growth rate (per assessment period) for MCI (γ_{10}), and difference in mean growth rate between MCI and PE (γ_{11}).

For all dependent measures, γ_{00} was statistically significant ($p < .05$), indicating that the MCI group started out at a nonzero level of performance (see Table 5). In similar fashion, γ_{01} was not statistically significant for any variable; thus, there was no significant difference in initial performance between the two treatment groups.

Table 4
Means and Standard Deviations for Outcome Measures Across Treatment Groups

Outcome Domain	Measure	PE BL	PE 6 Months	PE 12 Months	MCI BL	MCI 6 Months	MCI 12 Months
Social skills	SSRS Social Skills (Parent)	40.8 (9.3)	43.8 (9.0)	46.0 (8.5)	37.8 (9.1)	44.4 (8.8)	45.9 (10.6)
	SSRS Social Skills (Teacher)	27.1 (8.7)	32.0 (7.9)	34.5 (10.0)	24.7 (8.2)	29.9 (9.4)	31.5 (11.7)
Preacademic skills	Bracken School Readiness Composite	105.2 (16.8)	106.7 (16.1)	113.4 (11.6)	102.7 (13.3)	107.0 (15.6)	106.7 (14.0)
	DIBELS Initial Sound Fluency	4.5 (4.7)	8.2 (6.1)	15.5 (9.2)	4.1 (4.2)	8.3 (7.3)	14.8 (10.1)
	DIBELS Letter Naming Fluency	9.5 (12.1)	15.5 (14.6)	28.9 (14.5)	7.7 (11.4)	11.2 (11.6)	23.9 (20.0)
Ratings of home behavior	CBCL Aggressive Behavior	12.9 (5.0)	11.6 (5.4)	9.7 (5.7)	14.8 (7.2)	13.0 (6.7)	12.3 (7.0)
	CBCL Delinquent Behavior	4.3 (2.2)	3.9 (2.4)	2.7 (1.8)	4.7 (2.8)	4.5 (3.0)	4.4 (2.9)
	CBCL ADHD Problems	9.7 (2.6)	8.4 (2.5)	8.6 (3.1)	10.0 (3.0)	9.0 (3.2)	9.0 (2.8)
	CBCL Oppositional Defiant Problems	5.7 (2.1)	5.0 (2.2)	4.0 (2.3)	6.3 (2.3)	5.5 (2.4)	5.2 (2.6)
	CBCL Conduct Problems	6.2 (3.1)	5.4 (3.7)	4.0 (3.2)	6.4 (4.6)	5.7 (4.8)	5.2 (4.3)
	Conners Oppositional (Parent)	63.5 (12.3)	64.1 (12.8)	56.6 (11.0)	67.4 (13.7)	65.7 (13.1)	63.0 (13.4)
Ratings of school behavior	TRF Aggressive Behavior	14.5 (9.0)	11.3 (9.6)	9.6 (7.8)	17.7 (9.3)	12.8 (9.3)	12.7 (10.4)
	TRF Delinquent Behavior	4.2 (2.6)	2.8 (2.5)	2.8 (2.3)	4.8 (3.4)	3.4 (3.1)	3.2 (3.1)
	TRF ADHD Problems	18.0 (5.5)	14.1 (6.8)	14.4 (6.4)	18.9 (5.3)	15.8 (7.4)	14.7 (7.8)
	TRF Oppositional Defiant Problems	4.8 (3.1)	3.7 (3.2)	3.3 (3.0)	5.7 (2.8)	4.2 (2.9)	4.0 (3.4)
	TRF Conduct Problems	7.7 (4.7)	5.6 (5.3)	4.3 (4.1)	8.7 (5.9)	6.0 (5.0)	5.5 (5.6)
	Conners Oppositional (Teacher)	70.8 (16.1)	60.2 (15.6)	59.2 (15.1)	72.4 (15.0)	65.1 (16.5)	64.6 (17.6)

Note. Standard deviations are in parentheses. PE = parent education; MCI = multicomponent intervention; BL = baseline; DIBELS = Dynamic Indicators of Basic Early Literacy Skills; CBCL = Child Behavior Checklist; TRF = Teacher Report Form; SSRS = Social Skills Rating System; ADHD = attention deficit hyperactivity disorder.

Table 5
Hierarchical Linear Modeling Analyses of Intervention Outcomes

Dependent Measure	Mean Intercept for MCI (γ_{00})	Mean Change in Intercept for PE (γ_{01})	Mean Growth Rate for MCI (γ_{10})	Mean Change in Growth for PE (γ_{11})
SSRS Social Skills (Parent)	38.21**	1.64 (ns)	4.10**	−1.02 (ns)
SSRS Social Skills (Teacher)	25.24**	2.13 (ns)	3.40**	0.42 (ns)
Bracken School Readiness	103.31**	1.08 (ns)	1.64 (ns)	0.77 (ns)
DIBELS Initial Sound Fluency	3.94**	0.18 (ns)	5.16**	0.18 (ns)
DIBELS Letter Naming Fluency	8.04**	0.90 (ns)	6.81**	2.42 (ns)
DIBELS Phoneme Segmentation Fluency	2.24*	0.07 (ns)	5.45**	−0.57 (ns)
CBCL Aggressive	14.75**	−1.89 (ns)	−1.74**	0.33 (ns)
CBCL Delinquent	4.67**	−0.33 (ns)	−0.25 (ns)	−0.36 (ns)
CBCL ADHD Problems	9.94**	−0.35 (ns)	−0.80**	0.08 (ns)
CBCL Oppositional Defiant Problems	6.24**	−0.55 (ns)	−0.63**	−0.16 (ns)
CBCL Conduct Problems	6.35**	−0.14 (ns)	−0.76**	−0.23 (ns)
Conners Oppositional (Parent)	67.41**	−3.06 (ns)	−2.48**	−0.37 (ns)
TRF Aggressive	16.90**	−2.61 (ns)	−2.53**	−0.08 (ns)
TRF Delinquent	4.57**	−0.50 (ns)	−0.69**	0.00 (ns)
TRF ADHD Problems	18.60**	−1.05 (ns)	−2.30**	0.18 (ns)
TRF Oppositional Defiant Problems	5.55**	−0.89 (ns)	−0.79**	−0.04 (ns)
TRF Conduct Problems	8.43**	−1.07 (ns)	−1.57**	−0.03 (ns)
Conners Oppositional (Teacher)	71.47**	−2.05 (ns)	−3.75**	−2.67 (ns)

Note. PE = parent education; MCI = multicomponent intervention; DIBELS = Dynamic Indicators of Basic Early Literacy Skills; CBCL = Child Behavior Checklist; TRF = Teacher Report Form; SSRS = Social Skills Rating System; ADHD = attention deficit hyperactivity disorder; ns = not statistically significant.
* $p < .05$.
** $p < .01$.

Table 6
Effect Sizes for Change from Baseline to 12 Months

Dependent Measure	PE	MCI
SSRS Social Skills (Parent)	0.98	1.00
SSRS Social Skills (Teacher)	0.57	0.59
Bracken School Readiness	0.21	0.20
DIBELS Initial Sound Fluency	1.31	1.22
DIBELS Letter Naming Fluency	1.81	0.86
DIBELS Phoneme Segmentation Fluency	0.81	0.76
CBCL Aggressive	−0.54	−0.60
CBCL Delinquent	−0.72	−0.15
CBCL ADHD Problems	−0.52	−0.59
CBCL Oppositional Defiant Problems	−0.60	−0.56
CBCL Conduct Problems	−0.68	−0.38
Conners Oppositional (Parent)	−0.63	−0.42
TRF Aggressive	−0.54	−0.42
TRF Delinquent	−0.22	−0.35
TRF ADHD Problems	−0.41	−0.55
TRF Oppositional Defiant Problems	−0.54	−0.34
TRF Conduct Problems	−0.43	−0.36
Conners Oppositional (Teacher)	−0.80	−0.40

Note. PE = parent education; MCI = multicomponent intervention; DIBELS = Dynamic Indicators of Basic Early Literacy Skills; CBCL = Child Behavior Checklist; TRF = Teacher Report Form; SSRS = Social Skills Rating System; ADHD = attention deficit hyperactivity disorder.

Statistically significant growth ($p < .01$) was obtained for 16 of the 18 dependent measures (see γ_{10} values in Table 5). Specifically, significant negative trajectories (indicating decrease in problem behaviors) were found for CBCL and TRF Aggressive Behavior, TRF Delinquent Behavior, CBCL and TRF ADHD Problems, CBCL and TRF Oppositional Defiant Problems, CBCL and TRF Conduct Problems, and Conners Oppositional Scale. Statistically significant positive slopes (indicating improvement or growth) were obtained for SSRS parent- and teacher-rated Social Skills as well as Initial Sound Fluency, Letter Naming Fluency, and Phoneme Segmentation Fluency on the DIBELS. Significant slopes were not obtained for CBCL Delinquent Behavior or the Bracken School Readiness Composite, although it should be noted that obtained slopes were in the negative and positive directions, respectively, on these two measures. Contrary to prediction, γ_{11} values were not statistically significant and thus none of the slopes differed between the two treatment groups.

To estimate the magnitude of change, within-group effect sizes were calculated using the formula $(M_{12\text{-mo}} - M_{BL})/(\text{pooled } SD)$.[1] These effect sizes thus represent change over baseline functioning in standard deviation units (Cohen, 1988; see Table 6). Effect sizes were in the small range (effect size $\leq$ 0.50) for Bracken School Readiness (both groups), CBCL Delinquent and Conduct Problems (MCI only), Conners Oppositional (Parent and Teacher; MCI only), TRF Aggressive and Oppositional Defiant Problems (MCI only), TRF ADHD Problems (PE only), as well as TRF Delinquent and Conduct Problems (both groups). Alternatively, moderate effect sizes ($0.50 <$ effect size < 0.80) were obtained for SSRS Social Skills (Teacher; both groups); DIBELS Phoneme Segmentation Fluency (MCI only); CBCL Aggressive, ADHD Prob-

lems, and Oppositional Defiant Problems (both groups); CBCL Delinquent and Conduct Problems (PE only); Conners Oppositional (Parent and Teacher; PE only); TRF Aggressive and Oppositional Defiant Problems (PE Only); and TRF ADHD Problems (MCI only). Finally, large effect sizes (effect size $>$ 0.80) were found for SSRS Social Skills (Parent; both groups), DIBELS Initial Sound Fluency and Letter Naming Fluency (both groups), and DIBELS Phoneme Segmentation Fluency (PE only).

Discussion

The findings from this study suggested that the children in both intervention groups made significant improvements in behavior and preacademic skills compared with baseline. The findings were inconsistent with our hypothesis that individualized assessment-based intervention would prove superior to parent education alone. One explanation is that we used an intent to treat methodology and many parents did not receive the full complement of interventions. Specifically, only 51% of the children received all three of the MCI components, including attending at least one parent education session and development of intervention plans in both the home and school. Future analyses might parcel out the contribution of each of the intervention components, as well as the dosage (e.g., number of parent education sessions, comprehensiveness and intensity of home- or school-based intervention) necessary to produce meaningful differences. If dosage indeed contributes to intervention outcomes, given overall low attendance rates in the parent education sessions, additional strategies should be used to increase participation. For example, it appeared that many parents responded to the monetary incentives linked to assessment completion. Similar contingencies could be associated with parent education attendance. Also, although efforts were made to identify a convenient location for parent education classes, holding classes in a location where parents regularly frequent, such as their child's school, may increase attendance.

It is also possible that although differences were not evident at 1 year postintervention, they will emerge at a later time. For example, the increased need for academic and social skills at kindergarten engenders greater demands for appropriate deportment and sustained attention (e.g., Wolraich, 2006). It may be that parents who received individualized assessment-based intervention in the MCI group will be more adept at assessing their child's needs and developing related interventions (e.g., homework, skill instruction, and task-related problem behavior). Likewise, the interventions introduced in the preschool or day care setting with the MCI group may better prepare them for the demands of kindergarten and early elementary school. Indeed, there is research to suggest that intervention effects may be more evident over the long term. For example, Shaw and colleagues (Shaw, Dishion, Supplee, Gardner, & Arnds, 2006) implemented a parent education intervention with parents of 2-year-old children with conduct problems. Although no significant differences were found in maternal involvement between the intervention group and a control group at 1 year postintervention, significant differences did occur at 2 years postintervention. Specifically, parent involvement maintained for the intervention group whereas involvement steadily declined across the 2 years for the control group.

Another potential confound is that a number of families discontinued participation as their child's behavior improved. In fact, some parents indicated they did not want the stigma of an at-risk label that might occur if preschool or day care staff became aware of their child's association with the project. This may have differentially affected the MCI group, given the more intensive preschool or day care involvement. Unfortunately, it is not possible to evaluate this, given that many parents did not indicate a reason for withdrawing from the project.

It also may be that the interventions were equally effective. During parent education classes the PE group received instruction in general parenting approaches, such as praising appropriate behavior and following

through on demands. In addition, parents were heard sharing strategies for addressing problem behavior with one another. It may be that complex, intensive, and multisetting intervention is not needed at the onset of behavior problems when those problems may be less intensive and long histories of reinforcement for problem behavior have not yet been established. The possibility that a simpler and less intensive intervention package may be effective with very young children is supported by Sonuga-Barke and colleagues (Sonuga-Barke, Thompson, Abikoff, Klein, & Brotman, 2006), who assert that the sometimes marginal effectiveness of psychosocial interventions might be attributed to their late introduction, typically during middle childhood, when untreated social, academic, and behavior problems have intensified. In fact, prior research suggests that structured parent education programs are sufficient to address at least some behavior problems of young children (e.g., Hartman, Stage, & Webster-Stratton, 2003; Shaw et al., 2006; Sonuga-Barke et al., 2006; Webster-Stratton, Reid, & Hammond, 2004).

It is possible that a multitiered approach to treatment may be warranted similar to that proposed for school-aged children exhibiting challenging behaviors (Sugai & Horner, 2006). For example, it may be that parent education alone is sufficient for a percentage of preschoolers at risk for ADHD, whereas others will require more intensive, individualized early intervention as was provided in the MCI group in this study. The specific intervention or combination of interventions for children at the top tier that will best address their needs remains unclear. Additional research is needed to determine whether medication is the most effective option, in spite of the side effects, or whether a nonpharmacologic alternative is equally effective. Further research should identify the minimal intervention components that result in effective outcomes for specific subgroups of young children at risk for ADHD. In addition, it will be important to parcel out the behaviors and intensity of those behaviors responsive to various interventions. These are critical research questions with significant cost–benefit implications.

Limitations

The most critical limitation to this study was the lack of a no-treatment control group. Because the control condition in this study received some active intervention (i.e., parent education) and no between-group differences in 1-year slopes were obtained, it is unclear whether growth that occurred in both groups was attributable to treatment or a function of history and maturation. Of course, the use of a no-treatment control group for a longitudinal treatment outcome study is problematic from both the feasibility and ethical perspectives; for those reasons this type of control group was not included.

Multiple comparisons were conducted in the hierarchical linear modeling analyses, thus potentially inflating experimentwise Type I error. The use of a Bonferroni correction would have necessitated the use of an alpha of .001 for each individual analysis, which would be unduly conservative, particularly for an initial study of early intervention in this population.

Conclusions

Overall, the findings of this study are encouraging, yet suggest the need for further research. The gains made by children in this study stand in contrast to the significant impairment typically exhibited by preschoolers at risk for ADHD (e.g., DuPaul, Eckert, McGoey, & VanBrakle, 2001). Conclusions regarding the specific effects of early intervention are tempered by the lack of significant group differences in the absence of a no-treatment control group. Further, follow-through studies are desperately needed to assure that these promising outcomes maintain across time. Still, the fact that pivotal problem areas affected by ADHD (even when problems are intensive) can be significantly reduced in young children holds promise for diminishing the long-term deleterious sequelae that typically follow.

Supplementary Material

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

Footnotes

[1]The formula used for the denominator was the square root of the following term: The variance at baseline plus the variance at 12 months minus twice the correlation between baseline and 12 months times the product of the two standard deviations (Cohen, 1988).

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