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Predictor Variables Associated With Positive Fast Track Outcomes at the End of Third Grade

The Conduct Problems Prevention Research Group[1,2]

[1]Karen L. Bierman (Department of Psychology, Pennsylvania State University), John D. Coie (Department of Psychology, Duke University), Kenneth A. Dodge (Sanford Institute of Public Policy, Duke University), Mark T. Greenberg (Department of Human Development and Family Studies, Pennsylvania State University), John E. Lochman (Department of Psychology, The University of Alabama), Robert J. McMahon (Department of Psychology, University of Washington), and Ellen E. Pinderhughes (Department of Psychology and Human Development, Vanderbilt University)

Abstract

Progress has been made in understanding the outcome effects of preventive interventions and treatments designed to reduce children's conduct problems. However, limited research has explored the factors that may affect the degree to which an intervention is likely to benefit particular individuals. This study examines selected child, family, and community baseline characteristics that may predict proximal outcomes from the Fast Track intervention. The primary goal of this study was to examine predictors of outcomes after 3 years of intervention participation, at the end of 3rd grade. Three types of proximal outcomes were examined: parent-rated aggression, teacher-rated oppositional-aggressive behavior, and special education involvement. The relation between 11 risk factors and these 3 outcomes was examined, with separate regression analyses for the intervention and control groups. Moderate evidence of prediction of outcome effects was found, although none of the baseline variables were found to predict all 3 outcomes, and different patterns of prediction emerged for home versus school outcomes.

Keywords

conduct-problems; prevention; prediction

Introduction

Intervention research has had as a central tenet for a number of decades, the dictum to identify "*What* treatment, by *whom*, is most effective for *this* individual with *that* specific problem, and under *which* set of circumstances" (Paul, 1967, p. 111). One central aspect of this dictum is to identify which type of individual will be most likely to benefit from an intervention. There has been progress in the adult intervention literature in addressing this issue, but there has been insufficient attention to this topic in the literature on child prevention and treatment (Kazdin & Weisz, 1998). Intervention research is dominated by tests of main effects of the interventions (Durlak, Wells, Cotton, & Johnson, 1995), which has had the benefit of identifying intervention programs for conduct problem children with a solid or promising base of empirical evidence (Brestan & Eyberg, 1998; Kazdin & Weisz, 1998). However, child intervention research now needs to move beyond this initial, and important, scientific endeavor and begin to answer with

2Address all correspondence to John E. Lochman, Box 870348, Department of Psychology, The University of Alabama, Tuscaloosa, Alabama 35487. Address requests for copies of this article to Robert J. McMahon, University of Washington Fast Track, 146 N. Canal Street, Suite 111, Seattle, Washington 98103.

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greater certainty the question of "For whom does this intervention work?," identifying those who do or do not benefit (Brestan & Eyberg; 1998; Lochman, in press). Some child intervention studies have begun to examine this topic, and have examined whether a certain variable, such as the child's initial severity of problem behaviors, predicts which children will show improved behavior following intervention. Typically these analyses examine temporal relationships between risk and outcome variables within the intervention condition, thus providing information about individual difference factors that predict intervention outcomes.

The ability to understand individual child differences in intervention responsivity is further complicated by the need to consider multiple outcome indicators. Different patterns of prediction and moderation of outcomes may occur, depending on which specific outcome measure is used. For example, measures of behavioral adjustment at home, behavioral adjustment at school, and learning are all important and interrelated outcomes targeted by conduct problem prevention and intervention programs. However, these outcomes are only moderately intercorrelated (Achenbach, McConaughy, & Howell, 1987) and may have different determinants of intervention responsivity. Until recently, the limited research on the prediction of differential intervention effectiveness has typically relied on single outcome indicators, thus potentially underestimating the complexity of these patterns. A case in point is Kazdin's recent study, which revealed that parent-rated treatment outcomes were successfully predicted by a set of child, parent, and family factors, whereas teacher-rated outcomes were not predicted by these risk factors (Kazdin, 1995).

This study examines predictor variables and multiple outcome variables with children in the Fast Track preventive intervention. In an accompanying article (Conduct Problems Prevention Research Group [CPPRG], 2002a), the Fast Track intervention led to reductions in teacher-rated aggressive–oppositional behaviors, parent-rated aggressive behaviors and special education services for high-risk intervention children in comparison to a high-risk control group, after 3 years of intervention. It is critical to determine whether this intervention, and other interventions, have a differential impact on children with certain types of characteristics (e.g., Brestan & Eyberg, 1998).[3]

Potential Baseline Predictor Variables

The set of potential factors that might predict intervention outcomes is quite broad, and can include characteristics of the child, of the family, of the parents themselves, and of the more extended social context around the child and the family, including characteristics of the child's peers, neighborhood, and school. Within the area of intervention research on children's conduct problems and aggression, initial research suggests that a certain set of factors may predict variations in child and family responsivity to effective parenting and child cognitive–behavioral interventions (Lochman, 1990; McMahon & Wells, 1998), although different studies have typically examined different predictors.

Child Behavioral and Cognitive Characteristics—With regard to child characteristics, prior studies suggest that the severity of the children's initial behavioral difficulties and the children's academic and cognitive abilities may contribute to variations in intervention responsivity. Children with greater and more pervasive levels of conduct problem behaviors prior to intervention have been found to make the least improvement in parent training interventions (Dumas, 1984; Holden, Lavigne, & Cameron, 1990; Home & van Dyke, 1983; Ruma, Burke, & Thompson, 1996; Webster-Stratton, 1996), and in interventions that have combined parent training and child skill training (Kazdin, 1995; Kazdin & Crowley, 1997), although several studies have not found that baseline severity of problems predicted outcomes

[3]For additional information concerning Fast Track, see http://www.fasttrackproject.org.

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(Fleischman, 1981; Henggeler, Melton, & Smith, 1992; Kellam, Rebok, Ialongo, & Mayer, 1994; Lochman, Lampron, Burch & Curry, 1985). Research has not examined whether other problem behaviors, such as hyperactivity, might also predict worse outcomes following intervention for conduct problem children. Prior research has found that children who have better reading achievement (Kazdin & Crowley, 1997) and better cognitive abilities (Copeland & Hammel, 1981) at baseline have shown greater improvement in parents' ratings of children's aggressive behavior and greater reductions in impulsive behavior following cognitive-behavioral interventions.

Parent and Family Characteristics—Parent and family characteristics examined as potential predictors of intervention effects with conduct problem children include parental psychopathology, single-parent status, and low levels of social support from friends. Single parenthood and maternal depression have demonstrated little or mixed evidence as predictors of outcome. Single-parent status did not affect intervention effect sizes in a meta-analysis of studies of behavioral parent training outcomes (Serketich & Dumas, 1996). Although single parent status has been associated with poorer intervention outcomes in some studies (Dumas & Albin, 1986; Strain, Steele, Ellis, &Timm, 1982; Webster-Stratton & Hammond, 1990), other studies suggest single- and dual-parent families respond equally well to parent or child cognitive–behavioral intervention (Dumas & Wahler, 1983; Fleischman, 1981; Holden, Lavigne, & Cameron, 1990; Kazdin, 1995). Similarly, maternal depression has been associated with poorer intervention outcomes in several studies (Dumas & Albin, 1986; Kazdin, 1995; McMahon, Forehand, Griest, & Wells, 1981; Webster-Stratton &. Hammond, 1990), but not in others (Dumas, 1986; Webster-Stratton, 1985).

The lack of constructive social support may be a critical feature that contributes to the difficulties seen among single parents and low SES parents, and may affect their responsivity to treatment (Webster-Stratton, 1985). The importance of parents' social supports in predicting outcomes from behavioral parent training has been clearly illustrated in Wahler's (1980; Wahler & Graves, 1983) study of maternal insularity. Wahler (1980) analyzed the relationship between the mothers' and children's daily behavior and the kinds of interchanges that the mother had with other adults on those days. On “low friendship” days, insular mothers primarily interacted with agency representatives and relatives rather than friends. These nonfriend contacts were rated as being more aversive to the mothers than were contacts with their friends. During “low friendship” days, mothers were found to be more aversive with their children, and their children were more oppositional as a result, in comparison to “high friendship” days. Wahler (1980) found that intervention gains were only maintained when mothers had sufficient social support from their friends. Similarly, Dadds and McHugh (1992) found that positive responders to parent groups were more likely to have high levels of social support from friends, although they also found that an adjunct intervention designed to enhance social support did not affect the outcome from parent groups.

Demographic and Community Characteristics—Studies examining children's gender and ethnic status have generally indicated that interventions with parents and children are equally effective for boys and girls (CPPRG, 1999a; Henggeler et al., 1992; Kazdin, 1995; Strain et al., 1982; Webster-Stratton, 1996) and for children of different ethnic backgrounds (Henggeler et al., 1992; Strain et al., 1982), although several prevention studies have reported stronger intervention effects for boys or for Caucasian children (Hawkins, Von Cleve, & Catalano, 1991; Kellam et al., 1994).

When sociodemographic disadvantage has been examined as a construct representing a cluster of variables (e.g., family income, maternal education, marital status, neighborhood poverty), this construct has been a significant predictor of nonresponse to treatment (Webster-Stratton, 1985) and of poor treatment involvement and outcome (Dumas & Albin, 1986). In these studies,

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sociodemographic characteristics were stronger predictors of outcome than were other parental characteristics. Socioeconomic status (SES), indexed by family income or by parental education and occupation, is less clearly linked to outcomes than the more general sociodemographic construct is. Low SES has been predictive of poorer outcome in some studies (Holden et al., 1990; Thompson, Grow, Ruma, Daly, & Burke, 1993), but Rogers, Forehand, Griest, Wells, and McMahon (1981) found that SES did not affect observed behavioral outcomes following parent training. A meta-analytic review has not found a relationship between SES behavioral parent training outcomes (Serketich & Dumas, 1996). It is not clear how community-level variables, such as neighborhood problems and poor neighborhood cohesion, predict intervention outcome.

The Current Study of Predictors of Fast Track Outcomes

This study examines whether the Fast Track intervention has a differential impact on children with certain preexisting characteristics. The results of this research on predictor variables can affect our understanding of the generalization of the Fast Track findings, and can indicate areas of need for future intervention development and refinement.

Except for research on behavioral parent training programs, the intervention literature has included relatively few studies that have examined predictors of outcome of interventions for conduct problem children. Of those studies that do exist, (1) mixed findings have occurred about the utility of different predictors; (2) different predictors have typically been examined in different studies, with only a few studies (e.g., Kazdin, 1995) examining a broad set of predictors within a given sample; and (3) the predictive patterns for multiple outcomes have rarely been examined in a given study.

This study addressed these issues, using a set of variables that have been examined in prior studies, and which represent multiple risk factors that have been useful in predicting developmental outcomes in prior research (Greenberg, Lengua, Coie, Pinderhughes, & the CPPRG, 1999). It is critical to examine the effects of an array of possible predictor variables, and to examine their individual and combined effects. The analyses first explore the effects of predictors associated with children's behavior and cognitive abilities, then parent and family characteristics that can be directly related to child behavior, and then to broader community and demographic factors. These 11 predictors are baseline levels of child behavioral and cognitive characteristics (early antisocial behavior, hyperactivity, cognitive abilities, and reading achievement), parent and family characteristics (single parent status, caretaker depression, caretaker social support from friends), and broader community and demographic characteristics (gender, SES, neighborhood quality, and urban/ rural status by race). We examined whether these baseline variables served as predictors of intervention effects, using several of the significant outcomes of the Fast Track intervention at the end of third grade (parent-rated aggression, teacher-rated aggressive–oppositional behaviors, and special education involvement; CPPRG, 2002a). Because of the limited and mixed findings from prior research, specific hypotheses for these predictor variables were not proposed. The relevance and importance of the predictors may vary according to the nature of the outcome. It could be expected that the parent, family, and community-based predictors might have greater power in predicting home-based outcomes, and that child cognitive characteristics might serve as stronger predictors of school-based outcomes.

The interaction between intervention status and each of the 11 predictor variables is also examined in regression analyses. These analyses test whether intervention status influences the relationships between predictor variables and outcomes, and whether the predictor variables relate to the outcome variables in different ways within the intervention and control conditions. Significant interaction effects would suggest that the intervention has altered children's

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distribution on an outcome variable, and thus altered the relationship between predictor variables and outcome.

Method

Participants

Identification of the High-Risk Sample—Behaviorally disruptive kindergarten target children (n = 891) and their parents were identified using a multistage screening procedure. First schools were identified in four areas of the country (Durham, North Carolina; Nashville, Tennessee; Seattle, Washington; and rural central Pennsylvania). Schools within the four sites were selected as high risk on the basis of crime and poverty statistics of the neighborhoods they served. Multistage screening of all kindergarten children from all of the schools proceeded first with teacher ratings of disruptive behavior, followed by parent ratings of behavior at home. In the spring, teachers rated the behavioral problems of each of the kindergarteners in the 54 participating elementary schools at these four sites using the 10-item Authority-Acceptance Scale of the Teacher Observation of Classroom Adaptation—Revised (TOCA-R; Werthamer-Larsson, Kellam, & Wheeler, 1991), which describes aggressive and oppositional behaviors (e.g., fighting, teasing and disobedience). The TOCA-R has been found to have adequate test-retest reliability in previous samples (Werthamer-Larsson et al., 1991), as well as the Fast Track data set (Lochman & CPPRG, 1995). The parents of children who scored in the top 40% of the sample at each site were then contacted by telephone or in person and asked to rate the frequency of child behavior problems at home. The 24 items on this parent screen measure were drawn from the Aggression scales of the Child Behavior Checklist/4–18 (CBCL; Achenbach, 1991) and the Revised Problem Behavior Checklist (Quay &. Peterson, 1987), and other items generated by the investigators (for further details, see Lochman & CPPRG, 1995).

Combined teacher-parent scores, which were the Screen Scores, identified the high-risk children. Children's total scores on the two screening measures (teacher and parent ratings of behavior problems) were averaged. Children who fell in the top 10% at each site on the combined Screen Score (“high risk”) were invited to participate in a longitudinal study of children's adjustment to school. Those who consented received parent and child interviews prior to Grade 1, which served as preintervention assessments. Families of children entering Grade 1 in intervention schools were invited to participate in regular parent/child groups, plus home visits, tutoring, and school follow-up. The intervention continued in a somewhat reduced basis, but with the same components, in Grades 2 and 3. Extensive descriptions of the intervention components can be found elsewhere (Bierman, Greenberg, & CPPRG, 1996; CPPRG, 1999a, 2002b; McMahon, Slough, & the CPPRG, 1996). Toward the end of Grade 3 (Time 4), teacher ratings and data on special education involvement were obtained. Parents and children were reinterviewed in the following summer. Three successive cohorts were recruited, intervened with, and assessed in this way.

The mean age of the high-risk children at the time of screening was 6.5 years (SD = 0.48). Across all sites, the sample was 51% African American, 47% European American, and 2% of other ethnicity (e.g., Pacific Islander and Hispanic), reflecting the ethnic diversity of the population at the four sites. Sixty-nine percent were boys. Demographic characteristics of the sample at each site can be found in CPPRG (1999a).

Assignment to Intervention and Control Conditions—Within each site, the schools were divided into two sets matched for demographics (size, percentage who received free or reduced price lunch, and ethnic composition) and the sets were randomly assigned to intervention and control conditions. Because part of the intervention involved a school-based intervention, we assigned entire elementary schools (N = 54) to either the intervention or the

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control condition. In the intervention condition there were 445 children in 191 classrooms. In the control condition there were 446 children in 210 classrooms. The details of assignment procedures, and of the intent-to-intervene design, are contained in an accompanying paper in this special section (CPPRG, 2002a).

Intervention Procedures

The details of the Fast Track intervention across the first, second, and third grade years are described in an accompanying paper in this special section (CPPRG, 2002b). The components of intervention include a universal preventive intervention component delivered in the intervention school classrooms (PATHS), and a set of indicated preventive intervention components for the high-risk target children. These indicated intervention components included social-skills groups for children, parent groups, parent–child sharing times, "peer pairing" sessions with nonrisk peers, home visiting, and academic tutoring.

Assessment Procedures

Multiple assessment methods (ratings, interviews) and informants (children, parents, teachers) were used to collect the data for this study of prediction of intervention effects. At least partial data were obtained from 821 children and families at the post–Grade 3 assessment. Data were also collected at the ends of Grade 1 (CPPRG, 1999a) and Grade 2, but those data were not included in this paper. Post-kindergarten data served as the baseline predictors in this study. The means and standard deviations for the predictor variables that had continuous data are included in Table I.

Home Visit—Parent data were collected during home visits during the summers before the target children's Grade 1 year, and then again 3 years later, after most of the children had completed third grade. While one research assistant interviewed the primary caregiver (usually the mother), a second assistant interviewed the target child in a separate room. Interviewers read the various rating forms to the primary caregiver or child and noted the responses. During that interview, in addition to other measures, parents reported on child behavior problems exhibited during the previous 24-hr period. Parents were recontacted by phone on two occasions during the next 2 weeks to make additional daily reports of child behavior problems. Caregivers received $75 for their participation in the summer interview.

Teacher Reports—Teacher ratings describing the behavior problems were collected in October of Grade 1, and in the spring of Grade 3. Teachers completed the TQCA-R (Werthamer-Larsson et al., 1991). They received $10 per child for completing these measures.

Attrition—The effects of attrition were analyzed separately according to the source of the data. Comparisons between those participants on whom data were available and those for whom they were not available were conducted separately for control and intervention participants, using the original screening score as the dependent variable. The accompanying paper (CPPRG, 2002a) describes the degree of subject attrition and of data attrition in the sample across these elementary school grades. None of the comparisons of attrited versus obtained scores on the original screening measure were statistically significant for either the control group or the intervention group analyses, suggesting that those who attrited did not differ significantly from those who were retained on the pretest measures.

Predictor Measures

Demographic Variables—SES was assessed by caretakers' reports of education and current occupations (Hollingshead, 1979). Education was assessed by the education level of the head of household (mothers in mother-headed families and the mean of mothers and fathers in two-

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parent families). Similarly, occupation was assessed using the Hollingshead (1979) 9-point categorization system of the head of household. Information about the target child's race, and single- versus two-parent family status was obtained from the parent. Households in which the parent was not married but had a live-in partner who had resided there for the past 12 months were considered two-parent households. Fifty percent of the intervention families and 47% of the control families were two-parent households. Because of the strong association between ethnicity and site in our sample (e.g., the Durham site was primarily African American, the rural Pennsylvania site was primarily European American, and the other two sites were more evenly divided between African American and European American children), an ethnicity/urbanicity composite variable was created for the analyses in this paper by creating three categories for minority/urban (51% of the control sample, 55% of the intervention sample), European American/urban (24% of the control sample, 20% of the intervention sample), and European American/rural (24% of the control sample, 25% of the intervention sample).

Neighborhood Context—The participants' perception of the neighborhood was assessed using the Neighborhood Questionnaire (NQ) to determine the quality of the family's neighborhood in terms of safety, violence, drug traffic, satisfaction, and stability (Greenberg et al., 1999). The 13 items from this parent-report measure were submitted to a principal components analysis, and three factors with eigenvalues grea-break ter than or equal to 1 were extracted. The factors were labeled Neighborhood Safety ($\alpha = .77$; e.g., How often are there problems with muggings, burglaries, assaults, etc.? How much of a problem is the selling and using of drugs around here?), Neighborhood Social Involvement ($\alpha = .74$; How many of your neighbors do you know well enough to visit or call on? How often do you get together with any of your neighbors?), and a two-item scale on Satisfaction with Public Services (e.g., How satisfied are you with public transit around here? How satisfied are you with the schools around here?). The Neighborhood Score was the mean of the three subscale scores.

Social Support—Social support was assessed by the Friendship Support ($\alpha = .77$) subscale from the 38-item Inventory of Parent Experiences (IPE; Crnic & Greenberg, 1990). Scores were the means of items on this subscale. The subscale was considered missing if 25% or more of the items on the subscale were missing.

Mother's Depression—Maternal depression was assessed using the Center for Epidemiological Studies—Depression scale (CES-D; Radloff, 1977). The scale was designed to measure the major components of depressive symptomatology, and respondents were asked to rate the frequency of each of 20 symptoms experienced in the previous 7 days on a 4-point scale. Scores on the CES-D were the sum of these 20 items. The scale was considered missing if 25% of items on the scale were missing.

Child Characteristics: Cognitive Ability, Reading Achievement, Hyperactivity, Initial Antisocial Behavior, and Gender—Two core subtests from the Wechsler Intelligence Scales for Children—Revised (WISC-R; Wechsler, 1974), Vocabulary and Block Design, were individually administered to all children. Scale scores were averaged together from the two subtests to form a composite estimate of cognitive ability.

Individual achievement test scores assessed child reading skills at baseline. The Woodcock–Johnson Psycho-Educational Battery—Revised (Woodcock & Johnson, 1990) was used to assess reading achievement. Five items on the Word Identification subtest assessed the child's ability to match a pictorial representation of a word with an actual picture of an object; the remaining items assessed the child's ability to identify letters and words. These items were summed for the summary measure of child reading skills.

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Children's hyperactivity was assessed with items from the Child Behavior Checklist (the Teacher Report Form [CBCL-TRF]; Achenbach, 1991). A confirmatory factor analysis based upon *DSM-IV* symptom criteria (Bellanti, Bierman, & CPPRG, 2000; Stormshak, Bierman, & CPPRG, 1998) identified five items on the CBCL-TRF assessing hyperactivity (e.g., can't concentrate, can't sit still, impulsive, and acts without thinking, talks too much, unusually loud), and found this factor to be distinct from factors reflecting inattention, oppositional–defiant and aggressive behaviors. The confirmatory factor analysis produced a model with good fit to the data, chi square (182) = 453.68, $p < .01$, goodness-of-fit index = .94, Bentler Bonnett = .91. The TRF items within this factor for hyperactivity were summed and averaged.

Children's baseline level of antisocial behavior was assessed using the Screen Score previously described in the section on multiple gating procedures used to select high-risk children (Lochman & CPPRG, 1995).

Outcome Measures

Child Aggressive–Disruptive Behavior at Home—Parents completed the Parent Daily Report (PDR; Chamberlain & Reid, 1987) on three occasions at each assessment period, indicating whether or not 30 different behavior problems occurred during the previous 24-hr period. A preliminary factor analysis of the PDR identified 15 behaviors that factored onto two scales, reflecting 6 aggressive behaviors (e.g., fighting, hitting, yelling;α = .83) and 9 oppositional behaviors (e.g., whining, talking back, noncompliance; α = .81). Reports of these 15 behaviors were summed over the three administrations of the PDR to provide a total score for analyses. Data were available for this variable for 798 participants within the sample at the end of third grade.

Child Aggressive–Disruptive Behavior at School—Teachers completed the TOCA-R (Werthamer-Larsson et al., 1991), which included a 10-item Authority Acceptance Scale (α = .94), providing an index of aggressive–oppositional behavior at school. Data were available for this variable for 800 participants within the sample at the end of third grade.

Special Education Services—School records on children's placement in special-education services were combined with teacher reports of special education placement to create a variable indicating special education involvement. A child received a score of 1 if either source revealed a special education diagnosis, time placed in special education, or an Individualized Education Plan (IEP) at the end of Grades 1, 2, or 3. A child received a score of 0 if none of these sources indicated such a diagnosis. Special education services were typically related to behavior management issues as well as learning difficulties. Data were available for this variable for 332 participants within the sample at the end of third grade.

Results

Linear regression analyses were used to examine the Predictors of the three third grade outcomes. Regression analyses were run in a Structural Equation Modeling framework, using Mplus (Muthen & Muthen, 1998). They included the 11 risk variables—predicting each of the three outcomes, all conducted separately for the intervention and control conditions. Predictor variables were all assessed at Time 1 in the spring and summer before the children's first grade year, and the outcome criterion variables were assessed at the end of the third grade year. Each of the regression analyses also included the baseline level of the outcome criterion variable for the two outcomes for which this was available (i.e., parent- and teacher-reported aggression).

The primary goal of this study was to determine if baseline child, family, and demographic characteristics predicted outcomes for children who had received the Fast Track intervention. This investigation of predictors of outcome effects was accomplished in two steps. First, the

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predictive effects of each of the 11 baseline variables was examined separately on each of the three outcome variables. Because our primary interest is in assessing baseline predictors of outcomes within the intervention group, we present these regression analysis results for the intervention group, without the control group. In addition, in subsequent regression analyses, we then examined how the interaction effect between intervention status (using the full sample, including the control group) and each of the baseline variables predicted third grade outcomes. Second, the baseline predictor variables that had significantly predicted each of the outcomes in the regression analyses of individual variables were entered into a separate hierarchical regression analysis for each of the three outcome variables. Variables were entered in planned steps, beginning with the Time 1 level of the outcome variable, followed by children's behavioral predictors, then by children's cognitive predictors, then by parent and family characteristics, and finally by demographic and community predictor variables. This order of entry examined the effects of child characteristics first, followed by progressively broader contextual factors (parents and family, then community factors) that could augment the predictive power of the child characteristics.

To avoid the problems of listwise deletion (i.e., sample size reduction and possible bias of parameter estimates), the regression analyses used Mplus's (Muthen & Muthen, 1998) facility for maximum likelihood estimation from raw data. This is a complete case analysis technique that results in unbiased parameter estimates under the condition of data missing at random, which avoids the much more restrictive assumptions of listwise deletion (Little & Rubin, 1987).

Prediction of Outcomes Within the Intervention Group: Individual Regression Analyses

Parent-Rated Aggressive Behavior (PDR)—Table II contains results from the total of 11 regression analyses within the Intervention condition, indicating which of the 11 child, family, and community characteristics predicted parent-rated aggressive behavior within the intervention condition. Table II also contains results for prediction within the control condition, and tests of the moderation effect of intervention status on the baseline predictors-to-outcome relationship, and these results will be noted in a subsequent section. The table provides the standardized regression coefficient and significance level for each predictor.

Within the Intervention condition, lower levels of third grade parent-rated aggressive behavior were only predicted by lower initial levels of children's antisocial behavior on the Screen Score. None of the children's cognitive variables, parent and family variables, or demographic and community variables predicted changes in parent-rated aggression at the end of third grade within the intervention condition.

Teacher-Rated Aggressive–Oppositional Behavior (TOCA-R)—Table III contains results from the 11 regression analyses, which indicated the relationship between the 11 baseline child, family, and community characteristics and the third grade children's TOCA-R aggressive–oppositional behavior, again within the intervention condition. Within the intervention condition, a lower level of teacher-rated oppositional–aggression by the end of third grade was predicted at baseline by (1) two cognitive predictors – higher levels of children's cognitive abilities and higher levels of reading achievement; (2) two parent and family predictors – lower levels of caretakers' depression, and not being a single parent (lsmeans: single parent, 1.81; nonsingle parent, 1.55); and (3) three demographic and community predictors – being female (lsmeans: males, 1.76; females, 1.55), having higher socioeconomic status in the family, and being European American (lsmeans: rural European American, 1.48; urban European American, 1.54; urban Minority, 1.86).

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Special Education Involvement—The results from the 11 regression analyses that indicated the relationship between the 11 predictor variables and children's involvement in special education services at their schools, conducted separately within the intervention condition, can be found in Table IV. A lower level of special education involvement by children within the intervention condition at the end of third grade was predicted at baseline by (1) a child behavioral predictor – having lower levels of hyperactive behavior; (2) two cognitive predictors – higher levels of children's cognitive ability, and higher levels of reading achievement; and (3) one demographic predictor – being female (lsmeans: males, .46; females, .27). None of the parent and family baseline variables predicted special education outcome.

Prediction of Outcomes Within the Intervention Group: Hierarchical Regression Analyses

Parent-Rated Aggressive Behavior (PDR)—Tables V–VII contain results for the hierarchical regression analyses conducted within the intervention group for the three outcome variables. Only those variables that had been significant predictors in the previously described individual regression analyses were entered into the hierarchical regression analyses, using the planned stepwise entry for Time 1 covariates, child behavioral predictors, child cognitive predictors, parent and family predictors, and demographic and community predictors. For the parent-rated aggression outcome, the Time 1 PDR aggression score significantly predicted later PDR aggression, accounting for 26% of the variance (see Table V). Children's baseline antisocial Screen Score significantly added to this prediction, with both predictors accounting for 28% of the variance in the outcome. Intervention children who had lower Screen Scores had the greatest reduction in parent-rated aggression.

Teacher-Rated Aggressive–Oppositional Behavior (TOCA-R)—Table VI contains the results for the hierarchical analysis for the teacher-rated aggressive–oppositional behavior at the end of third grade. The Time 1 TOCA-R aggression score predicted 7% of the variance in teacher-rated aggression 3 years later. Even though the seven baseline variables that had significantly predicted this outcome in the individual regression analyses did account for an additional 4% of the variance (by the 5th step in the analysis), none of these baseline variables had unique statistically significant prediction of outcome once the Time 1 TOCA-R score and the other predictors were entered in the hierarchical regression analysis.

Special Education Involvement—The results for the hierarchical regression analysis for the special education outcome are contained in Table VII. Because there was no Time 1 level of this outcome variable, no variable was entered at Step 1. In subsequent steps, higher rates of special education involvement were predicted by higher baseline hyperactivity (accounting for 3% of the variance at Step 2), and this predictor continued to serve as a significant predictor even after other variables were added at subsequent steps. Gender also emerged as a significant predictor when it was added in the final step, indicating that males had higher levels of special education involvement than did females (lsmeans: males, .44; females, .32). When all predictors were entered, they accounted for 6% of the variance in the prediction of special education involvement for children within the intervention group.

Interactions Between Intervention Status and Predictor Variables on Outcomes

To test for possible effects of intervention status on the relationship between baseline predictors and the three outcomes, interaction effects between intervention status and the baseline predictors regression analyses were entered into regressions with the full sample, including the control group, using the 11 predictor variables, as indicated in Tables II–IV. Each of these regression analyses included as predictor variables the main effect of intervention status, the main effect of one of the baseline variables at a time, and the interaction term involving the multiplication of intervention status by the baseline variable.

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Tests of intervention status effects on the predictor-to-outcome relationships for parent-rated aggression indicated that intervention status influenced the relationship between predictor variables and parent-rated aggression for one of the predictor variables, the social support that caretakers received from their friends. The pattern of this interaction effect is illustrated in Fig. 1, and in the direction of regression coefficients for the separate analyses conducted within the intervention and the control conditions (see Tables II–IV). For illustration purposes in Fig. 1 (high, low), the levels of social support were created by using a median split on the social support variable. Parents within the control condition who had low levels of social support at baseline reported the highest levels of aggressive behavior in their children by the end of third grade. However, within the intervention condition, parents who initially at baseline had low levels of social support reported lower levels of aggressive behavior in their children 3 years later. Parents who had relatively high levels of social support had relatively similar outcomes on parent-rated aggression, regardless of whether they were in the intervention or control condition.

There were no indications that intervention status influenced the relationship between predictor variables and the teacher-rated aggression outcome, suggesting that the baseline variables predicted this TOCA-R outcome in relatively similar ways across the intervention and control groups.

Tests of interaction effects on the special education outcome indicated that intervention status influenced the relationship between caretakers' level of social support from friends and their children's subsequent involvement in special education services. This interaction effect is illustrated in Fig. 2, and the pattern is similar to the pattern evident for the interaction effect of these predictor variables on the parent-rated aggression outcome. Parents in the control condition who had low initial levels of social support were likely to have children who had higher rates of special education involvement by the end of third grade. In contrast, parents in the intervention condition who had lower baseline levels of social support had children who were less involved in special education services 3 years later than was the case for the low social support parents in the control condition. In addition, intervention status affected the relationship between baseline single parent status and special education outcome, and between neighborhood quality and special education outcome. Within the control condition, children who came from two-parent families and who lived in better neighborhoods were more likely to have a relatively lower level of special education involvement at the end of third grade, but the relationships between these baseline predictors and the special education outcome were not apparent in the intervention group.

The pattern of prediction between the baseline variables and the outcomes within the control condition is also shown in Tables II–IV, to assist with subsequent explanation of interaction effects. Because the relationship between the baseline predictors and outcomes within the control group alone, apart from significant interaction effects, is not important to this study, the pattern of predictors within the control group will only be briefly noted. Within the control condition, improvements in parent-rated aggressive–oppositional behavior were predicted by being female and by living in a better neighborhood. Improvements in teacher-rated aggressive–oppositional behavior were most evident for children who were female, were European American and were less hyperactive at baseline, who had better cognitive and reading abilities, who had mothers who were less depressed and reported greater social support, who came from two-parent families, and who had higher SES and were from better neighborhoods. Lower levels of special education involvement by third grade were more evident for children with lower initial levels of behavior problems and hyperactivity, and higher cognitive ability and reading achievement, with two-parent families, higher levels of caretaker social support, and living in higher quality neighborhoods.

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Discussion

The results indicate that certain baseline characteristics of target children, their families, and their communities can modestly predict third grade outcomes for the Fast Track program, although considerable variability occurred in the prediction of the three different kinds of outcomes examined here. All the three outcomes—aggression at school, aggression at home, and special education involvement—decreased as a function of the Fast Track intervention by the end of third grade (CPPRG 2002a). Results suggest that some individual differences exist, and that certain children show greater or lesser response to the intervention, depending on the outcome measured. However, none of the baseline variables predicted poorer outcome among intervention children across all three outcomes, indicating that there is no simple answer to the question of which children benefit most and which least from Fast Track (Brestan & Eyberg, 1998). Instead, certain baseline variables can predict intervention children's third grade functioning on one or two outcomes, but not on all three outcomes. In addition, the results provide some limited evidence that the intervention may have altered the relationship between a few of the baseline variables and later outcomes. Prediction results, which are the primary focus of this paper, will be discussed first, followed by discussion of effects of differential intervention impact.

Prediction of Outcomes for Intervention Children

Results From Regression Analyses Using Individual Baseline Predictors—A limited degree of prediction of outcomes was evident from the child, family, and community baseline variables. Nine of the 11 baseline variables predicted at least one of the three outcomes. Thus, there is some evidence that baseline predictors ranging from characteristics of the children's behavior and cognitive abilities to their broader parent and family context, and their demographic characteristics, may help predict which children benefit to a greater or lesser degree from the Fast Track intervention on specific outcomes. However, because none of the baseline variables were predictive across all three outcomes, and because only 12 of the 33 individual tests of prediction across the three outcomes were significant, the confidence in the degree of prediction of individual differences in outcome is modest. Based on the current findings, it is not possible to identify certain types of children who will be completely unresponsive to Fast Track intervention across all three outcomes examined here. Instead, the prediction results indicate a more subtle pattern, in which certain intervention children can have poorer or adequate outcomes depending on the specific outcome variable. The prior literature on prediction of intervention outcomes for conduct problem children has been decidedly mixed, and the current results, in the context of the prior research, indicate that prediction of intervention outcomes may be likely to vary across interventions, and, even in the same intervention, across different types of outcomes.

In these results, outcomes for intervention children in the school setting were predicted better than was an outcome in the home setting. Half of the tests of predictors of teacher-rated aggression and of children's degree of involvement in special education services were significant, and three baseline variables emerged as significant predictors of both of these school-related outcomes. Among children who had received the Fast Track intervention, larger reductions in teacher-rated aggression and lower levels of special education services by the end of third grade were evident for children who, in kindergarten, had higher levels of cognitive ability, had better reading achievement, and were female. These three characteristics of the Fast Track children appear to be the most reliable predictors of school-related outcomes. Thus, less cognitively capable and more poorly achieving boys show less improvement in this high-risk sample. The pattern of prediction from these baseline measures of cognitive and academic functioning was consistent with the limited prior research on these variables (Copeland & Hammel, 1981; Kazdin & Crowley, 1997). The prior literature examining the predictive effect

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of children's gender on the outcomes from other interventions has been mixed (e.g., Hawkins, Von Cleve, &, Catalano, 1991; Kazdin, 3995). Five other baseline variables predicted at least one of the two school-related outcomes. Greater reductions in teacher-rated aggressive behavior were evident among Fast Track children who had caretakers who were less depressed at baseline, who came from two-parent families, who came from higher SES families, and who were White. Single-parenthood, maternal depression, SES, and ethnicity have been predictors of intervention outcome in some prior studies (e.g., Dumas & Albin, l986; Holden et al., 1990; Kazdin, 1995; Strain et al., 1982; Webster-Stratton & Hammond, 1990), although these predictive effects have been mixed, and various of these specific predictors have not been significant in other intervention research (e.g., Serketich & Dumas, 1996; Holden et al., 1990; Kazdin, 1995). Lower third grade levels of special education involvement were apparent for Fast Track children who had lower levels of hyperactive behavior in kindergarten.

In prediction analyses for the home-related outcome of parent-rated aggressive behavior, only I of the 11 baseline variables significantly predicted outcome among the Fast Track children. Reductions in parent-rated aggression were more evident among Fast Track children who bad relatively fewer behavior problems at initial screening.

Consistent with most of the prior findings (e.g., Dumas, 1984; Holden et al., 1990; Kazdin, 1995; Kazdin & Crowley, 1997; Ruma et al., 1996; Webster-Stratton, 1996), children who had less severe levels of initial antisocial behavior, assessed with our multiple-gate screening of kindergarten teachers and parents, had better parent-rated outcomes than did children with higher levels of initial antisocial behavior. Although this effect for initial antisocial behavior was not evident for the school-related outcomes, the direction and pattern of the predictive effect is the same across all of the significant predictors. That is, children at the more benign end of the predictor (lower initial antisocial behavior, less hyperactivity, better cognitive ability, better reading achievement, two-parent families, less caretaker depression, being female) were more likely to make clear progress during their involvement in the first 3 years of Fast Track. Thus, the most antisocial children in kindergarten may already have such a collection of problematic behaviors across settings that psychosocial intervention may have more limited effects in altering the developmental trajectories for these children. Similarly, children at the extreme end of other risk predictors may have such an extreme form of risk that psychosocial interventions—even intensive and comprehensive ones like Fast Track—may not be sufficient to alter the course of development for these individuals. However, the role of initial antisocial behavior and of other risk markers, as predictors of outcomes within this sample, has to be carefully interpreted because the whole sample was selected to be high risk. The Fast Track target children were the 10% most aggressive and disruptive children in their kindergarten classrooms and homes, according to teacher and parent ratings, and were drawn from schools that were determined to be already at high risk for later antisocial behavior. Thus, the less severe of these children were still within the top 5–10% of risk for later serious conduct problems, suggesting that Fast Track may have its strongest effects with all but the most severe (i.e., top 2 or 3%) of high-risk children. These results are generally consistent with the developmental model on which Fast Track is based (CPPRG, 1992).

Results From Hierarchical Multiple Regression Analyses—Although the individual regression analyses indicate the range of baseline variables that can predict Fast Track outcomes, they do not control for some degree of expected intercorrelation of the predictors, and do not indicate which of the predictors may be most important for intervention planning with Fast Track. In addition, because of the number of individual regression analyses conducted (33) with the outcome variables, 2 of the 12 obtained significant predictors may have been significant by chance alone. Thus, the hierarchical regression analyses were conducted to identify the most notable of the baseline predictors. Three of the baseline predictor variables remained significant even after they had been included in the multiple regression analyses

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(initial antisocial behavior, hyperactivity, gender). Fast Track children who had the greatest reductions in parent-rated aggression had initially better screen scores for antisocial behavior, and Fast Track children who were less likely to be involved in special education at the end of third grade were female and were initially less hyperactive.

The hierarchical regression analyses for teacher-rated aggressive behavior did not yield any significant baseline predictors, even though the individual regression analyses had found 7 of the 11 baseline variables to significantly predict changes in this outcome behavior. This pattern suggests that the amount of prediction accruing to each of these baseline variables overlapped with the prediction from other baseline predictors, and that there were no primary baseline variable predictors of the TOCA-R outcome at the end of third grade.

The hierarchical regression analyses indicated that 4–6% of the variance in the prediction of the three outcomes was due to the sets of baseline variables entered. These results suggest that although some prediction of outcomes is evident within the intervention group, the amount of variance due to the these baseline predictor variables serving as moderators of intervention is limited, and the predictor variables are only partially successful in predicting outcomes. Thus, we would expect that not all the boys in Fast Track will have negative special education outcomes, or that all of the children with the most hyperactive behavior or with the most severe initial screen scores will have negative outcomes.

Effects of Intervention on the Baseline Variable-to-Outcome Relationships

In prediction of outcomes, the intervention researcher is engaged in the relatively straightforward task of determining if certain baseline risk characteristics predict which children will have better or worse outcomes on the defined outcome, and hence whether these variables predict intervention effects. In studying how intervention status influences the relationship between predictor variables and outcomes, the intervention researcher is determining if intervention will alter the relationship found to exist between a baseline characteristic and an outcome within a nonintervention condition. In analyses of outcomes at the end of third grade for Fast Track (CPPRG, 2002a), over 60% of the children in the control group were found to have poor outcomes by third grade. An active component or process within the intervention would be presumed to change the outcome variable for the children in intervention, and thus might change this baseline variable-to-outcome relationship. Because not all of the children would be expected to benefit from the intervention to the same degree, the distribution of the children on the outcome variable may be different if children receive intervention than if they do not receive intervention.

In this study, intervention was found to have a differential influence on two of the outcomes depending on the level of certain baseline characteristics: social support for caretakers, single parenthood, and neighborhood quality. However, because only 4 of the 33 tests of the interaction between intervention status and baseline characteristics were significant (11 predictors across three outcomes), and two of these tests could have been expected to be significant by chance alone, the interpretation of these effects has to be tentative. These results indicate that intervention status has not influenced the relationship between baseline variables and later outcomes in most cases, and that the relationships between predictors and outcomes are relatively similar across the intervention and control groups. Of the four significant tests, perhaps relatively stronger confidence can be placed in the findings that intervention status influenced the relationship between baseline levels of caretaker social support and outcomes because this effect was evident for two different outcomes, parent-rated aggression and special education involvement.

Control parents who had little initial social support from friends were likely to rate their children as having increasing problems with aggression 3 years later, and to have children who were

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more likely to be involved in special education. In comparison to these control parents with low social support, intervention parents who had low levels of social support from friends at the baseline, when children had just completed kindergarten, were more likely to report lower rates of aggression by their target children after 3 years of intervention and to have lower rates of special education involvement by their children. Low levels of support from friends contribute to parental "insularity" and irritability, increasing their tendency to provoke aversive behavior from their children and reducing their responsivity to interventions (Wahler, 1980; Wahler & Graves, 1983). After 3 years of intervention, Fast Track appears to have reversed some of the negative sequelae resulting from initial parental insularity.

Prediction to Multiple Outcomes

The variability in how baseline characteristics predict to different outcomes in this study underscores the need to examine how predictor variables relate to multiple-variable, rather than single-variable, outcomes in future intervention research. Similar to the general pattern of findings in this study, Kazdin (1995) found markedly different abilities to predict home-based versus school-based outcomes. However, in the Kazdin study, predictors emerged primarily for home-based outcomes, whereas in the current study predictors emerged primarily for school-based outcomes. Although some predictors could have relatively common effects across multiple outcomes with any typical cognitive–behavioral intervention for children and parents, the current study indicates that predictors of Fast Track outcomes operate much more narrowly, and that their predictive power is affected by the source and setting for different outcome measures. Future intervention research should explore, in a more fine-grained manner, how predictors relate to various important outcomes.

Summary

In summary, the findings address important gaps in current intervention research by addressing prediction of three key third grade outcomes with children who have received 3 years of Fast Track intervention. Overall, baseline variables predict intervention outcomes, but they account for relatively limited amounts of the variance in these outcomes, and none of the baseline predictor variables predicted intervention in children's outcomes across all three outcome variables. However, some baseline variables can predict one or two, but not all three, of the intervention's outcomes, with somewhat greater prediction evident for school-based outcomes.

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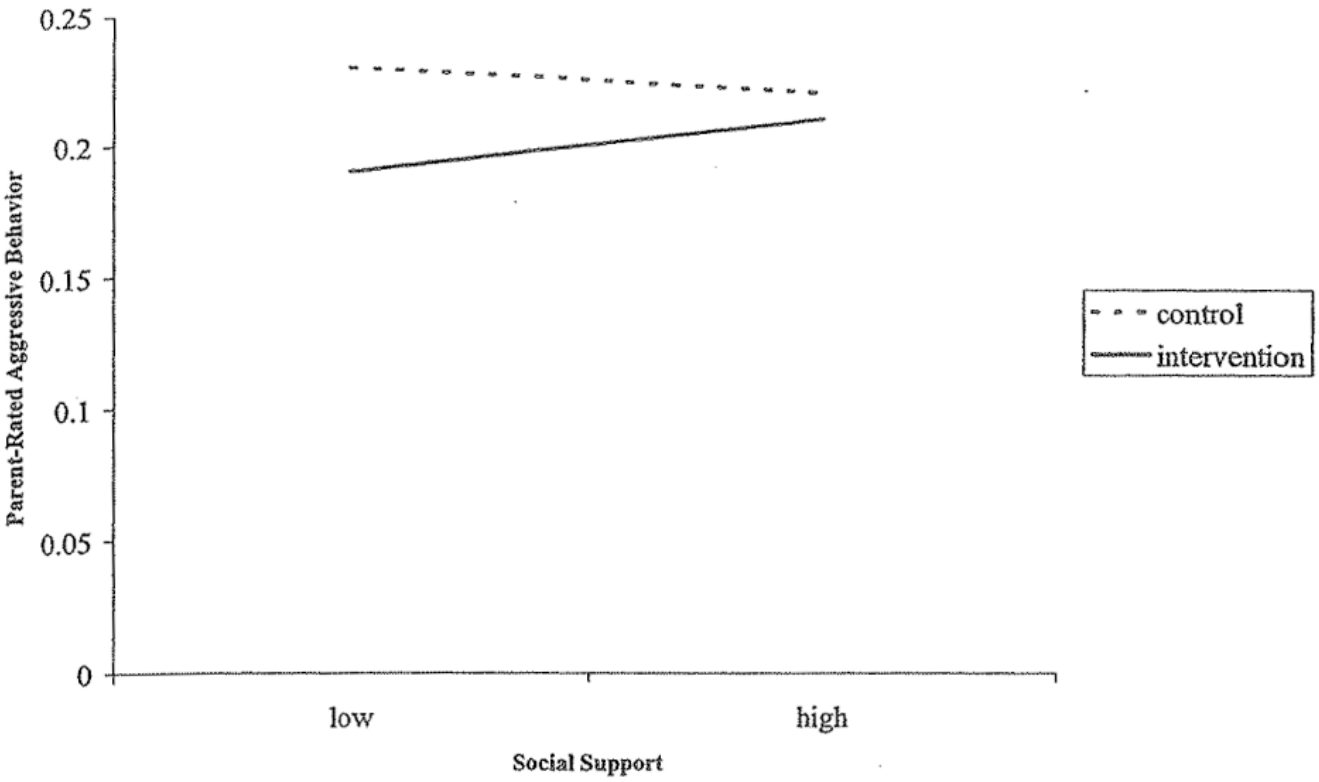

Fig. 1.
Effect of the interaction between interaction status and caretakers' baseline level of social support on parent-rated aggressive behavior when children have completed third grade.

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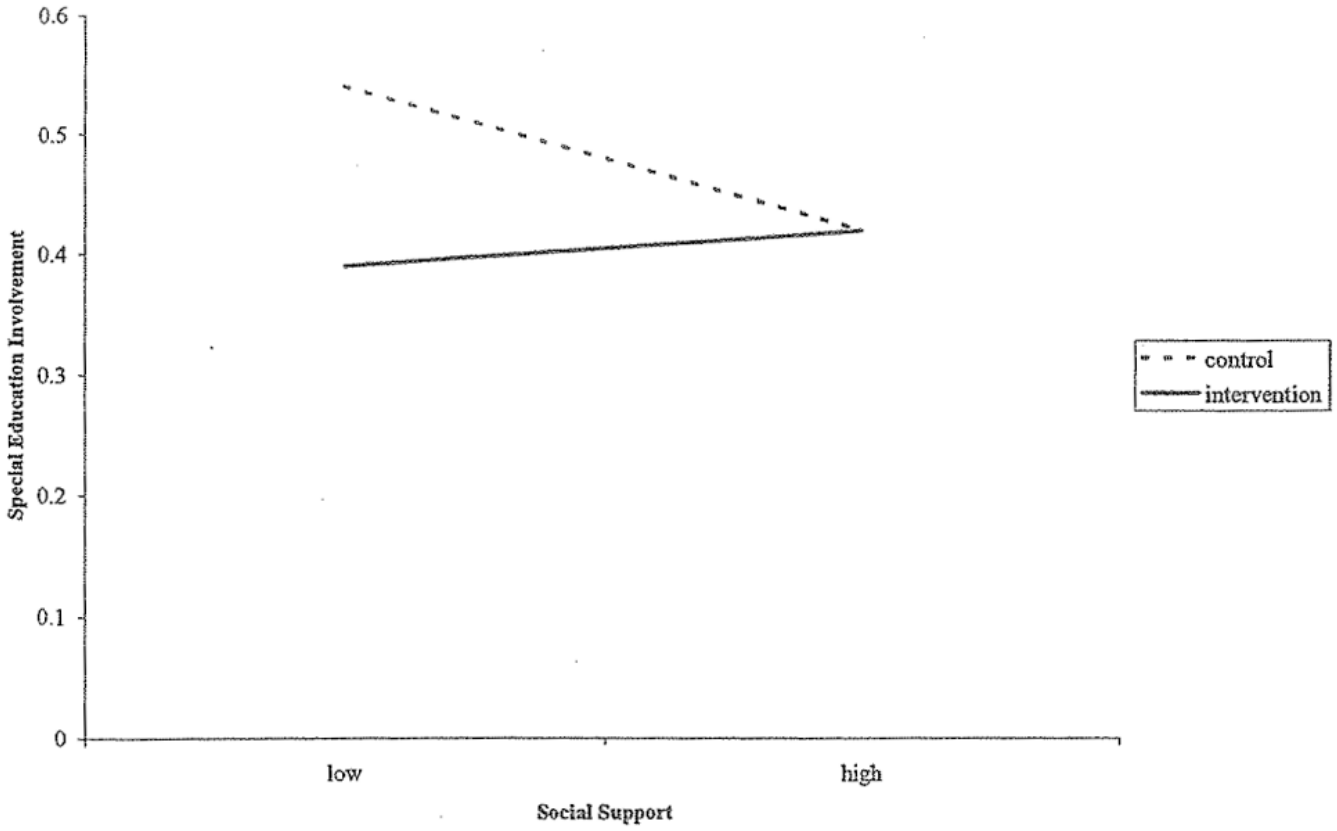

Fig. 2.
Effect of the interaction between interaction status and caretakers' baseline level of social support on children's special education involvement in third grade.

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Table I

Means and Standard Deviations of Predictor Variables

Variable	Intervention condition	Control condition
Antisocial behavior	124.99 (11.26)	124.41 (10.83)
Hyperactivity	1.10 (0.59)	1.08 (0.57)
Cognitive ability (Z score)	−0.04 (0.79)	−0.10 (0.77)
Reading achievement	13.04 (4.98)	12.18 (4.01)
Maternal depression	13.94 (8.95)	14.96 (9.77)
Friends' social support	6.89 (1.94)	7.12 (1.71)
SES	26.24 (12.97)	25.82 (12.82)
Neighborhood (Z score)	−0.05 (0.61)	−0.03 (0.59)

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Table II

Standardized Regression Coefficients for Variables Predicting Parent-Rated Aggressive–Oppositional Behavior, Within the Intervention and Control Condition, and Tests for the Interactions Between Intervention Status and Predictor Variables

	SRC		
Characteristics	**Intervention predictors**	**Control predictors**	**Intervention Status × Predictors (Z)**
Child behavior			
Antisocial behavior	.142**	.073	.81
Hyperactivity	.001	.006	−.06
Child cognitive			
Cognitive ability	.026	.003	.35
Reading achievement	.053	−.056	1.81
Parent and family			
Maternal depression	−.032	.026	−.98
Single parent	.083	.015	−.93
Friends' social support	.069	−.059	2.12*
Demographic and community			
Gender	.051	.094*	−.69
SES	.023	−.021	.63
Neighborhood	.012	−.089*	1.75
Urbanicity/ethnicity	.058	.024	.37

Note. SRC: Standardized regression coefficient.

* $p < .05$.

** $p < .01$.

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Table III

Standardized Regression Coefficients for Variables Predicting Teacher-Rated Aggressive–Oppositional Behavior, Within the Intervention and Control Conditions, and Tests for the Interactions Between Intervention Status and Predictor Variables

Characteristics	SRC		Intervention Status × Predictors (Z)
	Intervention predictors	Control predictors	
Child behavior			
Antisocial behavior	−.00	−.06	1.37
Hyperactivity	.05	.13*	−.34
Child cognitive			
Cognitive ability	−.12*	−.16**	.54
Reading achievement	−.10*	−.12*	.79
Parent and family			
Maternal depression	.11*	.10*	.12
Single parent	.12*	.17**	−.55
Friends' social support	−.02	−.11*	1.57
Demographic and community			
Gender	.10*	.15**	−.69
SES	−.12*	−.15**	.65
Neighborhood	−.04	−.13*	1.32
Urbanicity/ethnicity	−.13**	−.17***	.24

Note. SRC: Standardized regression coefficient.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

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Table IV

Standardized Regression Coefficients for Variables Predicting Special Education Involvement, Within the Intervention and Control Conditions, and Tests for the Interactions Between Intervention Status and Predictor Variables

Characteristics	SRC		Intervention Status × Predictors (Z)
	Intervention predictors	Control predictors	
Child behavior			
Antisocial behavior	.10	.16**	−.86
Hyperactivity	.18***	.20***	.39
Child cognitive			
Cognitive ability	−.11*	−.16**	.74
Reading achievement	−.14**	−.23***	1.77
Parent and family			
Maternal depression	.02	.06	−.50
Single parent	−.01	.18***	−2.45*
Friends' social support	.03	−.18***	3.14**
Demographic and community			
Gender	.16**	.10	.90
SES	−.07	−.05	−.14
Neighborhood	.05	−.09*	2.01*
Urbanicity/ethnicity	−.01	−.09	1.05

Note. SRC: Standardized regression coefficient.

* $p < .05$.

** $p < .01$.

*** $p < .001$.

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Table V

Hierarchical Multiple Regression Analysis for Parent-Rated Aggression, Within the Intervention Condition

	Variable	SRC	Adjusted R^2 at Step
Step 1. Covariate			.26
	Time 1 PDR aggression	.51***	
Step 2. Add child behavior			.28
	Time I PDR aggression	.48***	
	Antisocial behavior	.14**	
Step 3. Add child cognitive			
Step 4. Add parent and family			
Step 5. Add demographic			

Note. SRC: Standardized regression coefficient.

* $p < .01$.

*** $p < .001$.

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Table VI

Hierarchical Multiple Regression Analysis for Teacher-Rated Aggression, Within the Intervention Condition

	Variable	SRC	Adjusted R^2 at Step
Step I. Covariate			.07
	Time 1 TOCA-R aggression	.26***	
Step 2. Add child behavior			
Step 3. Add child cognitive			.08
	Time 1 TOCA-R aggression	.25***	
	Cognitive ability	−.10†	
	Reading achievement	−.04	
Step 4. Add parent and family			.10
	Time 1 TOCA-R aggression	.23***	
	Cognitive ability	−.09	
	Reading achievement	−.02	
	Single parent	.11†	
	Maternal depression	.05	
Step 5. Add demographic			.11
	Time 1 aggression	.22**	
	Cognitive ability	−.07	
	Reading achievement	.00	
	Single parent	.08	
	Maternal depression	.03	
	Gender	.07	
	Urbanicity/ethnicity	−.07	
	SES	−.10	

Note. SRC: Standardized regression coefficient.

† $p < .10$.

** $p < .01$.

*** $p < .001$.

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Table VII

Hierarchical Multiple Regression Analyses for Special Education Involvement, Within the Intervention Condition

	Variable	SRC	Adjusted R^2 at Step
Step 1. Covariate			
Step 2. Add child behavior			.03
	Hyperactivity	.18***	
Step 3. Add child cognitive			.04
	Hyperactivity	.17**	
	Cognitive ability	−.04	
	Reading achievement	−.09	
Step 4. Add parent and family			
Step 5. Add demographic			.06
	Hyperactivity	.14*	
	Cognitive ability	−.06	
	Reading achievement	.06	
	Gender	.12*	

Note. SRC: Standardized regression coefficient.

* $p < .05$.

** $p < .01$.

*** $p < .001$.