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*Journal of Early Intervention* 1999 22: 126

DOI: 10.1177/105381519902200205

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# ***Maternal Responsivity Mediates the Relationship Between Prelinguistic Intentional Communication and Later Language***

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*Intentional communication may be related to later language development, in part, because intentional communication is a relatively clear communicative cue, which may elicit language-facilitating maternal responses. As a first step in testing this model, this study was conducted to determine whether the relationship between early intentional communication and later language is in part due to covariation with maternal responsivity. The participants were 58 children with developmental disabilities in the prelinguistic period of development and their mothers. Children's intentional prelinguistic communication, mothers' responses, and children's language were measured at entry into the study, 6 months later, and 12 months later, respectively. The results support the model that the relationship between intentional communication and later language was, in part, due to the covarying relationship with maternal responsivity. Implications for future research are discussed.*

The frequency of prelinguistic intentional communication predicts productive and receptive language levels in children with disabilities a year or more later (Mundy, Kasari, Sigman, & Ruskin, 1995; Smith & von Tetzchner, 1986). The relationship between intentional communication and later language level is important for both theoretical and clinical reasons. Theoretically, such a relationship provides information about the origins of language development (Bruner, 1976; Harding, 1983). Clinically, discovering precursors of language development, even if they are not essential prerequisites, is useful for diagnostic and treatment purposes. Identifying child characteristics that are present in the prelinguistic period and that predict later language places us one step closer to very early identification (before 2 years) of children at risk for language delays (McCathren, Warren, & Yoder, 1996). Understanding why this relationship occurs may provide guidance on developing effective communication treatment

methods for children in the prelinguistic period.

Many theories have been advanced concerning why intentional communication is related to later language level (Yoder & Warren, 1993). These theories can be categorized as child-driven or transactional. Child-driven models only consider within-child factors. For example, Bruner (1978) suggested that gestures and vocalizations serve the same pragmatic functions (e.g., requests and comments) as early words. Therefore, fluent prelinguistic communicators only need to learn the words for the meanings they have already been expressing nonverbally (Bates, O'Connell, & Shore, 1987; Bruner, 1978; Snow, Perlmann, & Nathan, 1987). Others have suggested that prelinguistic and linguistic communication are related because both rely on the same cognitive achievements (Bates, Benigni, Bretherton, Camaioni, & Volterra, 1979; Golinkoff, 1981). For example, linguistic and prelinguistic forms of requesting appear to rely on understanding that desired objects can be ac-

quired via indirect means (i.e., means-end) and that this means is often a person (i.e., social agency). The child who has mastered means-end and social agency may better attend to and learn from the words for what he or she is requesting than the child who is still struggling with these cognitive achievements (Yoder & Warren, 1993). Empirical evidence concerning whether one needs to master these cognitive achievements before one learns to talk is equivocal (Rice & Kemper, 1984). Kahn (1984) demonstrated, however, that children with mental retardation who received direct training on means-end relations acquired more language in subsequent language intervention than children who received only language intervention.

Another explanation for the relationship between intentional prelinguistic communication and later language level is the transactional model (Yoder & Warren, 1993). Yoder and Warren posited that intentional communication may be related to later language level, in part, because intentional communication elicits maternal responsivity, which in turn facilitates later language development. The notion that intentional communication elicits maternal responsivity is supported in part by the finding that mothers of typically developing children respond to intentional communication more than to preintentional communication (Yoder & Munson, 1995). A similar finding was documented with four children with mental retardation (Yoder, Warren, Kim, & Gazdag, 1994). No studies have demonstrated that frequent intentional communicators have mothers who respond relatively frequently.

Several studies have shown that maternal responsivity predicts later child language level. For example, Beckwith and Cohen (1989) found that maternal responsivity to infant crying and fussing at 1 month was positively related to receptive vocabulary in pre-term children 23 months later. Maternal imitation of typically developing 9-month-olds' facial expressions and actions was positively associated with the frequency of spoken utterances 9 months later (MacTurk, Meadow-Orlans, Sanford, & Spencer, 1993). Responsivity to 5-month-olds' nondistress vocalizations was

positively related to symbolic play and receptive language 7 months later (Bornstein & Tamis-LeMonda, 1989). Bornstein and Tamis-LeMonda (1989) also reported a similar finding with Japanese mothers and infants. All longitudinal correlational studies of maternal responsivity and later language assume that measures of early responsivity reflect an interaction style that is relatively stable across time. The stability of individual differences in responsivity has been demonstrated in at least two studies (Beckwith & Cohen, 1989; Bornstein & Tamis-Lemonda, 1989).

There is also experimental evidence that mothers' responsivity to prelinguistic acts may actually facilitate intentional and verbal communication in children with developmental disabilities (Girolametto, 1988; Wilcox, 1992; Wilcox, Shannon, & Bacon, 1992). Using randomized (Girolametto) and matched (Wilcox) group experiments, parents were taught parents to be more responsive to their prelinguistic children's communicative acts. Children in the experimental group used significantly more intentional communication (Wilcox, 1992) and talked significantly more with the mothers than did children in the control groups (Wilcox, et al., 1992; Girolametto, 1988).

The types of responsivity measured and taught in many studies of maternal responsivity during the prelinguistic period include nonlinguistic components (e.g., compliance with the presumed meaning of or imitation of the child's communicative act) and linguistic components (e.g., linguistic mapping of the child's message). Nonlinguistic responsivity may enhance later communication development because it facilitates possible cognitive underpinnings of intentional communication and language (e.g., contingency learning and exploratory play). In randomized group experiments, it has been shown that teaching mothers to use nonlinguistic responses facilitated infants' contingency learning (Riksen-Walraven, 1978) and exploratory play (Riksen-Walraven, 1978; van den Boom, 1994); both of which are positively related to later measures of intelligence (Messer et al., 1986; Ohr & Fagen, 1994). Linguistic mapping (i.e.,

saying what the child is attempting to communicate nonverbally) may facilitate later language because children may be better able to learn the associations between words and referents when they hear the words while they are thinking about the referents (Bloom, 1993). The child's communication act provides evidence of what the child is thinking about, thus making linguistic mapping of the child's thoughts possible. Linguistic mapping has been found to be concurrently associated with early vocabulary in typically developing children (Masur, 1981).

### **Hypotheses**

This study sought to replicate the positive relationship between prelinguistic intentional communication and later language level in children with developmental delays. Additionally, we tested whether intentional communication predicts later maternal responsivity. Finally, we tested whether the relationship between intentional communication and later language is mediated by maternal responsivity. That is, we predicted that the relationship between intentional communication and later language level will become nonsignificant when maternal responsivity is statistically controlled.

## **METHODS**

### **Participants**

The sample for this study was a part of a longitudinal intervention study being conducted by the authors. In this larger study, children were randomly assigned to receive one of two staff-implemented prelinguistic interventions. In both treatments, mothers were kept naive about the intervention methods used and about the variables measured. Because the results of the present investigation could have been influenced by the different treatments the children experienced in the larger experiment, we tested interactions between group assignment and predictor variables for both criterion variables used in the present study. That is, we tested whether the relationship between intentional communication and later language or maternal responsivity was different between

**Table 1.**  
*Median and Standard Deviations on Selected Child Descriptor Variables at Time 1*

Variables	<i>Mdn</i>	<i>SD</i>
Chronological age	22	4
Mental age	15	2.6
Mental Development Index <sup>a</sup>	54	13
Number of different words or signs used in parent-child sessions	1	1.1

*Note.* Ages are reported in months.

<sup>a</sup>Bayley Infant Scales of Mental Development.

groups. We also tested whether the relationship between maternal responsivity and later language was different between groups. The results of these preliminary analyses showed no evidence that treatment assignment influenced the relationships examined in the present study. Therefore, the remainder of the analyses and presentation will not refer to the larger intervention study.

Children were recruited through three early intervention programs for children with developmental disabilities. The selection criteria for the study was (a) Bayley Mental Development Index (Bayley, 1969; 1993) between 85 and 35 (i.e., using the extrapolated norms in Naglieri, 1981 for the 1969 version and those computed using the same procedure for the 1993 version; McCathren & Yoder, 1994), (b) production of fewer than 10 different words as indicated by teacher report and direct observation during three communication samples, (c) at least one instance of coordinated attention to a person and an object, of reach to a distant object, or of vocalization with attention to an adult, (d) no evidence of severe visual or hearing impairment as indicated by school files and parent and teacher report, (e) ability to hold an object while rotating the torso, and (f) chronological age between 17 and 36 months.

Participants were 58 children with disabilities and their primary caretakers. Ninety percent of the caretakers were the children's mothers. Table 1 presents descriptive statistics on several child variables. Medians are presented because number of different words was

skewed. In addition to the variables presented in Table 1, we used the Uzgiris Hunt's Means-End scale (Uzgiris & Hunt, 1975) to determine that 14% of the children scored at stage IV, 45% scored at stage V, and 41% scored at stage VI. Sixty-four percent of the children were males. All of the children fit the Tennessee definition for developmental delay (i.e., 40% delay in one domain, or 25% delay two domains). The etiology for these developmental delays varied. Four children had Down syndrome, four were premature births with medical complications (e.g., chronic lung disease), three had "failure to thrive" diagnoses, two were diagnosed as "pervasive developmental disorder", one had macrocephaly, one had microcephaly, one had Duane's syndrome, one had neonatal meningitis, one had Fetal Alcohol Syndrome, one had tuberculous sclerosis, and the rest had no identifiable etiology or diagnosis other than developmental delay.

A median occupational status score was computed for our sample. Occupational status score is based on a system of ranking professions into different occupational groups and businesses by their size and value in the United States (see Stevens & Cho, 1985, for details). The occupational status for the U. S. averages 34.5 ( $SD = 18$ ; Stevens & Cho) and for our sample, the occupational status score was 23 ( $SD = 22$ ). Thus, our sample was lower and more variable than the general population. Likewise, the racial composition and level of formal education for our sample was not representative of the 1980 U. S. census data (Zill & Schoenborn, 1990). Fifty-seven percent of the families were Caucasian, 36% were African American, and the remaining 7% were Hispanic. For mothers' formal education, the average was high school graduate with a range from one year of school to post-graduate school training.

### **Design**

A longitudinal correlational design was used. We expected the cumulative influence of the predictor variable on the outcome variables to take several months, therefore, the three variables were measured at three 6-month inter-

vals. The point at which the participants entered the study is referred to as Time 1. Measures taken 6 months and 12 months after Time 1 are referred to as Time 2 and Time 3, respectively.

### **Procedure**

At Time 1, the mothers and children came to our play room. The mothers completed a demographic questionnaire, from which we derived our measure of occupational status and formal education, and interacted with their children in the way described below (i.e., Parent-child interaction session). At Time 2, the children and parents repeated the Parent-child interaction session. At Time 3, the children's language was tested using the Reynell Developmental Language Scale (Reynell & Gruber, 1990). All three procedures took place either at our research center or at the children's schools.

*Parent-child interaction (PCX) session.* At Time 1 and Time 2, parents were asked to play with their children for a total of 15 minutes, divided into three 5-minute segments. All sessions were videotaped for later coding. During these sessions, the child was seated in a chair that was attached to a table to discourage the child from getting up. The toys remained constant across children. The mothers were seated across the corner of the table so that the children would have to turn their heads toward their mothers to see them. The camera angle maximized the proportion of the session in which we could view the mother, the child, and the child's focus of attention.

Pilot testing indicated that unstructured parent-child interaction sessions resulted in so few codable communication acts that maternal responsivity could not be examined. Thus, to increase communication acts, the first two 5-minute segments of the PCX session were semi-structured. This degree of contrivance was considered acceptable because we were interested in relative, not the absolute, levels of responsivity. Additionally, we reasoned that such structure would reduce error in measures of child communication due to differences in the way parents played with their children.

In the first segment, developmentally ap-



appropriate toys were placed in clear containers so the child could see them but could not have access to them without assistance from the parent. The parent was told to begin by playing with a toy the child was likely to want. When the child let the parent know the toy was wanted, the parent was to put it back into the container and give the closed container to the child. When the child again indicated that the toy was wanted, the parent was to open the container and give the toy to the child. Then the parent could play with the child in the same way they played at home.

In the second segment, the parent was given juice, cereal, and cookies and told to give small portions to the child when the child indicated that he or she wanted some. While the child was eating the snack, brief animal noises were played at about 90 second intervals on three separate occasions. Additionally, a slinky, suspended from the ceiling by clear fishing line, was lowered to within about 5 feet from the floor. Parents were told to ignore these events until the child drew their attention to either the sound or the slinky.

The last segment of the parent-child session was freeplay. Toys were placed at the end of a table and the parent began the session by playing with one toy. When the child indicated that he or she wanted the toy, the parent gave it to the child and played with the child as if they were at home.

From the PCX sessions, we coded intentional communication at Time 1 and maternal responsivity at Time 2. Both variables were coded by a trained observer who made repeated viewings of the videotaped sessions to determine whether communication acts and responses had occurred.

*Coding children's intentional communication.* Intentional communication was scored when (a) an unconventional gesture or vocalization occurred within 3 seconds of coordinated attention to the caregiver and to the object or event about which the child was communicating, (b) a conventional gesture was used with attention to adult or a vocalization, or (c) an approximation to a word or conventional sign was used with attention to adult. Coordinated attention to the caregiver and ob-

ject was showed either sequentially or simultaneously. For example, a reach for an object and then looking at the mother is sequential attention to the caregiver and an object. Handing an object to the mother is simultaneous attention to the caregiver and an object. Unconventional gestures were those listed in the Communication and Symbolic Behavior Scale (Wetherby & Prizant, 1993). For example, reach, proximal points (i.e., touching the object pointed to with the index finger), and clapping were unconventional gestures. Conventional gestures are those with an agreed upon meaning within a society. An exclusive list used for this study was as follows: Distal points, head nods and shakes, the "shhh" sign, shrugging the shoulders, upturn and extended palm, and waving.

Word approximations had to fulfill four criteria. The sound sequence had to (a) share at least one phoneme with the adult form of the word, (b) share the same number of syllables as the adult form of the word, (c) have non-linguistic support that the potential word represented a reasonable approximation of adult meaning of the word, and (d) be an approximation to a word that occurred in an unabridged English dictionary (The American Heritage Dictionary of English Language, 1992) or occurred on the Communication Development Inventory (Fenson, et al., 1991). A sign approximation had to meet criteria "c" and "d" from above. In addition, the movement and location of the hands with respect to the rest of the body and to each other had to be similar to the conventional sign. The hand shape (i.e., the way the fingers were positioned) did not have to match the conventional sign exactly. The number of intentional communication acts represented our measure of intentional communication.

*Coding maternal responsivity.* Our definition of a communication act (and thus the opportunity for a maternal response) included both intentional and preintentional communication acts. Preintentional communication acts were those that did not meet the definition for intentional communication, but were included in the types of behaviors that mothers in U.S. consider communicative (Harding, 1983; Yod-

er, 1985). These included vocalizations directed to objects (without showing attention to the caregiver), vocalizations to the caregiver (without showing attention to an object or event), sustained changes in affect, and unconventional gestures to an object or event (without showing attention to the caregiver). For a mother's behavior to be considered a response to their child's communication act, the mother's behavior had to (a) immediately follow the child's communication act, and (b) either say the noun or main verb implicit in the child's act, ask for clarification of the child's act, comply with the presumed meaning of the child's act, or imitate the child's act.

The theories posited in the introduction explaining why certain responses to children's acts may facilitate later language all implicitly assume that the number of responses, not the proportion of acts responded to, should predict later language. For example, children probably learn their behavior has an effect on their partner's behavior faster if compliant responses to the presumed meaning of the child's communication act (i.e., effects) occur frequently. Children also probably learn a greater number of vocabulary words in a given period of time if the child hears linguistic mapping about several different referents and about each referent many times. If the child does not communicate frequently, then regardless of how responsive the mother intends to be, she will not be able to respond as frequently as a mother whose child communicates frequently. Therefore, the number of maternal responses represents our measure of maternal responsiveness.

*Reynell Developmental Language Scale.* At Time 3, project staff members administered the receptive and expressive scales of the Reynell to the children. The raw score from these scales were used to quantify children's language level. We used raw score because we were not comparing the children in our sample to a normative sample and our research questions did not require a transformation to norm referenced scores. Furthermore, raw scores allowed us to address our research question without introducing measurement error due to a possibly unrepresentative normative sample.

The Reynell was used because expressive and receptive Reynell scores have been predicted by earlier measures of prelinguistic communication in other studies of children with mental retardation (Mundy, et al., 1995; Smith & von Tetzchner, 1986).

### **Reliability**

In the case of the coded variables, generalizability (G) coefficients were used to quantify the extent to which observations were reliable across observers because G coefficients reflect the between-subject variability on the variable. An index of reliability that includes information about between-subject variability (as well as between-coder variability) informs the investigator about the importance of the degree of observed between-coder disagreement to the goal of discriminating between subjects (Cronbach, Gleser, Norda, & Rajaratnam, 1972). Summary level reliability was selected because the analysis was at the summary level.

Inter-observer reliability was estimated on 15 randomly selected PCX sessions each at Time 1 and Time 2. Pairs of trained observers independently coded the 30 PCX sessions. The G coefficient for number of intentional communication acts at Time 1 was .98. The G coefficient for number of maternal responses at Time 2 was .96.

## **RESULTS**

### ***Descriptive Statistics on the Communication, Responsivity, and Language Variables***

Before testing the hypotheses, we present the means and standard deviations for the communication, responsivity, and language variables (see Table 2).

### ***Analysis Procedures Used to Test the Hypotheses***

Hypotheses that specify a relationship between two variables were tested using Pearson's product moment correlation coefficient. An accompanying t-test was used to determine the significance level of the correlation coefficient. If the relationship was significant

**Table 2.**

*Means, Standard Deviations, and Ranges of Child Communication, Maternal Responsivity, and Child Language Variables*

Variables	<i>M</i>	<i>SD</i>	<i>Range</i>
Number intentional communicative acts in PCX at Time 1	19	14	1–69
Number of maternal responses at Time 2	45	22	4–124
Raw scores on Reynell—receptive	20	10	2–37
Raw scores on Reynell—expressive	21	9	0–48

we computed the 95% confidence intervals for the correlation coefficient. We used a multiple regression analysis to test whether the relationship between intentional communication and later language was mediated by maternal responses. For this procedure, the maternal responses variable was entered first, intentional communication was entered second and later language was the outcome. If the relationship between intentional communication and later language was no longer significant after controlling for maternal responses, it was consistent with the hypothesis that the relationship occurred, in part, because both variables were correlated with maternal responses. This interpretation rests on the assumption that the covariate does not interact with the predictor (Pedhazur, 1982). Therefore, we also tested whether the interaction between maternal responses and intentional communication predict later language.

*Does intentional communication predict later language?* As indicated in Table 3, the number of times children intentionally communicated with their mothers at Time 1 predicted their receptive and expressive language levels 12 months later. The 95% confidence interval for intentional communication pre-

dicting receptive and expressive language was .08–.59 and .02–.54, respectively.

*Does maternal responsivity predict later language?* Table 3 also indicates that the number of maternal responses to child communication at Time 2 predicted the children's expressive and receptive language level 6 months later. The 95% confidence interval for the relationship between maternal responses and receptive and expressive language was .15–.64 and .10–.60, respectively.

*Does child intentional communication predict later maternal responses?* Table 3 indicates that the number of child intentional communication acts with the mother at Time 1 predicted the number of maternal responses 6 months later. The 95% confidence interval for the relationship between intentional communication and later maternal response was .003–.52. Therefore, the maternal responsiveness was related to both later language and earlier intentional communication.

*Is the Relationship Between Intentional Communication and Later Language Mediated by Maternal Responsivity?* When Time 2 maternal responses were statistically controlled, the relationships between Time 1 intentional communication and Time 3 receptive

**Table 3.**

*Pearson Correlation Coefficients for Selected Bivariate Relationships*

Relationship	1	2	3	4
1. Time 1 Intentional Acts	—	.26*	.33*	.28*
2. Time 2 Maternal Responses		—	.40*	.35*
3. Time 3 Receptive Scores			—	
4. Time 3 Expressive Scores				—

\**p* < .05; two-tailed test.



( $t = 1.62$ ;  $p = .11$ ) and expressive ( $t = -.32$ ;  $p = .75$ ) scores became nonsignificant. The interaction between intentional communication and maternal responses predicting later language was nonsignificant for both language outcomes. Therefore, one can interpret the finding to mean that the relationship between intentional communication and later language was mediated by maternal responses.

## DISCUSSION

These results replicate the relationships between (a) early prelinguistic intentional communication and later language level and (b) maternal responsivity and later language level in children with developmental delays. The results are the first to demonstrate (a) a relationship between early intentional communication and later maternal responsivity and (b) that the relationship between intentional communication and later language is in part mediated by maternal responsivity.

Replicating a relationship increases our confidence that the relationship exists in the population of children with disabilities, not just in a particular study's sample. The relationship between intentional communication and later language has now been documented in children without disabilities (Bates, et al., 1979), with Down syndrome (Smith & von Tetzchner, 1986), and with autism (Mundy, et al., 1995). Our study's sample had children with developmental delays due to heterogeneous etiologies. Prior to this study, the relationship between early maternal responsivity to prelinguistic communication and later language level had been documented only in mother-child pairs in which the child was without disabilities (Beckwith & Cohen, 1989; Bornstein & Tamis-LeMonda, 1989; MacTurk, et al., 1993). The relationship between maternal responsivity to linguistic communication and later language level has been documented in children in the single and early multiword stages of language acquisition in children without disabilities (Barnes, Gutfreund, Satterly, & Wells, 1983; Farrar, 1990; Harris, 1994; Nelson, Bonvillian, Denninger, Kaplan, & Baker, 1984) and with Down syn-

drome (Harris, 1994). In addition several intervention studies have demonstrated that teaching parents or teachers to use various types of responsivity facilitated various aspects of language development in children with autism (Scherer & Olswang, 1989) and mental retardation of unspecified etiology (Girolametto, 1988; Girolametto, Verbey, & Tannock, 1994; Yoder, Spruytenburg, Edwards, & Davies, 1995). This study fills a gap in the literature on the maternal responsivity-language level relationship by studying responsivity to prelinguistic communication in children with disabilities.

The evidence regarding maternal responsivity mediating the relationship between intentional communication and later language in children with developmental delays adds to the evidence supporting the transactional model of language development (Yoder & Warren, 1993). There is still, however, much to be learned. For example, we do not yet know whether the relationship between intentional communication and later maternal responsivity is causal. It can be argued that intentional communication may very well elicit maternal responsivity because it may be more salient and interpretable to mothers than preintentional communication (Yoder & Munson, 1995). Before we conclude that mothers respond more to intentional communication than to preintentional communication in mother-child pairs with children with disabilities, we need replication of this finding with a large sample of such mother-child pairs. The only published study reporting that mothers respond to intentional communication more than preintentional communication in children with disabilities is with 4 children with mental retardation (Yoder, et al., 1994).

Before we conclude that intentional communication elicits maternal responsivity, we need to test whether facilitating intentional communication with an intervention has an indirect effect on maternal responsivity. However, intervention studies are not sufficient in demonstrating that intentional communication elicits maternal responsivity because any intervention with children with disabilities would inevitably change more than just inten-

tional communication. The present study provides the precision that an intervention study lacks. A well-conducted intervention study would provide the greater internal validity this study lacks.

Although teaching mothers to be more responsive to the children's communication has been the focus of several studies, there is still much to be learned. For example, is it equally important to respond to preintentional communication acts as it is to intentional communication acts? Does the relative importance of such responding depend on the developmental level of the child? Does type of maternal responsivity impact what aspect of children's communication or language that is facilitated? Such specification is necessary for us to efficiently teach parents to help their children develop and to prevent needless tinkering with the mother-child relationship.

In summary, this study found that the much replicated relationship between intentional communication and later language is in part mediated by maternal responsivity. Future research is necessary to determine why this mediated relationship occurs. But the mediating role of maternal responsivity points out the importance of attending to the family context for child development and suggests the folly of only considering children's communication skills when predicting future language levels. This study is a part of program of research that has implications for (a) the types of goals interventionists select for nonverbal children, and (b) whether parents are included in such intervention.

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*Thanks is given to Carol Chapman, Kim Gilbert, Dana Oman, Betsy Reineke, Melissa Crim, Hope Van Beselaere, Anne Edwards, Sandy Cooper, and Martha Shy for recruiting subjects and coding videotaped procedures, to the Susan Gray School, Duncanwood, and Heads Up schools for allowing us to recruit families through their programs, and to the families that participated in the study for their cooperation and trust.*

*This research was supported by NICHD grant RO1HD27594 and US Department of Education grant HO23C20152.*

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