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ASSESSING MEDIATED MODELS OF FAMILY CHANGE IN RESPONSE TO INFANT HOME VISITING: A TWO-PHASE LONGITUDINAL ANALYSIS

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Abstract

The objective of this study was to assess whether a mediated model of change could account for the long-term effects of infant home-visiting services observed at ages 5 and 7 years in a high-risk cohort. Participants were 41 mothers and infants from low-income families who were referred to parent–infant home-visiting services during the first 9 months of life due to concerns about the caretaking environment. Services ended when infants reached 18 months of age. Families received between 0 and 18 months of weekly home visits based on infant age of entry into the study. During childhood (ages 5 and 7 years), teachers rated children's behavior problems using standardized instruments. Early home-visiting services accounted for positive child outcomes at 18 months, 5 years, and 7 years of age; however, earlier positive outcomes related to intervention did not account for intervention-related effects at later ages. Further inspection of the data revealed that two additional principles, one of escalating morbidity among less intensively served groups and one of generalized family problem-solving skills, were needed to account for the pattern of effects over time. We conclude that the “domino models” assessed by mediational analyses may be too simple to capture the intervention-related change processes occurring in high-risk cohorts over time.

Conduct disorders are the most common, costly, and treatment-resistant disorders identified among school-age children, particularly boys (Greenberg, Kusche, Cook, & Quamma, 1995; Hinshaw & Andersen, 1996). About half of the children who show an early onset of disruptive behavior problems continue on a chronic and escalating aggressive trajectory known as the “early starter” pathway (Loeber & Dishion, 1983). Therefore, diminishing the early display of aggression and disruptive behaviors is one of the keys to preventing the emergence of juvenile delinquency and associated risks such as school failures and peer rejection. Because of the long-term outcomes associated with aggression and delinquency, a focus on infant and preschool services designed to prevent the early onset of aggression and disruptive behavior is critical (Tremblay, Le Marquand, & Vitaro, 1999).

Home visiting is a commonly utilized mode of providing prevention and intervention services during infancy. Despite the widespread use of home-visiting services, few studies have

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explored the impact of clinical infant home-visiting services on the early onset problem behaviors evident by school age. Interventions for early forms of aggressive or other problem behaviors have generally been concentrated after the first 2 years of childhood and have focused on children already displaying conduct problems (e.g., Webster-Stratton, Hollinsworth, & Kolpacoff, 1989). In one exception, Johnson and Walker (1987) found that children from poor Mexican American families who received early interventions were rated as less aggressive and disruptive in elementary school. Several intervention studies, however, have documented effects of early home visiting on adolescent or adult aggression. Olds and colleagues (1997; Olds et al., 1998) conducted the largest scale, randomized early home-visiting study, using a 2½-year program of nurse home visitation begun in pregnancy. At 15-year follow-up, there were significant reductions in the number of arrests, convictions, and probation violations among adolescent children of poor, unmarried women in the home-visited group. Of note, Olds et al.'s (1997) work showed a dose–response pattern of outcomes on a variety of variables, with mothers visited only during pregnancy having intermediate outcomes compared to nonvisited mothers and to mothers visited for 2 years. Lally, Mangione, and Honig (1988) reported that among children of young African American single mothers, a program of early home visitation and early daycare showed long-term effects in reducing later criminal acts, with 22% of unserved versus 6% of served 16-year-olds having contact with the probation department. In one exception, Johnson and Walker (1987) found that children from poor Mexican American families who received early interventions were rated as less aggressive and disruptive in elementary school.

Currently, we know very little about the child and family change processes that might link the provision of early services with later child and adolescent positive social motivation and decreased delinquency. An extensive research literature on the correlates of childhood behavior problems indicates that disruptive behavior problems are associated with (a) mild mental deficits, (b) insecure-disorganized early attachment relationships, and (c) lack of parental involvement and coercive parenting (Greenberg, 1999; Lyons-Ruth, 1996). A mediator model (Baron & Kenny, 1986) of the links between early intervention and later problem behavior would suggest that impacting early parenting behavior and the early parent–infant attachment relationship would be expected to contribute to reduced problem behavior at later time points. More positive parenting behaviors, such as increased involvement or reduced hostile-intrusive behaviors, and their associated positive infant outcomes, including more secure attachments and enhanced mental development, would be expected to mediate the decreases in later problem behaviors associated with early intervention. Therefore, we would expect that early home-visiting might exert its effects through an early positive influence on the parent–child relationship.

The current report formally evaluates such a mediational model of the mechanisms through which early home-visiting services might continue to exert positive effects on later problem behaviors, even years after the services themselves have ended. The data are from an ongoing longitudinal study of low-income families in which half of the sample was referred to the study during the first 9 months of the infant's life for weekly clinical home-visiting services due to concerns about the quality of the relationship between parent and infant.

Previous findings from the study provide indirect support for the model proposed earlier. First, longitudinal analyses using the full study sample (i.e., referred families plus community families) have demonstrated that infant security of attachment, infant development, and the quality of maternal–infant interaction were all predictive of child behavior problems during the early school years (Lyons-Ruth, Alpern, & Repacholi, 1993; Lyons-Ruth, Easterbrooks, & Cibelli, 1997).

Second, intervention effects were observed among those families at 18 months of age when home-visiting services ended (Lyons-Ruth, Connell, Grunebaum, & Botein, 1990). At 18 months, among infants receiving no services, 60% of infants were classified disorganized-insecure and only 10% were classified secure; among infants receiving 1 year or more of services, 32% were classified disorganized-insecure and 37% were classified secure. Infants who received an intermediate duration of services had intermediate outcomes (22% secure).

Improved mental-development scores also were significantly associated with provision of early services among infants of depressed mothers. Among infants of nondepressed mothers, mental-development scores were not initially lowered relative to controls, so no intervention effects were observed in that group.

Third, findings from the kindergarten phase of the study indicated that teacher-rated hostile-behavior problems at age 5 years decreased in dose-response relation to the duration of early home-visiting services, with duration of early services accounting for 15% of the variance in child hostile behavior at school. Parents' reports of positive play behaviors also were significantly linearly related to service duration (Lyons-Ruth & Melnick, 2004). Among children who received no services, 71% displayed hostile-behavior problems at school over the cutoff score indexing clinical concern while among children who received 1 year or more of services, 29% were rated by teachers over the clinical cutoff. Among those with intermediate service duration, 44% were rated over the cutoff. The effect sizes observed in the study also were substantial, with betas of $-.46$ for hostile-behavior problems and $.45$ for positive play behaviors with peers.

Based on these prior findings, then, the service-related positive outcomes in infancy are plausible mediators of the continued service effects evident at age 5 years. The current report evaluates whether these infant outcomes do indeed account for the effect of the home-visiting services on behavior problems during the early school years. The primary question of interest is whether the impact of infant home-visiting services at ages 5 and 7 years was mediated by changes in the behaviors of mothers and infants by 18 months of age when services ended. Alternatively, there may have been a continuing residual effect of early services that was not captured by the infant assessments.

Second, this report extends the analysis of service effects to teacher ratings of behavior problems observed in school at age 7 years, which have not been examined in prior reports. And finally, a parallel mediational analysis is conducted to assess whether service-related effects at age 7 years can be accounted for by the positive service-related effects observed at age 5 years. The proposed mediated-effects model is presented in Figure 1.

METHOD

Participants

As part of a larger study of the impact of family risk factors and early home-visiting services on infant development involving 76 infants and mothers from low-income families (Lyons-Ruth et al., 1990), 41 families were referred for clinical infant home-visiting services due to community service providers' concerns about the quality of caregiving for the infant. Referred families included all infants identified as needing services in our state-defined mental health service area who were able to remain in parental custody. The sample was 80% Caucasian and 20% other ethnicities. At the 5-year follow-up, 84% of the families ($N=64$, 30 referred) the infant study were reassessed, 11% had moved too far away or could not be relocated, and 5% refused to participate. For 2 families who participated, the children were not in preschool so teacher ratings were unavailable. Child age at the 5-year follow-up ranged from 49 to 71 months, and 58% were male (Lyons-Ruth et al., 1993).

At the 7-year assessment, 5 families refused participation, and the remainder could not be relocated. The 50 families who participated in the 7-year sample, of whom 18 were in the service-referred group, did not differ significantly from those who did not participate on any of the demographic, parent, or infant measures. Mean age at the 7-year assessment was 92 months, and 30 were male.

Infant Home-Visiting Study Procedure

Infants were referred for home-visiting services from a variety of community service agencies due to concerns about the quality of caregiving for the infant. Infants had to be under 9 months of age at the time of referral, and an income ceiling was set at the federal poverty level. Among the 41 families referred for services, 31 families were enrolled in a weekly home-visiting service until 18 months infant age; 10 referred families whose infants were over 9 months of age at referral were not eligible, and these families were assessed when the infant reached 18 months of age. To control for willingness to participate in home-visiting services, families whose infants were past the 9-month cutoff point were provided short-term home-visiting services (6–8 sessions) after the 18-month assessments to connect them with other available community resources.

Among families offered weekly services, the mean infant age at intake was 4.7 months. Duration of services varied from 9 to 18 months depending on how young the infant was when the family was referred. By the time their infant was 18 months of age, families had received an average of 13.3 months of service, with an average of 47 completed home visits per family.

Assessment Procedures

Study intake—*Cumulative demographic risk* was represented by the sum of the following factors assessed at study entry: mother not a high-school graduate, mother under 20 years at birth of first child, mother a single parent, mother of minority race, family supported by government assistance, and three or more children under age 6. Each of these indicators has been linked with increased risk for developmental maladaptation during childhood.

Maternal psychosocial problems at study entry was coded as present if the mother had a state-documented history of child maltreatment; if she had a history of inpatient psychiatric hospitalization, but no maltreatment; or if at study entry she reported depressive symptoms over the validated cutoff point for possible clinical disorder. All other mothers received a score of 0.

The CES-Depression Scale (CES-D; Radloff, 1977) was administered verbally to mothers at study entry and again when infants were 18 months old. The CES-D is a 20-item questionnaire concerning depressive symptoms during the past week; it yields a score for frequency of depressive symptoms, and a cutoff score denoting that symptoms above this level indicate clinically significant levels of depression. It has been well validated in large-scale epidemiologic studies.

18 months of age—*Maternal behavior at home* was videotaped in a naturalistic observation for 40 min when the infants were awake and alert. Maternal behavior was coded in ten 4-min intervals on twelve 5-point rating scales and one timed variable, including sensitivity, warmth, verbal communication, quality and quantity of comforting touching (physical contact in the service of communicating affection, “touching base,” or reducing distress), quality and quantity of caretaking touching, interfering manipulation, covert hostility, anger, disengagement, flatness of affect, and time out of room, rounded to the nearest half-minute. Coders were blind to all other data on the families. Interobserver reliabilities, computed on a randomly selected 20% of the videotapes, yielded intraclass correlations ranging from .76 to .99. Principal

components analyses of the scales yielded two main factors. Factor 1, labeled *maternal involvement*, accounted for 38% of the variance and included negative loadings ($<.50$) for maternal disengagement and positive loadings for maternal sensitivity, warmth, verbal communication, and quantity of comforting touch. Factor 2, labeled *hostile-intrusiveness*, accounted for 26% of the variance and included negative loadings for quality of comforting touch and quality of caretaking touch and positive loadings for covert hostility, interfering manipulation, and anger.

Infant development—The Bayley Scales of Infant Development, Mental and Motor Scales (Bayley, 1993), were administered to each infant in a laboratory visit before assessment in the Ainsworth Strange Situation (Ainsworth, Blehar, Waters, & Wall, 1978).

Infant attachment security—Within 2 weeks of the home videotaping, mothers and infants were videotaped in the Ainsworth Strange Situation (Ainsworth et al., 1978). In this procedure, the infant is observed in a playroom during a series of eight 3-min episodes in which the mother leaves and rejoins the infant twice. Videotapes were coded for attachment-related behaviors and for the three attachment classifications as described by Ainsworth et al. (1978) and for disorganized/disoriented behaviors as described by Main and Solomon (1990). The three original organized attachment classifications (secure, avoidant, ambivalent) were assigned by both a computerized multivariate classification procedure developed on the original Ainsworth data (Connell, 1976; see also Richters, Waters, & Vaughn, 1988) and a trained coder. Agreement between the two sets of classifications on the full 18-month group ($n=72$) was 86%. Agreement on the disorganized/disoriented classification for 32 randomly selected tapes was 83%, $\kappa=.73$. Security of attachment was ordered from 1 to 3 (disorganized=1, insecure=2, and secure=3).

Assessment Procedures—Ages 5 and 7

Teacher ratings of child behavior problems were made on the Preschool Behavior Questionnaire (PBQ; Behar & Stringfield, 1974). The PBQ represents a modified version of Rutter's Children's Behavior Questionnaire (Rutter, 1967), developed for children in the 3- to 6-year-old age range. Total score ranges from 0 to 60. Test-retest values, interrater reliabilities, standardization sample characteristics, and validity are all acceptable. Factor analysis extracted three factors: hostile-aggressive, anxious, and hyperactive. The cutoff score which maximally discriminated normal and disturbed groups was at the 90th percentile (Behar & Stringfield, 1974).

When children were approximately 7 years of age, in Grade 2, classroom teachers rated their behavior using the 113-item Teacher Report Form of the Child Behavior Check List (CBCL; Achenbach, 1978,1991;Achenbach & Edelbrock, 1979). The instrument yields standardized scores for internalizing and externalizing problem behaviors, including a cutoff score representing clinical-range problems. The instrument also yields a standardized score for overall school functioning. The CBCL is a widely used instrument with good psychometrics.

RESULTS

Do Service-Related Outcomes at 18 Months Account for the Service-Related Outcomes Observed at 5 Years?

First, initial demographic and psychosocial risk scores for families in the infant, 5-year, and 7-year cohorts were evaluated for their relation to service duration. There was no significant relation between initial risk status and duration of services. In fact, there was a mild trend for the initial risk status of the families to be *lower* among the less served groups with the poorest outcomes. For example, for the full cohort in infancy, mean risk scores were as follows:

demographic risk scores for infants served 1 year or more=2.86, served under 1 year=2.56, no service=2.14, $F(2,27)=1.43$, n.s.; mean psychosocial problems served 1 year or more =1.71, served under 1 year=1.78, no service=1.43, $F(2,27)=.23$, n.s.

Hierarchical multiple regression analyses were then computed on teacher-rated hostile behavior problems at age 5. To evaluate a mediational model, infant gender, family cumulative demographic risk, and maternal psychosocial risk at study intake were entered on Step 1 to control for even small potential variations in family risk status at study entry. Maternal and infant outcomes at 18 months when services ended were entered on Step 2, and service duration was entered on Step 3. The measures of maternal and infant functioning at 18 months included infant attachment security in the Strange Situation, maternal hostile-intrusive behavior toward the infant at home, maternal involvement with the infant at home, and infant mental development (for infant outcome data, see Lyons-Ruth et al., 1990).

Even when effects of all 18-month outcomes were controlled, service duration continued to account for the same significant proportion of variance in the development of hostile behavior problems, as when no infancy mediators were entered ($\beta=-.46$; see Lyons-Ruth & Melnick, 2004) $\beta=-.46$, $R^2_{\text{chg}} = .15$, as shown in Table 1. This finding indicates that the provision of infant home-visiting services had a continuing ameliorating effect on the development of hostile behavior problems at age 5 that could not be explained by any changes in maternal and infant behavior that had occurred by 18 months of age.

One possible interpretation of such a failure of mediation is that the longer served families continued to improve after 18 months of age in ways not captured by the 18-month assessment; however, inspection of the data suggested a somewhat different view. To illustrate the form of the effect, Figure 2 presents the proportion of children over normed cutoff points on each measure by three service groupings: those served for 1 year or longer (range =12–18 months of services), those served for less than 1 year (range=9–11 months of services), and those who received no services. As can be seen in Figure 2, one reason that outcomes at 18 months did not explain outcomes at age 5 was because in the group as a whole, children who received less service time *deteriorated* in functioning from 18 months to 5 years. In contrast, as a group, outcomes among longer served infants remained stable and did not deteriorate. Therefore, service-related differences widened from 18 months to 5 years not because the more intensively treated group got better relative to current norms or to their outcomes in infancy but because the less intensively treated groups worsened relative to their own infant assessments and to instrument norms. This means that among less served families, children who had adequate developmental outcomes at 18 months were no longer developing adequately at age 5. Therefore, the lack of mediation of later effects by earlier effects occurred because of the escalating rate of child morbidity in the less served groups. In contrast, among families who received services for 1 year or more, the more positive outcomes observed by 18 months were maintained over time, with the group as a whole getting neither better nor worse, both in relation to their own status in infancy and to normative data for the assessments.

Do Service-Related Outcomes at Age 5 Account for Service-Related Outcomes at Age 7?

Given the service-related effects that continued to be observed at age 5, the 7-year data also were analyzed for the presence of continued effects of early services and for potential mediation of those effects by earlier effects. Child adjustment in Grade 2 was assessed by the Teacher Report Form, which yielded three summary scores: internalizing symptoms (T scores), externalizing symptoms (T scores), and overall adaptation to school. Hierarchical linear regressions were computed on each variable, controlling for the initial status variables of gender, maternal psychosocial problems, and family demographic risk on Step 1 and entering duration of services on Step 2.

Externalizing symptoms were much less frequent overall in Grade 2 than in kindergarten, and service effects were not significant on either internalizing or externalizing symptoms. However, more general maladaptation to school was strongly negatively related to duration of services, $\beta = -.51$, $F_{\text{chg}}(1,16) = 5.42$, $p < .05$; variance explained by service duration = 26%.

Given this significant effect of early services, a second hierarchical regression analysis evaluated whether the lower rate of hostile behaviors at age 5 associated with early services mediated the better adaptation to the Grade 2 school environment that also was related to services. The same initial-status variables as mentioned earlier were entered at Step 1, age 5 hostile behavior was entered at Step 2, and service duration was entered at Step 3. Hostile behavior at age 5 accounted for only 3% of the variance in Grade 2 adaptation while service duration continued to account for 23% of the variance ($\beta = .47$), as shown in Table 1. Again, a mediated model in which positive outcomes at age 5 accounted for positive outcomes at age 7 was not supported.

One further analysis was computed to examine whether outcomes in infancy rather than outcomes at age 5 might mediate the observed service effect on adaptation to school. Security of attachment was the only infancy outcome significantly related to Grade 2 adaptation, so given the limited n for the Grade 2 analysis, only this variable was entered. With initial risk variables and security of attachment at 18 months controlled, the service effect remained essentially the same, $\beta = -.53$, $R^2_{\text{chg}} = .19$, $F_{\text{chg}}(1,12) = 4.25$, $p < .06$.

Again, inspection of the patterning of the outcome data indicated a similar pattern of effects from ages 5 to 7 as that observed from 18 months to 5 years. One contributor to the lack of mediation was the escalating morbidity from 5 to 7 years of age observed among the less served groups compared to the groups who received longer services. The small number of families in the 7-year follow-up study created more variability in the patterning of the 7-year data, therefore Figure 3 displays data for both the smaller group who had data at all assessment points through age 7 and for the larger groups with data available at each assessment point. However, as can be seen, even among the relatively smaller group of families with data through age 7, the pattern of increased morbidity is evident.

DISCUSSION

Contrary to the model initially proposed, service-related effects on child problem behaviors observed 3½ years to 5½ years after the end of services were not directly mediated by service-related maternal and infant outcomes observed at 18 months of age when services ended.

Therefore, the expected “domino model” or mediated-effects model did not account for the pattern of results. Three possibilities could be advanced for why the “domino model” failed; that is, why earlier service-related outcomes failed to mediate later service-related outcomes. First, the outcomes assessed in infancy may have been from different developmental domains than later outcomes, with no plausible reason for predicting across domains. However, as noted in the introduction, this possibility is not congruent with a large body of data from this study and others (for reviews, see Greenberg, 1999; Lyons-Ruth & Jacobvitz, 1999) linking early attachments and parenting to later behavior problems.

Second, infants receiving longer services could continue to improve beyond infancy relative to their infant status. If this occurred, then the more modest gains in infancy could not account for the larger gains evident by follow-up. This would be a “sleeper-effects” model; however, this model did not fit the pattern observed in the data over time.

Finally, infants receiving fewer services could deteriorate over time, relative to their infant outcomes and to normed cutoff points for the assessments. If this pattern occurred, then the

more positive status of the group in infancy could not account for the later poor outcomes. This model could be termed an “escalating morbidity” model, and it is this model that best fits the data displayed in Figures 2 and 3.

The escalating child-morbidity pattern observed in the data suggests that by 18 months of age in infancy, the full developmental effects related to the difficult family processes that led to referral for services had not become evident. This could occur because we are still not adept at measuring these difficult family processes or their effects on infant behavior; however, such a pattern also could occur because the negative effects on the child of more coercive or withdrawing family-interaction patterns do escalate over time (e.g., Dishion, Patterson, & Kavanagh, 1991). For example, the negative effects of such processes may impact the child in new ways at each developmental level, an escalating process that results in cumulative developmental impairment.

In summary, the findings presented here indicate that with less intensive intervention, a number of infants classified as not disorganized in their attachment at 18 months were having problems by age 5, and another group of children who were not exhibiting behavior problems at age 5 were displaying them by age 7. This supports the role of an escalating pattern of problematic environmental impact.

In addition to a process of escalating morbidity with less services, a second principle seems necessary to fully account for the patterning of the data. Children of families receiving longer services were consistently rated more positively *as a group* at each assessment; however, the lack of mediation also indicates that there was little correspondence in child outcomes from age to age at the level of the individual child within the longer served group. Service-related continuities at the level of the individual child, under the very high-risk family conditions in the present cohort, were more the exception than the rule.

If the study had involved a very large cohort, perhaps even a small degree of service-related continuity across time would reach statistical significance; however, even in lower risk cohorts, the relatively small amount of variance generally accounted for by significant continuity over time still underscores the point that for many children, lack of individual continuity over time is more the rule than the exception. Simple mediated models do not account well for such discontinuity at the level of the individual.

In other words, what we did *not* see in the data is evidence of an “inoculation” effect in infancy at the level of the individual child. This means that for a given child in a high-risk setting, the achievement of a better attachment relationship in infancy was no guarantee against a high level of behavior problems by age 5. However, there *was* an “inoculation” effect at the level of the group, such that as a group, the longer served families appeared to keep working with their children to right the problems that developed. Therefore, a given child did not stay on the “problem behavior” roster time after time, and there is no “escalating morbidity” in this group such that more and more children exhibited problems over time. Instead, in the longer served group, child problems were less frequent by the end of infancy, and while later problems came and went for individual children, they did not tend to persist from one assessment to the next. This self-righting tendency at the level of the group was service related, so that it does not simply reflect expected developmental variation in child outcomes over time. Instead, this effect must reflect a more active family process that kept morbidity low over time in the face of individual variability. There appears to be some higher order family communication or problem-solving skills that act at the group level to maintain a lower group rate of child problems over time. Even though previously nonproblematic children do develop temporary problems along the way, previously problematic children also become less problematic, stabilizing the overall rates of child problems in the group at any one time.

In summary, two principles seem to be needed to understand the mechanisms through which the provision of early services affected later child outcomes. First, among highly stressed families, developmental morbidity appears to increase over time, with more and more children showing signs of serious maladaptation. Early services appear to shift family dynamics so that this downward spiral of escalating morbidity does not occur. Thus, the first mechanism associated with early services was the prevention of escalating morbidity among longer served families.

Second, generalized family skills, in addition to specific child behaviors, seem to be enhanced by early services. Intervention effects in this cohort did not occur because a particular subset of children was set on a positive course in infancy and continued on that positive course through kindergarten and Grade 2. While other studies indicate that such continuity in child behavior over time does exist, particularly in lower risk cohorts, it is not the mechanism by which early services produced its effects. If it were, there would be greater mediation of later effects by earlier effects. Instead, different children in the longer served group were doing well at different times. However, a generalized effect at the level of the group as a whole was still evident. This pattern of effects argues for a more superordinate effect on family process that is not best captured at the level of particular child outcomes. Instead, some larger shift in parent problem-solving skills, family communication styles, or parental investment seems indicated, and such enhanced family skills continue to negotiate the child's problem behaviors over time and contribute to getting the child back on track. Such enhanced skills may include greater contact with community services when problem arise. Therefore, the second mechanism that seemed needed to account for the observed patterning of the data was the enhancement of generalized family relational skills that continued to operate across time at each new developmental level. An important frontier of prevention services is to understand more deeply how family processes set in motion in the first year to 18 months of life continually evolve to maintain positive effects on later developmental processes, even in the face of episodic child difficulties.

Limitations of the Study

The major limitation of the current study is the small number of subjects involved, particularly by the time of the age 7 assessments. However, the small cohort at age 7 is to some extent offset by the fact that there is within-study replication of the basic finding of lack of mediation, with the same pattern of effects occurring from infancy to kindergarten and from kindergarten to age 7. What the absence of mediation tells us is that at each phase of the study, different children were necessarily involved in producing the intervention-related outcomes, so the similar findings at each wave indicate a similar effect occurring among different children at each assessment. Nevertheless, it will be important in future work to replicate these findings and to look closely at the actual patterning of the effects at the level of the individual child over time if we are to understand further how broad-based early interventions exert long-term and potentially increasingly large effects on developmental outcomes.

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Figure 1.
Mediational model of the effects of home visiting services.

Figure 2.
Increased morbidity over time among families with shorter services: Infancy to kindergarten.

Figure 3.
Increased morbidity over time among families with shorter services: Infancy to second grade.

TABLE 1
Teacher-Rated Behavior Problems in Kindergarten and Second Grade: Hierarchical Regression Results

<i>Predictors</i>	<i>Kindergarten Hostile Behavior Problems^b</i>			
	<i>df</i>	β^a	R^2_{chg}	F_{chg}
Step 1	3, 24		0.03	0.42
Male gender		0.18		
Demographic risk		-0.18		
Psychosocial problems		-0.15		
Step 3	4, 20		0.11	0.64
Approach to mother (18 months)		0.07		
Mental development (18 months)		-0.27		
Maternal involvement (18 months)		0.08		
Maternal hostile intrusiveness (18 months)		0.17		
Step 4	1, 19		0.15 [†]	4.13 [†]
Service time		-0.49 [†]		
<i>Predictors</i>	<i>Second-Grade Maladaptive Behavior Problems</i>			
	<i>df</i>	β^a	R^2_{chg}	F_{chg}
Step 1	3, 13		0.12	0.59
Male gender		-0.33		
Demographic risk		-0.08		
Psychosocial problems		-0.01		
Step 2	1, 12		0.1	0.08
Kindergarten hostile behavior problems		-0.15		
Step 3	1, 11		0.19 [†]	3.10 [†]
Service time		-0.47 [†]		

^a Betas are reported for the final equation with all variables entered; significance of individual betas assessed by *t* test, with all other variables controlled.

^b *N*=28. Two subjects were missing attachment data.

[†] *p*<0.10.