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Association between Maternal sensitivity and Externalizing Behavior from Preschool to Preadolescence

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Abstract

Using data from the longitudinal NICHD Study of Early Child Care and Youth Development (N=1364), this study examined the association between mothers' sensitivity and children's externalizing behavior from preschool to preadolescence. Externalizing behavior declined on average across this period with a slowing of this decline around middle childhood. Maternal sensitivity remained relatively stable on average, and there was significant variation across mothers. A decrease in maternal sensitivity from ages 3 to 11 was related to an increase in externalizing behavior from ages 4 to 12. A model-based test of the direction of the effect suggested that the association between changes in maternal sensitivity and externalizing behavior from ages 4 to 11 was driven by child effects on mothers and not vice-versa. Between late preschool age and preadolescence, the behavior problems of children appear to strongly influence the sensitive support of mothers. Practical implications were discussed in light of these findings.

Keywords

externalizing behavior; maternal sensitivity; child effect

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Externalizing behaviors encompass defiance and oppositionality, overactivity and impulsivity, and physical, relational, and verbal aggression, as well as covert antisocial behaviors (Crick & Grotpeter, 1995). Externalizing symptoms are usually visible and can have a negative impact on others and society (Resnick & Burt, 1996). While aggressive and other externalizing behaviors may be normative in toddlers, especially in interaction with peers (Hay, Castle, & Davies, 2000), these behaviors subside as most children age (Campbell, 1990). The normative decrease of externalizing behavior as children become older may be a function of children's increased physical and mental capacities for self control (Dahl, 2004). Behavioral control may also be socialized by multiple agents, including predominantly parents as well as other significant people such as caregivers, teachers and peers in child care and school settings (Bradley & Corwyn, 2008; Pianta, Cox, & Snow, 2007). Yet, the literature documents that some children continue to exhibit externalizing symptoms at school age (Denham et al., 2000), and even into adulthood (Moffitt, 1993). Studies indicate that compared to children whose externalizing symptoms decrease over time, children whose externalizing symptoms continue or increase are more at risk for a variety of problems such as low social competence (Campbell, 1994), low academic achievement and class engagement, and poor relationships with peers and teachers (NICHD Early Child Care Research Network, 2004). Thus, it is important to understand conditions that are associated with the maintenance or exacerbation of children's early behavior problems.

The literature documents that high externalizing symptoms, particularly aggressive symptoms, are associated with socio-demographic and family risks (Nagin & Tremblay, 2001). One major research focus has been on the robust relation between parenting behavior and child disruptive behavior. For example, parents who are harsh, controlling, rejecting, and uninvolved are more likely to have children who are noncompliant and aggressive at preschool ages (Smith, Calkins, Keane, Anastopoulos, & Shelton, 2004) and have persistent externalizing problems at school age (Ackerman, Brown, & Izard, 2003). However, few studies have considered the potential interplay between child characteristics and proximal parenting processes over time that may be involved in the maintenance or exacerbation of externalizing symptoms in the child, even though these pathways have been suggested as important (Campbell et al., 2010). A lack of sensitive and supportive parenting may be associated with more disruptive behaviors in the child, but the child's emotional and behavioral difficulties may also interfere with the ability of the parent to be sensitive and supportive, which in turn could lead to more problem behaviors. Additionally, the effect of child behavior on parenting behavior may become stronger as the child develops increased motor, linguistic and cognitive abilities from early childhood through the late preschool years and into the elementary school years (Cox, Mills-Koonce, Propper, & Gareipy, 2010). This potential bidirectional process has not been sufficiently studied. The few studies that have examined the bidirectional relation between parent factors and child problem behaviors focused on older children and followed them for a shorter period of time (Zadeh, Jenkins, & Pepler, 2010) or modeled the developmental dynamics of parent and child characteristics separately (Miner & Clarke-Stewart, 2008). Some previous studies also tended to focus on negative parental practices (Patterson, Reid, & Dishion, 1997) or the behavior of boys or girls only (Pardini, Fite, & Burke, 2008).

To address these limitations, the present study examined associations between children's externalizing behaviors as reported by mothers, fathers, and teachers, and mothers' observed sensitive support from ages 4 to12. We examined these associations during the preschool period, which is earlier than most previous studies and is a time when externalizing behavior tends to become consolidated (Keller, Spieker, & Gilchrist, 2005). Our examination also covers two critical transition periods during which children may be especially likely to display externalizing behaviors, namely the transition to formal schooling and adolescence. A latent variable of externalizing behavior problems was constructed using three reporters and multivariate, longitudinal models were used to provide greater strength in tests of associations and direction of effects.

Sensitive Parental Behavior

Our interest in the sensitivity of parenting was guided by the fact that warm, supportive, and sensitive parenting during the early years of a child's life is associated with fewer externalizing behavior symptoms in early childhood (e.g., Shaw, Keenan, & Vondra, 1994; NICHD Early Child Care Research Network, 2004). This is likely because behavioral and emotional regulation in very young children is heavily dependent on the regulation provided by a sensitive, supportive caregiver, and it is out of the experience of regulation provided by the caregiver that a child's own competence in self-regulation develops (Calkins & Fox, 2002; Propper et al., 2008). In addition, consistently high maternal sensitivity from early childhood to middle childhood buffers children from developing externalizing problems at school age, especially for those with difficult temperaments (Bradley & Corwyn, 2008), which suggests the continuing protective and regulatory effects of sensitive, supportive parenting even after the first few years of life. The failure to acquire skills for regulating emotional arousal may result in problems in social interactions (including those with the parent) and problematic behavior (e.g., Cicchetti, Ackerman, & Izard, 1995).

Child Effects on Parenting

As suggested above, child emotional and behavioral difficulties likely interfere with the ability of the parent to be sensitive and supportive, which in turn can lead to more problem behaviors in the child. The importance of considering this bidirectionality in parent-child relationships was brought to the attention of developmental psychologists in Bell's (1968) classic paper, followed by Sameroff and Chandler's (1975) influential depiction of transactional models between the child and the environment. Regarding problem behaviors in children and parental behavior, Shaw and Bell (1993) suggested there would be reciprocity between children and parents from infancy to early school ages, but there have been few opportunities to explicitly test these models.

The strength and direction of effects may also change over time (Cox et al., 2010). A parent may be the dominant force in shaping children's behavior in early childhood, but during the late preschool years and early school years, there are significant increases in the cognitive and social capacities of children such that one might expect children to be playing an increasingly stronger role in their own development (Cox et al., 2010; Sroufe et al., 2005). Research suggests that neurobiological changes in the child at ages 5 to 7 may be associated

with changes in complex problem solving and integration of information across modalities (Janowsky & Carper, 1996), as well as with a child's increased ability to function autonomously (Sroufe et al., 2005). These new abilities are likely to equip children to more actively influence their own environments and may be reflected in their behavior having a greater effect on the behavior of their parents than at previous times. Additionally, in the late preschool years and as children transition to formal schooling, many other sources, including peers and other adults, may be important influences on child behavior and may dilute the parents' effect on children during this period (Lansford, Criss, Pettit, Dodge, and Bates, 2003; Scaramella, Conger, Spoth, & Simon, 2002).

Some studies have reported a child driven effect in the relation between mother and child behaviors during middle childhood through adolescence (Burke, Pardini, & Loeber, 2008; Huh, Tristan, Wade, & Stice, 2006). For example, Huh et al. (2006) found a significant effect from elevated externalizing behavior to decreased parental support and control as reported by adolescents, but not the opposite during the teenage years. Burke et al. (2008) found that child oppositional defiant disorder impacted parent-reported parent-child communication and support but not vice versa in a clinical sample studied from ages 7 to 17. No studies have examined whether this child effect might occur even earlier. The present study is the first to test this bidirectional effect between maternal sensitivity and externalizing behavior starting at age 4 and extending into early adolescence.

Earlier work using the NICHD SECCYD sample (Miner & Clarke-Stewart, 2008) tested the bidirectional nature of observed maternal sensitivity and mother- and caregiver- reported externalizing behaviors from toddlerhood to nine years of age. The findings suggest that more maternal sensitivity at one time point is associated with less externalizing behavior problems at the next time point; and more externalizing problems at one time point are associated with less maternal sensitivity at the next time point. However, there were limitations in the analytic approach adopted in this study because the bidirectional effects were tested by modeling two separate processes, i.e., parent effect processes and child effect processes. The model therefore, evaluated separately the effects of the time-varying maternal sensitivity variable on the externalizing trajectory and the time-varying externalizing variable on the maternal sensitivity. Thus, the tests of bidirectional associations did not estimate change in the parenting and child characteristics simultaneously. In other words, in these models, the effects of the *absolute values* of the predictor at the previous time point were estimated, rather than *changes* in the predictor since the previous time point. This approach is limited because the association between changes in the two processes (i.e., the association between trajectories) is not evaluated. An estimation of the association between trajectories and of cross-lagged effects provides more support for causal mechanisms because all unobserved time-invariant conditions and the modeled, time-varying conditions are controlled for in both processes. It is therefore possible to estimate the association of the dynamic nature of the trajectories (baseline levels, rate of change, and decreases or increases in the rate of change) and provide a stricter test of drivers of the relation. In addition, the Miner and Clarke-Stewart study constructed models for externalizing behavior reported by mothers and teachers separately. While their findings

shed light on reporter differences in externalizing behavior, they did not eliminate reporter bias in the measurement of children's behavior.

The Current Study

The analytic limitations found in previous research were overcome in the current study, and a broader age range was examined. Specifically, we estimated the association between the trajectory of observed maternal sensitivity from ages 3 to 11 and that of externalizing behavior reported by mothers, fathers, and teachers from ages 4 to 12. In doing so, we removed potential confounders in both the trajectories of maternal sensitivity and externalizing behaviors, as well as dealt with random measurement error (including errors due to reporter) in the measure of externalizing behaviors. Using the same measures, we modeled the cross-lagged effect between maternal sensitivity and externalizing behaviors from ages 4 to 11, so that bidirectional associations between maternal sensitivity and externalizing behaviors were estimated simultaneously. In the cross-lagged model, we were able to identify the agent who contributed most to the association and the strength of the effect between agents within each time interval. Thus we were able to test for a child and a mother effect starting from the late preschool period and extend our test to the preadolescent period.

We considered the starting point of preschool to be a critical time for behavior consolidation in the child (Keller et al., 2005), following the normative peak of behavioral problems and negativity in toddlerhood when children are eager to exercise emerging motor skills and other capabilities through frequent limit testing and violation (Belsky, Woodworth, & Crnic, 1996). Our measurement of problem behaviors continued through the transition to formal schooling and the transition to adolescence. At both transition periods, children may be especially vulnerable to demonstrating behavior problems. As children transition to formal schooling, they must navigate new relationships with teachers and peers and adjust to classroom routines (e.g., Pianta et al., 2007). These challenges may be stressful and consequently undermine children's abilities to appropriately regulate behavior. The transition to adolescence, which often coincides with the transition from elementary to middle school, is also a period during which behavior problems can emerge. Maturation-related hormonal and neurobehavioral changes in adolescents may increase their tendencies toward sensation-seeking, risk-taking, high-intensity emotion and conflicts, which can lead to behavioral and emotional problems (Dahl, 2004). The increasing influence of peers may add pressure on preadolescents to conform to peers, and some may affiliate with deviant peers (Scaramella et al., 2002). During these often challenging developmental transitions, it is especially important that children are able to regulate their behavior and that parents are able to adjust to children's developmental changes with sustained sensitive support.

In the present study, we also tested sex moderation of the trajectories for both maternal sensitivity and externalizing behaviors. Different patterns and levels in the trajectories of externalizing behavior have been reported between boys and girls (e.g., Campbell et al., 2010). However, some studies of externalizing problems investigate only boys or only girls (e.g., Gross, Shaw, & Moilanen, 2008), and there is very little empirical work examining whether boys and girls differ significantly in their behavior trajectories and processes.

Moffitt, Caspi, Rutter, and Silva (2001) have argued that these processes are more similar than different, even if actual levels of behavior problems are different (with boys generally showing higher levels). Therefore, although we did not expect differences, we did empirically test whether levels and change in externalizing behaviors and maternal sensitivity are similar for boys and girls (Crick & Zahn-Waxler, 2003).

To summarize, in the present study, we first attempted to replicate the decrease over time in the average individual trajectories of maternal sensitivity (Feldman, 2010) and externalizing behaviors (Miner & Clarke-Stewart, 2008) previously reported in other studies, and we considered whether there were significant inter-individual differences in both trajectories. We also tested for child sex differences in the trajectories of maternal sensitivity and externalizing behavior. In line with earlier studies (e.g., Campbell et al., 2010), we did not expect such differences. Next, we tested our more fundamental hypotheses that the mean level at age 3 (baseline) and the change between age 3 and age 11 (i.e., Grade 5) in maternal sensitivity would be negatively related to the mean level at baseline and the change in children's externalizing behaviors from age 4 to age 12 (i.e., Grade 6), respectively. Furthermore, we hypothesized that there would be significant cross-lagged effects such that reciprocal feedback occurred between maternal sensitivity and externalizing behavior over the entire time period. Last, based on previous research (e.g., Janowsky & Carper, 1996), we hypothesized that, between late preschool and the early school years, children's behavior problems would have a stronger influence on mothers' sensitivity than mothers' sensitivity would have on children's behavior problems. Besides the standard demographic controls, we controlled for child difficult temperament, maternal harshness, and maternal depression in all the models given their possible confounding effect on levels and/or changes in externalizing behavior and/or maternal sensitivity (e.g., Grolnick & Farkas, 2002; NICHD SECCYD, 2004).

Methods

Sample Description

Participants in the current study included 1364 children and their families in the longitudinal NICHD Study of Early Child Care and Youth Development (NICHD SECCYD). Families were recruited in 1991 from 24 hospitals at 10 sites (Charlottesville, VA; Irvine, CA; Lawrence, KS; Little Rock, AR; Madison, WI; Morganton and Hickory, NC; Philadelphia, PA; Pittsburgh, PA; Seattle, WA; and Wellesley, MA). Participants were screened for eligibility for the study, and the final sample for the NICHD SECCYD was comprised of 1364 families with healthy newborns. There were no significant site differences in the number of participating families with 123 to 150 participants from each site.

There was moderate variation in family social/class status in the sample. When children were 1 month old, 26% of the mothers had a high school degree or less, 34% had some college education, 22% had bachelor's degrees, and 17% had graduate or professional degrees, and the average years of maternal education was 14. The average annual income for the families of the 36-months-olds was approximately $53,526.51 (SD = $ 43,866.36; range: $ 2,500.00 to $ 400,002.00). The sample included approximately 80% European American, 13% African American, 5% multi-racial, 1.6% Asian, and 0.4% American Indian children.

About half of the participants were boys (52%). In general, this is a community sample of children who were typically developing and not at risk for clinical levels of conduct problems. Table 1 provides mean and proportion estimates for all variables used in this analysis.

Data Collection Procedures

When children were one month of age, a home interview was conducted and data on child sex, child race, and maternal education were collected. Standardized mother-child interactions at 3, 4, 7, 9, and 11 years were videotaped for later scoring of parenting behaviors. Children's externalizing problems were reported on the corresponding versions of the Child Behavior Checklist by mothers during the laboratory visits when children were 3, 4, 6, 7, 9, 10, 11, and 12 years of age. Fathers reported children's externalizing problems at the same ages except age 6 and caregivers and teachers reported children's externalizing problems at the same child ages as mothers' reports.

Measures

Demographic controls—Maternal education was reported on a scale from 0 to 21 representing years of education. Child sex was dummy-coded with female as the reference category. Child race was collapsed into Black, White, and other race categories with White as the reference category. Annual family income in terms of thousands of dollars at age 3 included mother's income, income from other sources, and income of the cohabiting partner or husband as reported in a questionnaire. Data collection site was also used as a control.

Child temperament—This construct was based on maternal report on the Infant Temperament Questionnaire (Carey & McDevitt, 1978) at 6 months child age. There were five subscales and 55 items in total. The scales included mood, adaptability, approach, intensity, and activity. A total score indicating difficult child temperament was created by taking the average of the items (reversing items when needed).The Cronbach's alpha was . 81.

Maternal harshness—Maternal harshness was based on items from the Home Observation for Measurement of the Environment (HOME) Inventory (Caldwell & Bradley, 1984) at 3, 4, 9, 11 years of child age. These items evaluate the presence or not of maternal anger, intrusiveness or physical punishment toward the study child. Mean composites across items were formed and then reversed at each time point so that higher score suggests higher harshness at home. This variable was used as a time-varying control in the analytic models. This construct is distinct from the construct of maternal sensitivity (r=−.26 at best in this study) and has different correlates in predicting children's behavior (Bradley & Corwyn, 2007).

Maternal depression—Mothers reported their symptoms of depression on the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) at 3, 4, 7, 9, 11, 12 years of child age. The scale contains 20 items indicating the occurrence of mothers' positive or negative emotions in the past week. A total score was created for each time point and was used as a time varying control variable in the analytic models.

Externalizing behavior at age 3—The Child Behavior Checklist (CBCL/2-3, Achenbach, 1992) was completed by the mother when the child was 3 years of age. The CBCL contains 100 items and six syndrome scales. The current study used the externalizing raw score based on the sum of the aggressive behavior and destructive behavior subscales. The possible range for mother-rated externalizing behavior is 0–52 with an average for this sample of 13.47 which is slightly higher than that for a normative sample (12.9). Due to the differences between some items of the CBCL/2-3 and the CBCL for later ages (i.e., 40 of the 99 items on CBCL/2-3 are only used for this age group with 59 of the items having their counterparts on CBCL/4-18), the mother-reported externalizing behavior problems score at 3 years was used as a control variable rather than part of the externalizing behaviors trajectory.

Maternal sensitivity—Children were observed in videotaped interaction situations with their mothers at 3, 4, 7, 9, and 11 years of age. From 3 to 11 years of age, the maternal sensitivity composite included respect for autonomy, supportive presence, and hostility (reversed). *Respect for autonomy* indexed the mother's sensitive respect and support of her child's individuality, perspectives, and motives. High scores indicated that the mother acknowledged the child's opinions and actions as a valid part of the child's individuality. Low scores indicated that the mother was very intrusive in her interaction with the child. Instead of treating the child as a partner in the interaction, the mother may intrude harshly or coldly and constantly deny the autonomy of the child without any acknowledgement of the intentions of the child. *Supportive presence* indexed the level of positive regard and emotional support from the mother to the child. A mother high on this scale acknowledged the child's accomplishments, encouraged the child's efforts, and confirmed the child's actions. A mother low on this scale seldom provided supportive cues and was unavailable through passiveness, aloofness, uninvolvement, etc. The *hostility* scale reflected the mother's expression of anger toward or discounting or rejecting of the child. A mother scoring high on this scale clearly and overtly rejected the child, blamed the child for mistakes, and otherwise made explicit the message that she did not support the child emotionally. A mother scoring low on this scale did not blame the child nor reject the child, nor communicate hostility in other ways, regardless of how supportive she was to the child (see Owen, Vaughn, Barfoot, & Ware, 1996; Owen, Klausli, & Murrey, 2000).

At the 3 year lab visit, mothers and children were asked to play with three sets of toys. The first set of toys included markers, stencils, and a tablet. The second set of toys included a cash register and clothes for pretend play. The third set of toys included lego blocks with a pictured model. At 4 years of age, mothers and children were asked to work cooperatively on the following three tasks: use an Etch-A-Sketch to complete a maze, build a tower, and perform a play using a set of six hand puppets. During the 7 year laboratory visit, mothers and children were asked to work cooperatively on the following three tasks: draw a picture on an Etch-A-Sketch together with each person controlling one of the knobs, use different shaped parquet pattern blocks to fill in three geometric cutout frames, and play a card game that is competitive but developmentally appropriate for a 7 year old. During the 9 year laboratory visit, mothers and children were engaged in a rules discussion task with three types of topics (i.e. kid rules, parent rules, and difficult decisions) printed on colored cards

for selection and an errand planning task in which both parties worked together to determine the optimal route for the completion of 11 errands using a town map (e.g., take laundry to Laundromat). During the 11 year laboratory visit, mothers and children were asked to participate in a parent-child issues discussion task in which mother and child were presented with a set of 22 cards each labeled with a topic of potential parent-child disagreement (e.g., after-school activities). Mother and child and were asked to mutually decide on three cards representing disagreements that they had and spend 7 minutes discussing all three of these issues in an attempt to make progress towards a resolution. Then the mother and the child were asked to work cooperatively to create an apparatus that allowed an egg to drop while attached to a bungee cord so that it did not hit a surface and break.

The videotapes of the interactions from the 10 research sites were coded at a central location using 7-point rating scales. The coders were blind to all other information about the dyads. All coders were trained to a high reliability criterion and supervised by Dr. Margaret Tresch Owen, one of the study investigators. Inter-rater reliability was monitored throughout the coding period with intraclass correlations ranging from .84 to .91 for the maternal sensitivity composite. Cronbach's alpha for the composites ranged from .78 to .85.

Externalizing behavior—Externalizing behavior was measures using a latent variable with observed measures from three reporters: mothers, fathers, and caregivers/teachers. The latent variable were measured at ages 4, 6, 7, 9, 10, 11, and 12 (with only mother and teacher reports used as indicators at age 6). The latent variables measured the agreement among these three reporters with respect to the child's level of externalizing problems. The portions of the ratings that were not shared (uncorrelated among reporters) were separated from the latent variable and estimated as random measurement error.

At 4, 6, 7, 9, 10, 11, 12 years of child age, mothers completed the CBCL scale for ages 4–18 (Achenbach, 1991). Fathers completed the same scales at the same time points except at 6 years child age. The CBCL/4-18 has eight syndrome scales, with 118 items used for 4 through 12 years of age. This scale was standardized as well as validated with many samples of American children and children living abroad. Raw scores were used instead of T scores in this study because the T scores may have reduced the variation among the low scores on some scales such as the aggressive behavior scale. Using raw scores thus may better capture the variation in the externalizing behaviors especially at the low end.

The mother and father reported externalizing behaviors included the aggressive behavior scores and the delinquent behavior scores with item ratings ranging from 0 (not true of the child) to 2 (very true of the child). For mother report, the range for the raw sum scores was 0–43, 0–41, 0–45, 0–36, 0–40, 0–39, and 0–40 when children were 4, 6, 7, 9, 10, 11, 12 years old respectively. For father report, the ranges were 0-59, 0-35, 0-38, 0-49, 0-42, and 0-48 for 4, 7, 9, 10, 11, and 12 years old respectively.

The Caregiver-Teacher Report Form (C-TRF) was completed by caregivers or teachers when children were 4 years old if children were in child care for 10 or more hours a week. When children were 6, 7, 9, 10, 11, and 12 years old, teachers completed the Teacher Report Form of the CBCL (TRF; Achenbach, 1991). The TRF is modeled on the CBCL scale for

ages 4–18 and has high reliability and internal consistency (Achenbach, 1991). It compares a particular child's school functioning with that of the child's normative peers as perceived by the teacher. The TRF contains 122 behavior items and eight syndrome scales.. The possible range for the standardized scores of the externalizing behavior by teacher report was from 0 to 67, 0 to 61, 0 to 47, 0 to 60, 0 to 56, 0 to 60, and 0 to 58 for children who were 4, 6, 7, 9, 10, 11, 12 years old respectively.

Analysis

Data analysis was conducted in three stages. First, descriptive analyses of the independent variables, dependent variables, and control variables were undertaken. Second, within a structural equation modeling framework, the trajectories of maternal sensitivity and externalizing behaviors were separately estimated for the population. Tests of functional form were conducted to arrive at the best fitting trajectories. For both the maternal sensitivity and the externalizing behaviors trajectories, sex moderation testing was undertaken to establish whether these processes differed for boys and girls. Third, a "parallel process" model was estimated, which involved the simultaneous estimation of the maternal sensitivity and externalizing behaviors trajectories conditioned on controls. In this analysis, the correlation between the two processes was used to test their mutual evolution. Lastly, we utilized a cross-lagged model to establish whether a reciprocal relationship between maternal sensitivity and children's externalizing behaviors operates over time and to compare strength of mother vs. child effect at each time interval involved. Model estimation and testing was done in Mplus software, Version 6 (Muthén & Muthén, 1998–2010).

Models

Latent growth curve modeling (LCM) was used to estimate trajectories over time (Bollen & Curran, 2006). LCMs are equivalent to trajectory modeling in the multilevel modeling framework in that they are mixed effects models that estimate both fixed and random effects parameters, representing average trajectories and individual variation around the averages, respectively. The trajectory intercepts measure the starting value. Trajectory slopes and quadratic effects measure within-person rate of change and within-person acceleration or deceleration in the rate of change. We estimated maternal sensitivity trajectories over 5 time points starting at 3 years with subsequent assessments at 4, 7, 9, and 11 years. We estimated externalizing behavior trajectories over 7 time points starting at 4 years with subsequent assessments at 6, 7, 9, 10, 11, and 12 years. The externalizing behaviors trajectories were estimated for the latent variables, which combined the observed reports from mothers, fathers, and caregivers/teachers. For both processes, time was coded such that units of time were measured in approximately one year intervals. A parallel process (or bivariate LCM) model (Bollen & Curran, 2006) was used to estimate the relationship between maternal sensitivity and externalizing behavior trajectories. The strength of this model is that it provides more rigorous support for causal relationships compared to a cross-sectional association by eliminating potential spurious relationships with unobserved, time-invariant variables by controling for all static characteristics of the person (child) including stable reporter or observer bias. Therefore, the causal threat of spuriousness in the relationship between maternal sensitivity and externalizing behavior was greatly reduced in this model.

The correlation between these processes estimates whether *change* and slowing or speeding up in *change* over time in these phenomena were co-occurring.

A cross-lag panel model (Finkel, 1995) was used to estimate reciprocal relationships over time. We used parallel time points in this model so that we had equal intervals of approximately 2 years between time points (4, 7, 9, and 11 years). In this model, the effect of maternal sensitivity on externalizing behavior was estimated net of prior levels of externalizing behavior, and the effect of externalizing behavior on maternal sensitivity was estimated net of prior levels of maternal sensitivity – again a way of estimating within person change between time points and of controlling for the history of the outcome when evaluating effects on current levels. This model also provided an estimate of the stability of maternal sensitivity and externalizing behaviors between time points in the autoregressive parameter estimates. This model has been used, for example, to evaluate longitudinal reciprocal relations between maternal negativity and externalizing behaviors among adolescents (Zadeh et al., 2010). We tested several of the parameters for equality over time (i.e., stationarity), for example, whether the regression coefficient for the effect of the control variable income on externalizing behavior is the same at each time point. We also tested for equal error variances over time. In the event that associations and/or variances were stationary, we constrained the parameters to be equal and interpreted the cross-lagged effects within the context of the constrained and hence more parsimonious model.

Missing Data and Estimation

Eleven percent of respondents were missing family income; 14% of respondents were missing the 3 years externalizing behavior reported by mothers; 6% of respondents were missing child temperament at 6 months; 14%, 23%, 26%, and 26% of respondents were missing measures of harsh parenting at child ages 3, 4, 9, and 11 years, respectively; 12%, 21%, 26%, 25%, 25%, and 25% of respondents were missing mother's depression at child ages 3, 4, 7, 9, 11, and 12, respectively; 15% of respondents were missing maternal sensitivity at 3 years; 24%, 26%, 28%, and 32% of respondents were missing maternal sensitivity at child ages 4, 7, 9, and 11 years, respectively. For externalizing behavior reports, between 22% and 25% of respondents were missing mothers' report at the different ages; between 42% and 49% of were missing fathers' reports; and between 26% and 44% were missing teachers' reports.

The full sample (n=1364) was utilized in the analyses including respondents with missing values for some of the model variables. The direct maximum likelihood (or FIML) approach (Arbuckle, 1996) to missing data was used, which assumes that data are missing at random conditioned on the model. Attrition in the NICHD SECCYD was higher for African American respondents and for respondents with lower socioeconomic status. Because these variables were included as controls in the model, this helped ensure that the MAR assumption was met. Direct ML has less strict assumptions about the randomness in the missing data compared to listwise and pairwise deletion. In addition, it is more efficient, yields fewer convergence failures, results in relatively unbiased estimates of effects, and has near-optimal rates of Type 1 error (Enders & Bandalos, 2001).

Some of the endogenous variables in the model did not have a strictly normal distribution (e.g., externalizing behaviors at ages 10 and 11 have non-normal kurtosis), therefore standard errors and test statistics were corrected for non-normality using robust, sandwich estimators to obtain standard error estimates (e.g., Binder, 1983; the "MLR" estimator in the Mplus package; Muthén & Muthén, 1998–2010).

Results

Descriptive Analysis

As seen in Table 1, average maternal sensitivity scores appeared to be declining slightly from 3 to 11 years. There was little variation in these scores with means ranging from 16 to 17 and standard deviations between 2.4 to 3.0. Externalizing behavior was steadily declining for children between 4 and 12 years as reported by mothers and fathers with the largest declines occurring between ages 4 and 7.

Caregiver/teacher reports of externalizing problems also showed a decline between 4 years and 6 or 7 years with the level hovering around 6 after that. The average mother report of externalizing behaviors measured for 3 years was over 13, but this score was comprised of different items than in later measures and therefore not directly comparable to the other time points. Externalizing behavior had more inter-individual variation as compared to maternal sensitivity with average deviations from the means over 6 points for mother and father reports and over 8 points for caregiver/teacher reports.

Trajectories of Maternal Sensitivity and Externalizing Behavior

Quadratic trajectory models without covariates were estimated for maternal sensitivity and externalizing behavior for boys and girls separately (i.e., four models). The trajectories for these models are illustrated in Figure 1, row 1. Means and variances for the intercept, slope, and quadratic trajectory components were tested across sex using a z-test and the Wald chi-square test (Agresti, 2002). For the externalizing behavior trajectory models using multiple reporter latent variables and including both time-invariant control variables and time-varying harsh parenting and mother's depression controls, there were no sex differences in any components of the externalizing behavior trajectories, and the quadratic model fitted reasonably well for both sexes [$\chi^2(1013)= 1885.3$, $p = 0.00$; CFI=0.92; TLI=0.90; RMSEA=0.04]. See Table 2 for sex moderation test results. Therefore, a single trajectory model of externalizing behavior for boys and girls combined was used. Calculated from the conditional trajectory model, the externalizing behavior trajectory average intercept was 9.95, average linear slope was −0.84, and average quadratic effect was 0.046. Figure 1, row 2 illustrates the estimated trajectories conditioned on covariates for boys and girls separately and together. The final, average conditional trajectories used in subsequent analysis are represented by the bold black lines in Figure 1, row 2. The correlation between the intercepts and the slopes for externalizing behaviors was −.26 ($p < 0.001$). So, children starting out with more externalizing problems decreased more over time relative to children starting out lower on externalizing behaviors. Also, the externalizing behavior slopes and quadratics were negatively correlated showing that greater decreases over time were associated with a

slowing in the amount of decrease over time, indicating that those with substantial decrease experienced more of the decrease at the younger ages ($r = -0.93$, $p < 0.001$).

For maternal sensitivity, both the slope and quadratic components of the unconditional model of maternal sensitivity trajectories differed across child sex. However, after conditioning on covariates, there were no statistically significant sex differences in the trajectory components with the exception of more inter-individual variation in intercepts (values at age 3) for girls (Table 2). Therefore, boys and girls were combined in the trajectory model for maternal sensitivity as well. The quadratic effect in conditional models did not have a statistically significant mean or variance, so the linear trajectory models were used. The model fit for the combined model was good [$\chi^2(55)=172.8$, $p = 0.00$; CFI=0.936; TLI=0.901; RMSEA=0.04]. Calculating from the conditional trajectory model, the maternal sensitivity trajectory average intercept was 16.90 and average slope was −0.10. See Figure 1 for a depiction of this trajectory (solid black line in Figure 1, Row 2, Column 2). Also the intercepts were negatively correlated with the slopes ($r = -0.45$, $p < 0.001$) for maternal sensitive trajectories.

Parallel Process Model

The parallel process model had a very good fit to the data. While the chi-square test was significant [$\chi^2(787)= 1792.1$, $p = 0.00$] indicating a poor fit, the comparative fit indices and root mean square error of approximation indicated good model fit (CFI = 0.924, TLI = 0.905, and RMSEA = 0.031). The significance of the chi-square test was likely due to the sample size rendering high power in detecting even small deviations from the data (Bentler & Bonett, 1980). The parallel process model is depicted in Figure 2. Time invariant and time-varying covariate controls were included in the model, though they were not depicted in the figure. All relationships between trajectory components (intercepts, slopes, and quadratic) were conditioned on the covariates.

Table 3 provides the estimates of the covariate effects on the baselines and changes in the trajectories of maternal sensitivity and externalizing behavior problem. Higher externalizing problem scores at age 3 years were associated with lower maternal sensitivity scores at 3 years ($\beta= -.034$, $p < 0.001$). Being non-White and mothers using more harsh control at age 3 years were associated with a lower baseline of maternal sensitivity while both higher income and higher maternal education were associated with a higher baseline level of maternal sensitivity. Being neither White nor Black was associated with increase in maternal sensitivity over time while maternal education and harshness at age 3 years were associated with decrease in maternal sensitivity over time. For example, mothers who used more harsh control when the child was three also showed more decline in sensitivity over time.

There were few covariate effects on the externalizing trajectories, probably because the externalizing problem scores at 3 years were included in the model. Black race and child difficult temperament at age 6 months both were associated with fewer externalizing problems at age 4 (after controlling for mother reported externalizing problems at age 3) while mother’s greater depression and harshness were associated with more externalizing problems at age 4. Only harshness levels had an effect on the externalizing problems slope

where higher levels of harshness were associated with higher increases in externalizing behaviors between age 4 and 12 years ($\beta = 0.821$, $p < 0.05$).

The parameters of primary interest in this model were the associations between maternal sensitivity and externalizing problem trajectories. These parameters were labeled A, B, and C in Figure 2 and the estimates are given in Table 4. Parameter A measures the effect of the maternal sensitivity score when the child was 3 years old on the externalizing behavior score for the child at 4 years *after* controlling for externalizing behavior at 3 years. The standardized beta parameter was −0.29 ($p < 0.05$). Parameter B measures the correlation between the slopes of the two processes ($r = -0.23$, $p < 0.001$). This estimate revealed that decreases in a child's externalizing problems were associated with increases in the maternal sensitivity of their mother. This is an important effect that shows these processes were co-occurring and shared 5% of their change variance.

Finally, parameter C estimates the association between degree of change in maternal sensitivity and the velocity of change in externalizing problems (the quadratic component). The question was whether the rate of change in maternal sensitivity for a child was related to the slowing or speeding up in the rate at which changes in externalizing behaviors were occurring for that child. The correlation was estimated to be 0.19 ($p < 0.05$), therefore greater decreases in maternal sensitivity resulted in a more curved trajectory in externalizing problems. This means that for children whose mother's sensitivity was decreasing more during this time period, their externalizing problems dropped more sharply at younger ages and less sharply at older ages (Figure 1, Row 2, Column 1).

Cross-Lagged Model

The cross-lagged model was estimated to extend the findings from the parallel process model because the parallel process model did not make assumptions about the direction of the effects over time. That is, we were unable to determine whether the effects of changes in maternal sensitivity on externalizing behavior were greater than the reverse effects. So far, we have assumed the effects are equally bidirectional. The cross-lagged model allows us to test for a potential driving factor in the changes between each time interval.

The cross-lagged model is depicted in Figure 3. The same set of covariate controls were included in the model, but are not shown in the figure. The multiple reporter latent variables of externalizing problems at each assessment were used. The covariates affected outcomes at each of three time points (ages 7, 9, and 11 years). We tested that the effects were stationary over time and found that most of them were, so those covariate effects were constrained to be equal over time. All equality tests were performed in the free model where all other parameters were allowed to be freely estimated. Maternal sensitivity and externalizing problem behaviors were allowed to co-vary within time. This covariance is represented by the two headed, curved arrows. The covariance at 7, 9, and 11 years of age is the covariance between the residual terms. Tests of equality in the covariance of the residuals over time showed that it was the same across time points; therefore, one covariance parameter was estimated. The cross-lagged effects and the autoregressive effects were also found to be equal across time. For example, the effect of maternal sensitivity on externalizing behaviors was −0.012 between each time point. Estimates from the cross-lagged model are presented

in Table 5, and the autoregressive and cross-lagged estimates are also displayed on the model in Figure 3. The stationary effect estimates are presented in Table 5 just for age 7 years since they are equivalent at subsequent grades.

The overall model fit of the final cross-lagged model was very good [$\chi^2(309)= 557.6$, p = 0.00; CFI = 0.96, TLI = 0.94; RMSEA = 0.024]. Many of the covariates were associated with maternal sensitivity (Table 5). For example, children being black in contrast to white (although this was not a consistent effect over time) and mothers exhibiting more harshness toward the child predicted declines in maternal sensitivity over time. Only mother's greater depression and harshness were associated with more externalizing behaviors (Table 5). The autoregressive parameter for externalizing behavior showed that a child who was one unit higher in the externalizing problems score at one point in time was 0.83 units higher in the externalizing score two years later. This is a consistent effect for children from age 4 to 12 years (Table 5). The autoregressive parameters for maternal sensitivity were also consistent over time. For example, a mother who was one unit higher in the maternal sensitivity score when the child was age 4 years was 0.32 units higher at age 7 (Table 5). The standardized autoregressive effects were similar in size to the unstandardized estimates reported here. These effects indicate that within-person externalizing behaviors are much more stable between assessments than within-person maternal sensitivity.

Only the cross-lagged effect of child externalizing problems (as indicated by mother, father, and teacher reports) on maternal sensitivity was statistically significant while maternal sensitivity did not predict child externalizing problems indicating that there was not a reciprocal feedback relationship occurring between maternal sensitivity and externalizing behaviors between ages 4 and 11. A one unit increase in the externalizing problem score was associated with a 0.040 unit decline in the maternal sensitivity score 2 years later. Because externalizing problems and maternal sensitivity were measured on very different scales with a range of about 1 to 40 and about 4 to 21, respectively, we interpret the standardized effects. The fully standardized cross-lagged effects in this model showed that a one standard deviation unit increase in externalizing problems resulted in a decline of 0.078, 0.097, and 0.097 standard deviations in maternal sensitivity for the subsequent three time points, respectively.

Discussion

The goal of this study was to investigate the interplay between maternal sensitivity and child externalizing behavior problems in children from 4 to 12 years old. Models controlled for measurement error in the estimates of child externalizing behavior problems including errors due to reporter, unobserved child and mother characteristics that did not change during the study period (e.g., child temperament), observed characteristics such as previous reports of externalizing behaviors (i.e., 3 years of age), family income, maternal education, child race and sex, child difficult temperament, as well as time-varying maternal harshness and maternal depression. Specifically, we replicated patterns of decline in externalizing behavior (Miner & Clarke-Stewart, 2008) and maternal sensitivity (Feldman, 2010) from preschool ages to preadolescence and found support for significant inter-individual variation in the changes. As expected, we found that the trajectories did not differ by child sex. Trajectories

of maternal sensitivity and those of child externalizing behavior were found to be interrelated over time. Further modeling supported the finding that the relation was driven by the effect of child externalizing problems on maternal sensitivity from ages 4 to 11.

A major contribution to the literature lies in our finding of a unidirectional child effect explaining the association between maternal sensitivity and externalizing behavior from ages 4 to 11 based on the cross-lagged modeling technique. The mothers' effect on children was not statistically (nor substantively) significant at each time interval from ages 4 to 11. This finding is different from, but may be more accurate than, the reported bidirectionality based on a mother effect model and a child effect model using the same sample from ages 2 to 9 in the Miner and Clarke-Stewart (2008) study. Our results support only one side of the transactional model and emphasize a child effect on the parent. Our findings are consistent with a few other studies that focused on children from middle childhood to adolescence and tested a bidirectionality hypothesis (e.g., Burke et al., 2008; Huh et al., 2006). For example, Burke et al. (2008) reported a child only effect in the association between ODD and parental communication and involvement and between conduct disorder and parental control among children from ages 7 to 17. Huh et al. (2006) reported a child only effect in the transaction between adolescent girls' externalizing behavior and perceived maternal support and control. Our study makes a unique contribution to the literature by suggesting that this unidirectional child effect may emerge even earlier with regard to the impact of externalizing behavior problems on maternal sensitivity.

It is possible that children play a larger role in their own development from late preschool to the early school years than they have in earlier periods. Late preschool and early school years constitute a period during which there is an increasing consolidation of child regulatory and reasoning abilities, (e.g., Sroufe et al., 2005) and these developmental changes may lead to children having a larger impact on their environments than in previous years.

Alternatively, as children move into a larger social world outside of the home, extra-familial factors such as peers may come into play and dilute the influence of parenting. For example, Scaramella et al. (2002) found that the association of hostile and uninvolved parenting with children's delinquent behaviors in early adolescence was mediated by deviant peer affiliation. Lansford et al. (2003) also reported that high quality friendships with peers who were low in antisocial behaviors significantly attenuated the impact of negative parenting on children's externalizing behaviors in adolescence.

It is also possible that other dimensions of parenting may become important when children reach school age and may overshadow the impact of maternal sensitivity. For example, parental behavior monitoring may gain more prominence for older children since it has been found to buffer children from developing externalizing behaviors in early adolescence (Pettit, Laird, Dodge, Bates, & Criss, 2001). All of these alternative possibilities should be tested in future research.

Our finding of a unidirectional child effect on mothers from late preschool to middle and later elementary ages does not suggest that maternal sensitivity is not important. In our

cross-lagged model we were not able to consider externalizing behavior problems younger than age 4 because the form of the measure is different at the toddler age than it is from age 4 on. However, in the parallel process modeling, in which we established the significant inter-relationships between the maternal sensitivity trajectories from ages 3 to 11 and the child externalizing behavior trajectories from ages 4 to 12, we found that maternal sensitivity at age 3 predicted externalizing behaviors at age 4, after controlling for mother reported externalizing behaviors at age 3 and other covariates. This replicated what others have found for younger children using similar modeling approaches (e.g., Shaw et al., 1994) and supported the important role of mother's sensitivity as related to children's early behavior problems. Because this effect did not control for prior levels of maternal sensitivity, we cannot combine that finding with the child-driven finding for ages 4 to 12 to suggest a shift in the cause of the relationship. However, this may be a worthy line of inquiry in future research.

Additionally, the extent to which maternal sensitivity would predict a reduction in externalizing behaviors may be contingent on the occurrence of other parenting factors (Bradley & Corwyn, 2007), some of which we included as covariates. Previous research suggests that maternal harshness and depression are both associated with children's externalizing behaviors (Bradley & Corwyn, 2007; NICHD SECCYD, 2004). In our study we found that harshness (as a time invariant covariate) was associated with a low baseline and a decrease in sensitivity over time, and a high baseline and an increase in externalizing behaviors over time. Maternal depression (as a time invariant covariate) was not significantly related to maternal sensitivity, but independently predicted a high baseline of externalizing behavior at age 4. The effects of these other parenting dimensions suggest the need to understand maternal sensitivity and its interplay with child externalizing behaviors within the context of other occurring parental risk factors.

The present study also replicated previous findings regarding the trajectories of externalizing behavior (Miner & Clarke-Stwart, 2008) and maternal sensitivity (Feldman, 2010). Our finding of a general decline in externalizing behaviors from ages 4 to 12 may reflect the fact that children develop increased physical and mental capacities for self control as they age (Dahl, 2004). At the same time, frequent and expanded socialization experiences with multiple agents (e.g., parents, teachers, and peers) across settings may also help reduce children's externalizing behavior (Bradley & Corwyn, 2008; Pianta et al., 2007). However, this decrease in externalizing behaviors leveled off around ages 10 to 12. This may correspond to children's transition to puberty, a phase of development that has been associated with increased externalizing problems for both boys and girls (Ge, Brody, Conger, Simons, & Murry, 2002). Further research may be needed to test if the onset of the pubertal transition invites additional chances for displaying behavior problems, slowing the decreasing trend in children's externalizing symptoms over time.

The finding of a relatively flat slope (slight decrease) of maternal sensitivity with significant inter-individual variation from ages 3 to 11 is consistent with a study of a middle-class Israeli sample (Feldman, 2010). This sample also was primarily middle class and thus generally low in in sociodemographic risk with stability in their environments. In this relatively low-risk context, most mothers seem able to maintain their levels of sensitive

support for children over time. The variation in the change of maternal sensitivity corroborates other studies based on the same sample that have indicated different patterns of change in maternal sensitivity for children of different attachment quality in the first three years (Mills-Koonce, Gariepy, Sutton, & Cox, 2008) or for mothers with different trajectories of depressive symptoms from infancy to age 7 (Campbell, Matestic, von Stauffenberg, Mohan, Kirchner, 2007). Because we controlled for maternal depression and maternal harshness at each time point, as well as other child and demographic characteristics, our delineation of the average trajectory of maternal sensitivity should be quite precise.

Our study did not find that child sex was a significant moderator of the trajectory of externalizing behavior, which supports Moffitt et al. (2001) who suggested that developmental changes in behavior problems may be more similar than different for boys and girls, although the actual levels of behavior problems may be different. In addition, we did not find that child sex moderated the trajectory of maternal sensitivity. To our knowledge, ours is the first study to test sex differences in the mean trajectory of maternal sensitivity in childhood. Our findings suggest that within a relatively advantaged context, mothers are generally similar in their sensitive support for both male and female children.

Potential Implications for Practice

In general, our study suggests that parents, teachers, and other adults working with children should be sensitive to developmental change and challenge in children and tailor their approaches to children based on these developmental changes. For example, the slowing down in children's decrease of externalizing behavior around age 10 may suggest there are additional stressors children are experiencing during this time including those related to the transition to puberty. Therefore, guidance for children in understanding their bodily changes and assistance in finding reasonable outlets for the stresses associated with developmental change may be needed to prevent or reduce externalizing behavior during this period. Second, maternal sensitivity at age 3 was related to children's externalizing behavior at age 4 after controlling for externalizing behavior at age 3. Therefore, enhancing maternal sensitivity over the first three years of life may be important for reducing children's problem behaviors. Third, between ages 4 and 11, we found a child effect on maternal sensitivity, but not an effect of maternal sensitivity on the child's behavioral difficulties. During this period, an emphasis that includes multiple agents or other dimensions of parenting beyond maternal sensitivity might be warranted in our efforts to better understand children's problem behaviors. For example, many interventions are still driven by early socialization theories that focus largely on addressing parenting behaviors (Burke et al., 2008). While a focus primarily on parenting may be important for very young children, as children enter the late preschool period, it may be important to consider the child's broader environment and child-related factors to better inform strategies and interventions designed to reduce problem behaviors.

Limitations

Although our study makes several important contributions to the field, it is not without limitations. First, because the NICHD SECCYD sample is a fairly advantaged community

sample, it is not clear that these findings would generalize to other samples. For example, we only found a uni-directional child effect on mother's sensitivity but not a mother effect on child externalizing behavior from ages 4 to 11, but it is possible that a bi-directional influence between mother's sensitivity and child's externalizing behavior may emerge in the same time period among less advantaged and more at-risk children. For the less advantaged children, parents' maintenance of sensitive support may have more influence on children's behavior problems than it does for the generally more advantaged children studied here. Replication of our study using high risk samples will be important to fully consider the possible bidirectionality between maternal sensitivity and externalizing behavior. Second, the effect sizes reported in the current study are not large. However, Thornberry, Lizotte, Krohn, Farnworth, and Jang (1991) suggested small effect sizes are a common problem in models estimating change rather than the level of the construct of interest. The use of multiple informants and measures in the current study, while reducing shared method variance, may increase the conservativeness of model estimation (Scaramell et al., 2002). Thus, this study is a conservative evaluation of the reciprocity of the processes between maternal sensitivity and child externalizing behavior over a long time period and may represent the lower bound of these reciprocal processes. Last, while the models used in this study evaluate causal relations by eliminating many threats of spuriousness, we acknowledge that the true causal relation can only be obtained through experimental design with randomization.

Despite these limitations, the current study makes a significant contribution to the understanding of processes underlying the consolidation of problem behaviors and maternal sensitivity from the preschool years through the preadolescent years. That is, from ages 4 to 11, children's externalizing behavior appears to be driving the relation with mothers' sensitivity. We also contributed to the literature by applying rigorous and innovative statistical modeling to these questions. For example, we know of no other publication that estimates the relation between the person-level slopes of both externalizing behaviors and maternal sensitivity, particularly using a latent variable measurement approach to externalizing behavior. This is a stronger approach because many potential confounders of both maternal sensitivity and externalizing behavior are controlled for in the random effects, and random measurement error (including errors due to reporter) in the measure of externalizing behavior was estimated separately from the construct. Findings from the parallel process model corroborate existing cross-sectional and longitudinal assessments, but our cross-lagged method provides a test of the direction of effect in the association between externalizing behavior and maternal sensitivity while also rigorously controlling for unobserved static factors as well as time-varying factors.

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Highlights

- Externalizing behavior declines over time with a slowing down in middle childhood.
- Maternal sensitivity changes and child externalizing behavior changes are associated.
- Child externalizing behavior drives the relationship with maternal sensitivity.

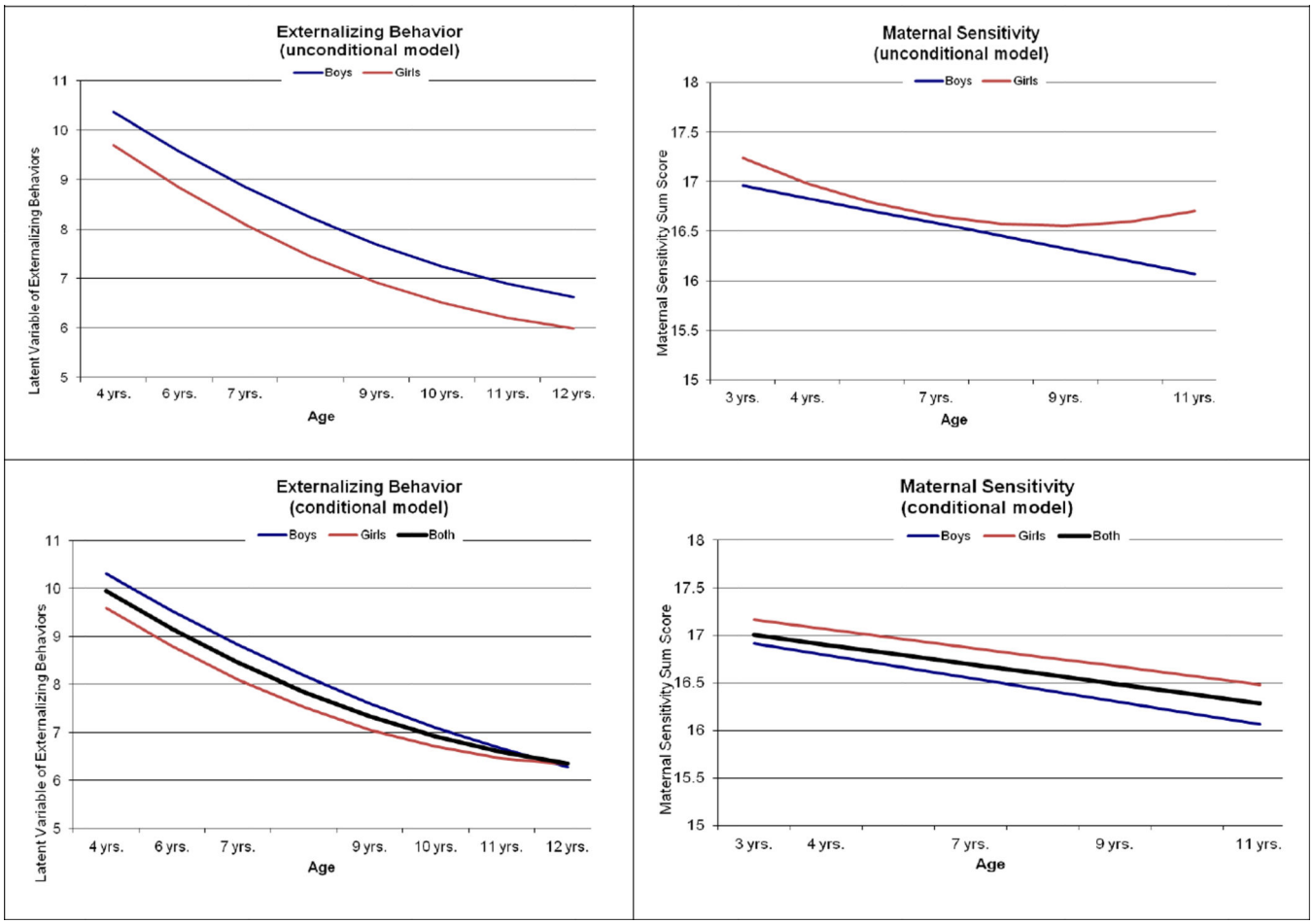

Figure 1.

Average trajectories of externalizing behavior and maternal sensitivity. The black lines in the second row represent average trajectories across sex as reported in the text. yrs. = years.

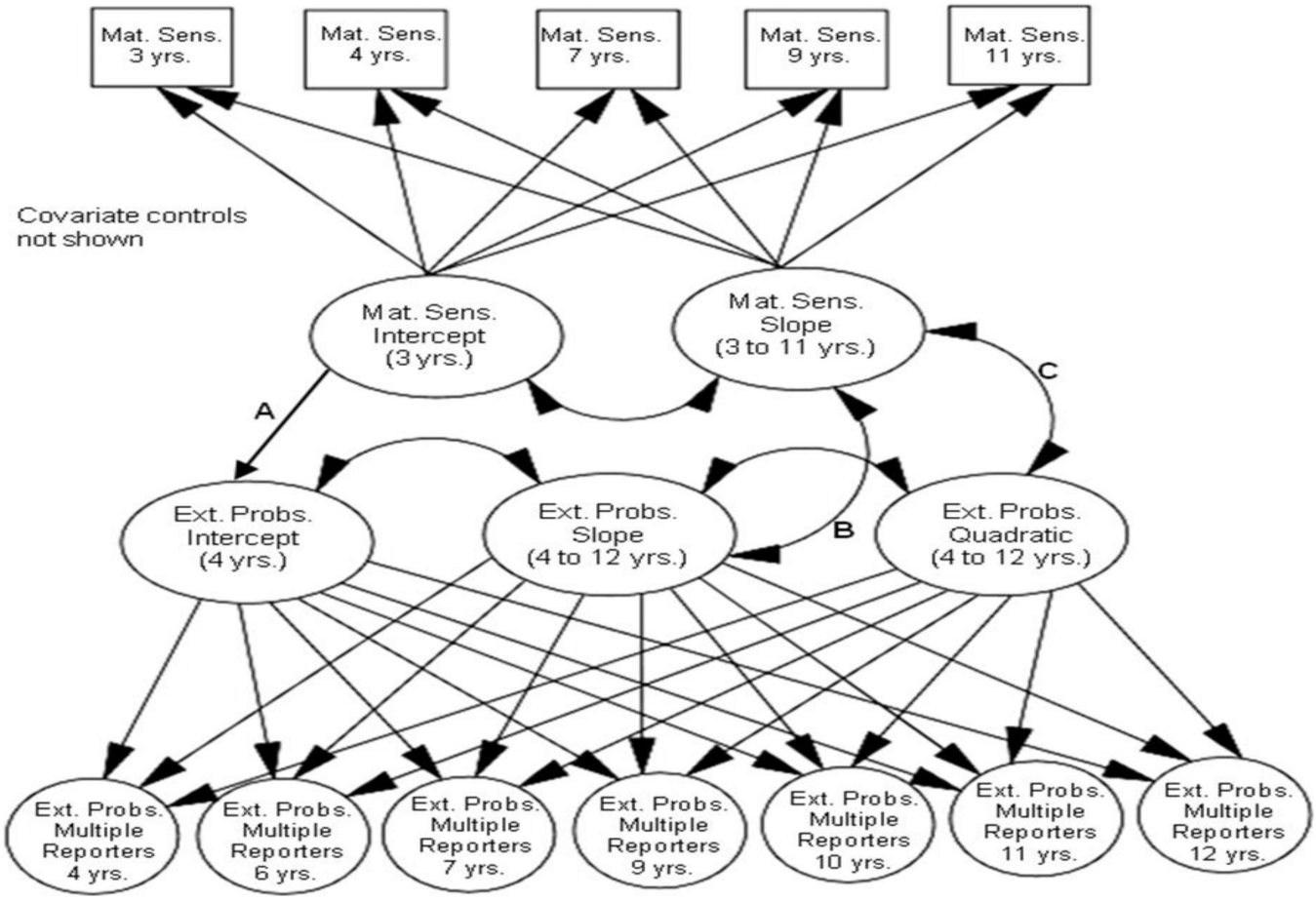

Figure 2.

Conceptual model for the parallel process between externalizing problems and maternal sensitivity. This is a model that simultaneously estimates the relationship between the trajectory of maternal sensitivity and that of externalizing problem trajectories. Maternal sens. = maternal sensitivity; Ext. Probs. = Externalizing behavior problems; yrs. = years.

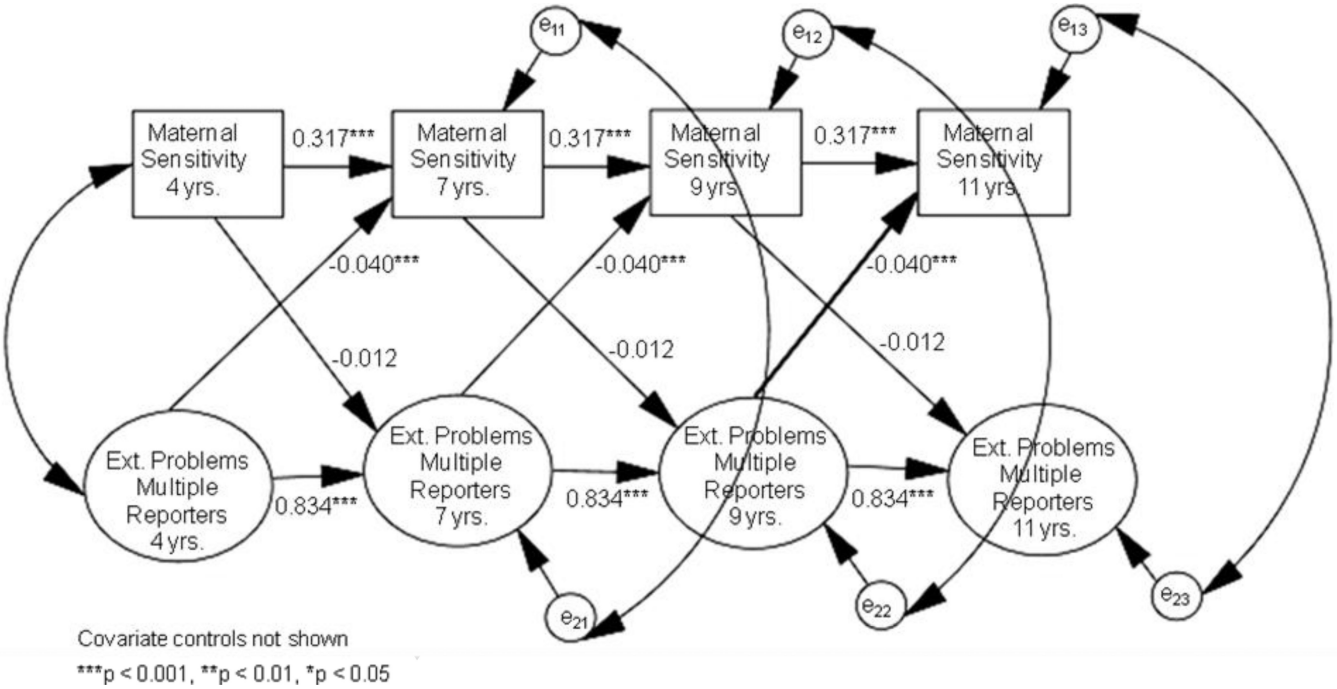

Figure 3.

The cross-lagged model between maternal sensitivity and externalizing problems. This is a model that estimates the reciprocal relationship between maternal sensitivity and externalizing problems over time. Yrs. = years. Ext. Problems = Externalizing Behavior Problems.

Table 1

Means/Proportions and Standard Deviations for Model Variables

Variables	*n*	*mean/ proportion*	*SD*	Variables	*n*	*mean/ proportion*	*SD*
Maternal Sensitivity				Male	1364	0.52	0.50
3 years	1161	17.19	2.78	White	1364	0.80	0.40
4 years	1040	16.95	2.91	Black	1364	0.13	0.34
7 years	1004	16.88	3.03	Other Race	1364	0.07	0.25
9 years	982	16.34	2.49	Income ($10,000)	1208	5.35	4.38
11 years	929	16.50	2.42	Mother's Education	1363	14.23	2.51
				Child Temperament	1279	3.18	0.40
Externalizing Behavior (Mother Report)							
3 years	1175	13.47	7.14	Maternal Depression			
4 years	1054	10.02	6.71	3 years	1202	9.22	8.31
6 years	1058	8.94	6.67	4 years	1077	9.83	8.70
7 years	1028	8.15	6.59	7 years	1009	8.39	8.47
9 years	1026	7.39	6.33	9 years	1026	9.08	8.85
10 years	1022	6.86	6.13	11 years	1019	8.73	8.62
11 years	1017	6.56	6.34	12 years	1023	8.96	8.82
12 years	1022	6.24	6.22				
				Maternal Harshness			
Externalizing Behavior (Father Report)				3 years	1179	0.15	0.23
4 years	798	9.62	6.42	4 years	1045	0.15	0.26
7 years	775	8.33	6.31	9 years	1006	0.15	0.23
9 years	751	7.00	5.80	11 years	1008	0.03	0.15
10 years	699	6.80	6.48				
11 years	756	6.15	6.67	Site			
12 years	724	6.21	6.70	Charlottesville, VA	1364	0.11	0.31
				Irvine, CA	1364	0.10	0.30
Externalizing Behavior (CG/Teacher Report)				Lawrence, KS	1364	0.10	0.30
4 years	768	9.96	11.93	Little Rock, AR	1364	0.10	0.30

Variables	*n*	*mean/ proportion*	*SD*	Variables	*n*	*mean/ proportion*	*SD*
6 years	1004	5.10	8.26	Madison, WI	1364	0.09	0.29
7 years	1008	5.63	8.18	Morganton, NC	1364	0.10	0.30
9 years	982	6.47	9.37	Philadelphia, PA	1364	0.10	0.30
10 years	914	5.70	8.95	Pittsburgh, PA	1364	0.10	0.30
11 years	927	6.07	9.19	Seattle, WA	1364	0.11	0.31
12 years	855	5.55	9.18	Wellesley, MA	1364	0.10	0.29

Table 2

Conditional Trajectory Model Sex Moderation Tests

	t(1)[a]	p
mean externalizing intercept	4.32	0.06
mean externalizing slope	−0.43	0.69
mean externalizaing quadratic	−0.02	0.88
	Wald(1)	
variance externalizing intercept	0.07	0.79
variance externalizing slope	2.41	0.12
variance externalizaing quadratic	3.55	0.06
	t(1)	
mean sensitivity intercept	−0.57	0.90
mean sensitivity slope	−0.39	0.37
mean sensitivity quadratic	0.13	0.08
	Wald(1)	
variance sensitivity intercept	3.83	0.05
variance sensitivity slope	0.00	0.97
variance sensitivity quadratic	0.60	0.44

Note. N_{boys} = 705, N_{girls} = 658.

[a]Test values are for girls versus boys.

Table 3

Covariate Effects on Maternal Sensitivity and Externalizing Behavior Trajectories

	Maternal Sensitivity Intercept			Maternal Sensitivity Slope			Externalizing Behavior Intercept			Externalizing Behavior Slope			Externalizing Behavior Quadratic		
Independent Vars.	B		SE B	B		SE B	B		SE B	B		SE B	B		SE B
Externalizing 36m	−0.034	***	0.009	0.001		0.002	0.600	***	0.024	−0.067	***	0.013	0.004	*	0.002
Black	−1.772	***	0.243	0.083		0.046	−1.182	*	0.557	0.464		0.292	−0.051		0.038
Other	−1.081	***	0.226	0.094	*	0.045	0.017		0.636	−0.381		0.288	0.045		0.039
Income	0.049	***	0.013	−0.001		0.003	0.060		0.038	−0.019		0.016	0.001		0.002
Maternal Education	0.289	***	0.025	−0.012	*	0.006	0.029		0.072	−0.065		0.035	0.004		0.005
Male	−0.172		0.106	−0.026		0.023	0.235		0.287	0.035		0.141	−0.004		0.019
Child Temperament	−0.052		0.133	0.047		0.028	−0.846	*	0.374	−0.013		0.192	0.015		0.026
Maternal Depression[a]	−0.014		0.009	−0.002		0.002	0.041	*	0.017	−0.001		0.010	0.000		0.001
Maternal Harshness[a]	−1.071	**	0.377	−0.216	***	0.062	1.513	*	0.627	0.821	*	0.386	−0.085		0.054

Note. N = 1,364. 36m = 36 months.

[a] the value of this variable was based on assessment at age 3.

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$.

Table 4

Correlations Among Trajectories from the Parallel Process Model (n=1,364)

		Maternal Sensitivity			Externalizing Behavior					
		Intercept	**Slope**		**Intercept**		**Slope**		**Quadratic**	
Maternal Sensitivity	Intercept	1.00	−0.48	***	−0.292[a]	*	*b*		*b*	
	Slope		1.00		*b*		−0.23	**	0.19	*
Externalizing Behavior	Intercept				1.00		−0.29	***	0.20	**
	Slope						1.00		−0.93	***
	Quadratic								1.00	

Note.

[a] This is a regression coefficient. All other coefficients are correlations.

[b] This parameter was not our primary interest and was thus not estimated in the parallel process models.

* $p < 0.05$,

** $p < 0.01$,

*** $p < 0.001$.

Table 5

Covariate, Autoregressive, and Cross-lagged Effects on Maternal Sensitivity and Externalizing Behavior Over Time (n=1,364)

	Maternal Sensitivity 7 years			Maternal Sensitivity 9 years[a]			Maternal Sensitivity 11 years[a]			Externalizing Behavior 7, 9, & 11 years[b]		
	B		**SE B**	**B**		**SE B**	**B**		**SE B**	**B**		**SE B**
Black	−2.407	***	0.316	0.170		0.252	−1.103	***	0.276	0.234		0.276
Other	−0.374	*	0.152							−0.315		0.233
Income ($10,000s)	0.034	***	0.009							−0.016		0.014
Maternal Education (years)	0.212	***	0.035	0.160	***	0.031	0.108	**	0.032	−0.051		0.028
Male	0.424	**	0.153	−0.630	***	0.133	−0.252		0.136	0.078		0.118
Child Temperament.	0.065		0.099							0.006		0.140
Mother's Depression prior measure	−0.009		0.006							0.049	***	0.010
Harsh Parenting prior measure	−0.757	**	0.254							1.003	*	0.453
Maternal Sensitivity 4 years	0.317	***	0.021							−0.012		0.032
Maternal Sensitivity 7 years				0.317	***	0.021						
Maternal Sensitivity 9 years							0.317	***	0.021			
Externalizing Behavior 4 years	−0.040	***	0.008							0.834	***	0.020
Externalizing Behavior 7 years				−0.040	***	0.008						
Externalizing Behavior 9 years							−0.040	***	0.008			

Note. N = 1.364.

[a] Some covariate effects are the same as for 7 years. They are stationary over time.

[b] All covariate effects are the same as for 7 years. They are stationary over time.

* p < 0.05,

** p < 0.01,

*** p < 0.001.