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Child Maltreatment and Children's Developmental Trajectories in Early- to Middle-Childhood

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Abstract

Associations between experiencing child maltreatment and adverse developmental outcomes are widely studied, yet conclusions regarding the extent to which effects are bidirectional, and whether they are likely causal, remain elusive. This study uses the Fragile Families and Child Well-Being study, a birth cohort of 4,898 children followed from birth through age 9. Hierarchical linear modeling and structural equation modeling are employed to estimate associations of maltreatment with cognitive and social-emotional well-being. Results suggest that effects of early childhood maltreatment emerge immediately, though developmental outcomes are also affected by newly occurring maltreatment over time. Additionally, findings indicate that children's early developmental scores predict their subsequent probability of experiencing maltreatment, though to a lesser extent than early maltreatment predicts subsequent developmental outcomes.

Each year, nearly 700,000 children are confirmed as victims of child maltreatment in the United States (U.S. Department of Health and Human Services [USDHHS], 2013), whereas the actual victimization incidence is believed to exceed one million children (Sedlak et al, 2010). Child maltreatment victims disproportionately exhibit a range of adverse outcomes during both childhood and adulthood. Although experiencing maltreatment is, itself, thought to adversely influence children's subsequent development, the actual impact of abuse or neglect on children's developmental trajectories and the ordering of these associations is difficult to estimate.

There are at least four possibilities that must be considered when examining associations between child maltreatment and child development. First, there may be a direct link from maltreatment to adverse developmental outcomes (De Bellis, 2001). Second, children's social-emotional and cognitive characteristics may directly influence the likelihood that they will be maltreated (Belsky, 1978). Third, maltreatment and poor developmental outcomes may be jointly co-determined by a similar set of factors or processes (such as poverty, parental functioning, and parenting quality), rather than one affecting the other. Fourth, child maltreatment and child development may be linked through an ongoing feedback loop, wherein suboptimal behaviors, abilities, or affect may predispose children to maltreatment

and, in turn, experiencing abuse or neglect may further adversely influence their behaviors, abilities, or affect (Bugental, Shennum, & Shaver, 1984). Each of these four hypotheses has received some degree of empirical support.

This study aims to further elucidate the dynamic links between child maltreatment and children's cognitive and social-emotional trajectories during early- and middle-childhood. Our analyses improve upon prior research in several ways. First, we used longitudinal data from the Fragile Families and Child Wellbeing Study (FFCW), which has, to date, followed children from birth to age 9. FFCW consists of a population-based sample of relatively disadvantaged urban families. It contains a three-to-one over-sample of non-marital births. As a consequence, children in the sample are disproportionately likely to be low-income, to have nonresident fathers, and to have mothers with low levels of education relative to children in a nationally representative sample. The sample is also racially diverse: nearly half of the mothers originally sampled identified themselves as African American and more than a quarter identified themselves as Hispanic. Thus, whereas the FFCW sample is not nationally representative, it is particularly well-suited for this study as it includes diverse sample of families with young children in low-income urban areas. Such families represent a large share of those that come to the attention of CPS; they are also disproportionately at risk for child maltreatment and poor developmental outcomes. The FFCW data allowed us to examine the evolution of child maltreatment and children's developmental trajectories using a large and diverse sample, which has rarely been possible in prior studies. FFCW also includes information about parental behaviors that approximate (specific types of) maltreatment as well as child protective services (CPS) involvement. This allowed us to examine associations of CPS involvement and parent-behavioral measures of maltreatment with aspects of children's cognitive and socio-emotional development.

Second, we employed two statistical approaches to examine the associations of interest. In a descriptive trajectory analysis, we used hierarchical linear modeling (HLM) to estimate associations of child maltreatment experiences with children's initial levels of cognitive and social-emotional functioning (at age 3), as well as with their developmental trajectories in these domains over the subsequent six-year period. By approaching the data as a series of time-specific observations nested within children, this strategy enabled us to leverage both within- and between-child variation in order to identify influences of maltreatment experiences on children's developmental trajectories over time. We subsequently used structural equation modeling (SEM) to explicitly examine the direction of associations of child maltreatment and child development by simultaneously estimating pathways in both directions and comparing effect sizes.

Conceptual Framework and Prior Research

Experiencing child maltreatment is associated with a range of adverse outcomes in childhood and adulthood (Institute of Medicine, 2013), in areas such as academic and cognitive performance (Mills et al, 2011), social-emotional and behavioral adjustment (English et al, 2005), and risky behaviors and depression (Arata et al, 2005). Multiple theoretical perspectives purport to explain these associations and how they may differ depending on the type(s) of abuse or neglect experienced. We focused on four of the most

common types of maltreatment: physical neglect, supervisory neglect, physical abuse, and emotional abuse (our data did not include information about sexual abuse, which accounts for just over 9 percent of CPS cases [USDHHS, 2013]; thus, its exclusion was a necessary limitation of the study). We also considered two global measures of maltreatment: whether a child experienced any parental behavior(s) that approximated abuse (physical or emotional) or neglect (physical or supervisory), and whether a child's family was investigated for maltreatment by CPS. Despite that CPS investigation is not a direct indicator that maltreatment has occurred, we included this measure because it is particularly relevant to both policy and practice, is a widely used proxy for child maltreatment, and constitutes a consequential life event for children and families.

Physical Neglect

Physical neglect consists of caregiver omissions or failures to provide for a child's basic needs in areas such as food and nutrition, housing, medical care, or education, for reasons other than poverty alone. Because physical neglect is defined by a child lacking adequate access to material resources that are crucial for healthy development, associations between physical neglect and adverse child outcomes may be attributable to similar experiences of instability and deprivation that are faced by poor children. Experiences such as unstable housing and inadequate nourishment, for example, can be both stressful and physically dangerous for children and, particularly if chronic, may compromise children's abilities to appropriately respond to the demands of their environments (Evans & Kim, 2013). Economic deprivation may also impact children through its effect on parents, who may respond with heightened hostility toward their children while under economic duress; such hostility may, in turn, induce negative affective and behavioral responses from children (Conger et al, 1994). Moreover, there is accumulating evidence that income and poverty may play a causal role in children's cognitive skills and academic achievement (Duncan, Morris, & Rodrigues, 2011).

Although physical neglect, as legally defined, constitutes the unwillingness or inability of a parent or caregiver to provide for the material needs of a child *for reasons other than poverty*, it effectively results in material deprivation. As such, we expected the effects of physical neglect to mirror the effects of poverty, which tend to be stronger with respect to cognition than social-emotional well-being (Brooks-Gunn & Duncan, 1997). A key mechanism for these effects is thought to be low-quality home environments, including inadequate housing and limited cognitive stimulation (Guo & Harris, 2000), each of which may constitute physical neglect in some circumstances. Existing empirical evidence supports this hypothesis: physical neglect is most strongly associated with poor academic performance (Manly et al, 2013). However, it is also associated with internalizing behavior problems (English et al, 2005) and depressive symptoms (Kim & Cicchetti, 2006).

Supervisory Neglect

Supervisory neglect frequently consists of both a caregiver action (e.g., domestic violence in the family home) and a caregiver omission (e.g., the child was not protected from exposure to the act), and broadly encompasses situations in which a parent is unable to adequately care for a child due to intoxication, allows a child to be exposed to criminal activity or

domestic violence, or leaves a child without an appropriate caregiver. Such inconsistent care may, in turn, induce children to develop anxious or ambivalent attachment styles (Finzi, Ram, & Shnit, 2001). Moreover, when distressed, children generally seek comfort from an attachment figure—if that figure is nonresponsive, children may be left in a state of heightened arousal, leading to anxiety and distress (Dutton, 2000), which may lead to compromised social-emotional development.

Few studies have investigated the consequences of supervisory neglect per se. However, there is substantial evidence that some circumstances—such as exposure to parental substance abuse (Osborne & Berger, 2009) and domestic violence (Evans, Davies, & DiLillo, 2008)—that constitute supervisory neglect are associated with adverse child outcomes. Other elements of supervisory neglect, such as exposure to criminal activity (drug sales, prostitution) have received scant attention, despite their inclusion in many states' child protection statutes (Child Welfare Information Gateway, 2011; 2012). Most prior studies have modeled a single category of child neglect, which includes both supervisory and physical neglect; yet, each may affect children differently. In particular, we expected physical neglect to be more closely linked to cognitive development and supervisory neglect more closely linked to social-emotional development.

Physical and Emotional Abuse

Physical and emotional abuse require overt actions by a caregiver which cause, or are likely to cause physical (bodily), psychological, or emotional harm to a child, often as a result of harsh or aggressive discipline or punishment. Each may disrupt parent-child attachment, which is a predominant pathway through which associations between maltreatment and social-emotional aspects of child wellbeing are believed to occur (Hankin, 2005). Secure attachment develops as a result of consistent, responsive, and sensitive care (Ainsworth, 1989). Abusive caregivers tend to be nonresponsive or punitive toward children. As such, experiencing abuse has been found to be associated with young children's insecure attachment orientation (Baer & Martinez, 2006) and, in particular, with avoidant or disorganized attachment (Cicchetti, Rogosch & Toth, 2006; Finzi et al., 2001). The consequences of attachment disruption are believed to include maladaptive behavioral and affective responses on the part of the child, particularly anxiety, depression, and externalizing behavior problems (Allen et al, 2007).

Scholars have further posited that emotional abuse may affect later well-being through maladaptive patterns of thought and belief pertaining to self-sacrifice, perceived defectiveness, shame, and vulnerability (Messman-Moore & Coates, 2007; Wright, Crawford, & Castillo, 2009). That is, emotional abuse may lead children to perceive themselves as unworthy of positive treatment, and these perceptions may manifest in depressive or anxious symptomology. Moreover, emotional abuse may evoke a fear of rejection from others which, in turn, could produce anxious or withdrawn social responses (Sneddon, 2003). Some physically and emotionally abused children cultivate internal models of relationships that include abuse-related elements or are maladaptive (Shields & Cichetti, 2001). Such responses are sometimes understood as traumatic reenactment such that victims (re)enact the role of either victim or perpetrator (van der Kolk, 1989).

Experiencing physical or emotional abuse may also evoke imitative behaviors (Bandura, Ross & Ross, 1961). This may be particularly relevant for children exposed to domestic violence, wherein the aggressive behavior of the abusive parent may be reenacted. At the same time, children are particularly prone to imitate the parent with whom they identify (Bandura & Huston, 1961). Thus, children identifying with an abused parent may display characteristics consistent with victimization (anxiety, fearfulness). For these reasons, we expected physical and emotional abuse to be more strongly linked to social-emotional development than to cognitive development. Consistent with this hypothesis, prior studies have identified associations between physical maltreatment and problems with aggressive, antisocial, and externalizing behavior (Maughan & Cicchetti, 2002), as well as mental health problems such as depression, withdrawal and anxiety (Kim & Cicchetti, 2006; Springer et al, 2007).

Operationalization of Child Maltreatment

Specific maltreatment subtypes may be differentially associated with (particular domains of) child development. Despite such evidence, however, there are also studies suggesting that maltreatment type may not be a crucial factor (Arata et al, 2005; Crozier & Barth 2005). Rather, given that many (if not most) maltreated children experience multiple types of abuse or neglect, the cumulative effect of (multiple types of) maltreatment may matter more than the specific type(s) experienced (Arata et al, 2005; Teicher et al, 2006). To this end, there is some evidence that prolonged or chronic exposure to maltreatment, irrespective of whether it consists of a single or multiple types of abuse or neglect, is associated with worse outcomes than exposure to fewer maltreatment events (Jaffee & Maikovich-Fong, 2011). The timing of maltreatment may also be important. Studies suggest that earlier onset is generally more strongly associated with adverse developmental outcomes (Kaplow et al, 2007), though findings diverge somewhat depending on the outcome of interest (English et al, 2005; Jaffee & Maikovich-Fong, 2011).

Associations between maltreatment and child development may also differ depending on whether maltreatment is operationalized by parental behaviors or by CPS involvement. Many prior studies have focused on CPS involvement. However, this strategy is limited in at least two ways. First, evidence from the National Incidence Studies (NIS) suggests that nearly two-thirds of child maltreatment incidents are not investigated by CPS (Sedlak, et al, 2010). At the same time, it is also known that some non-maltreated children are investigated by CPS (Waldfoegel, 1998). Second, particular types of maltreatment may be disproportionately reported. For instance, NIS estimates suggest that 60 percent of maltreated children are neglected, whereas CPS victimization rates suggest that 80 percent of cases are due to neglect (USDHHS, 2013). Similarly, emotional maltreatment is thought to occur frequently, but is rarely the primary focus of a CPS investigation, perhaps because it is difficult to establish (Chamberland et al, 2011; USDHHS, 2013). Consequently, CPS involvement and behaviorally-approximated maltreatment measures likely capture different, though overlapping, populations. Estimates using each may provide unique information about associations between maltreatment and child development.

Whereas studies using CPS-involvement and behaviorally-approximated maltreatment measures do not, in general, yield substantially different conclusions, researchers have rarely had the opportunity to compare estimates achieved using different maltreatment measures, but the same sample and model specifications. Furthermore, evidence regarding associations of specific maltreatment subtypes with particular domains of development is scant. The FFCW data allotted us the unique opportunity to explicitly examine the relative associations of multiple measures of maltreatment, including an indicator that a family had a CPS investigation, a behaviorally-approximated indicator of any maltreatment, and separate behaviorally-approximated indicators of four common subtypes of abuse and neglect, using the same model specifications and within the same sample. To the best of our knowledge, this has not been possible in prior work.

Bidirectionality of Associations between Child Maltreatment and Child Development

Another important consideration is that children's attributes and behaviors tend to affect their caregivers' behaviors. Belsky (1978) argues that explanatory models of child maltreatment must account for characteristics and behaviors of both perpetrators and victims. To bolster this theory, he notes that a single child is often the target of abuse or neglect within a family, suggesting that the maltreatment may be linked to distinct aspects of that child. For example, children with disabilities are at particularly high risk for maltreatment and to be victims of severe physical and sexual abuse (Hershkowitz, Lamb, & Horowitz, 2007). Likewise, children with behavioral disorders are at especially high risk of maltreatment, relative to both non-disabled children and to children with other health or cognitive impairments (Jaudes & Mackey-Bilaver, 2008). These patterns are thought to occur for several reasons. First, children who are difficult to parent are more likely to be maltreated and, on average, it is harder and more stressful to parent children with disabilities compared to non-disabled children. Second, children with disabilities may be more vulnerable targets for potential maltreatment perpetrators than non-disabled children because the former may be (perceived as) less able or likely to disclose abuse or neglect. Finally, caring for a disabled child may entail additional opportunities for neglect to occur—that is, for a child's physical, emotional, developmental, medical, educational, or supervisory needs to go unmet—simply because disabled children have greater and more complicated needs in these areas than their non-disabled counterparts (Ammerman, Lubetsky, & Stubenfort, 2000).

Whereas the vast majority of existing research has focused on estimating the effects of maltreatment on development, only a small body of research has examined the reverse pathways. Results from the few existing studies suggest that, in addition to disability, child characteristics such as difficult temperament, anxiety or withdrawal in early childhood, and limited verbal ability are associated with a greater risk of maltreatment (Brown et al, 1998). Moreover, some evidence suggests that behavioral problems frequently precede (rather than follow) maltreatment (Stouthamer-Loeber et al, 2001). Our analyses directly addressed these issues by modeling child maltreatment experiences and children's developmental trajectories over time, as well as by explicitly comparing the magnitude of the association of maltreatment with subsequent cognitive or social-emotional wellbeing to that of current cognitive or social-emotional wellbeing with subsequent maltreatment. Finally, we note that,

whereas, both abuse and neglect are known to vary considerably between children within a given family, abuse may be more strongly influenced by a child's characteristics and behaviors than neglect, which more so involves parental behaviors and resources that are household-based, rather than specific to a child.

Method

Data and Sample

We used data from FFCW, which includes a 20-city sample of urban births between 1998 and 2001. FFCW disproportionately consists of births to non-married parents, resulting in a relatively disadvantaged sample of families. To date, FFCW families were interviewed at the birth of the focal child and when the child reached ages 1, 3, 5 and 9. We made no exclusions to the original sample, thus retaining the complete set of 4,898 children. To account for missing data, we employed multiple imputation with chained equations. Specifically, we imputed 40 datasets using Stata's MI commands. Our primary models were estimated using fully-imputed data. However, because there is an ongoing debate about whether empirical models should be estimated using cases with imputed outcome variables, in supplemental models, we followed the strategy outlined in Von Hippel (2007) in which cases with missing outcome variables were excluded from the analytic models subsequent to the imputation. Results (not shown) show a high degree of similarity between both sets of estimates, such that our conclusions were not driven by the inclusion of cases with missing outcome values.

Measures

Cognitive skills and social-emotional wellbeing—We examined four outcomes, which collectively assess cognitive skills and social-emotional well-being (child behavior problems). Cognitive skills were measured by the Peabody Picture Vocabulary Test ([PPVT] Dunn & Dunn, 2007), which measure receptive and expressive vocabulary. The PPVT is a widely used developmental measure which has shown positive psychometric properties in a variety of contexts. Social-emotional wellbeing was assessed via three subscales of the Child Behavior Checklist ([CBCL] Achenbach, 2000). The CBCL is a measure of children's behaviors and competencies. It was completed by the primary caregiver, who, in the FFCW study, was most frequently the mother. We focused on two internalizing behaviors subscales: anxious and depressed behavior problems and withdrawn behavior problems. The anxiety and depression subscale measures concepts like self-consciousness, sadness, and clinginess, whereas the withdrawn subscale measures concepts like lack of responsiveness to affection, low activity level, and disinterest. We also used one externalizing behavior problems subscale, which tapped aggressive behaviors. It includes concepts like defiance, selfishness, and temper. Each CBCL item is measured on a three point scale, with response options of not true for this child, sometimes or somewhat true, and very true or often true. Subscale items vary somewhat by age, with different measures for ages 2 to 3 and 4 and over. We age-standardized each outcome measure in three-month intervals to have a mean of zero and a standard deviation of one. A description of these measures as well as the maltreatment measures is presented in Table 1.

Child maltreatment—Our key predictors consisted of two overarching indicators of maltreatment and four indicators of specific subtypes of maltreatment. The first overarching measure was a dichotomous indicator of whether a family had been investigated by CPS. This item was reported by the mother at the 5 and 9 year interviews, along with the date of the most recent contact. From the reported dates, CPS contact was attributed to the time spans preceding interviews at years 3, 5, or 9. However, given that respondents were asked for the dates of the most recent CPS contact only, CPS involvement at year 3 only captures those families who were investigated between year 1 and 3, but were not re-investigated between years 3 and 5. As such, we are likely underestimating rates of CPS involvement between each wave, which should bias our estimates toward zero, making them conservative in nature.

Our reliance on self-reports of CPS involvement is consistent with other analyses that have used large population-based samples (Nam, Meezan, & Danziger, 2006). Nonetheless, an important concern is that respondents may under-report. Unfortunately, neither administrative data nor CPS-related data from other reporters or observers is in the FFCW data. Under-reporting of CPS involvement, however, would bias our estimates toward zero. Additionally, existing evidence suggests that the self-reported CPS data in the FFCW study are consistent with CPS-involvement rates found among similarly disadvantaged populations based on both administrative (Slack et al., 2011) and self-report data (Berger & Brooks-Gunn, 2005). In short, whereas self-reported CPS involvement data and the potential that it is under-reported is a clear limitation of this study, we are encouraged by the fact that such under-reporting would serve to make our estimates conservative (lower bound) in nature, because they would be downwardly biased, as well as that existing evidence suggests that the self-reported rate of CPS involvement in the FFCW data is consistent with what would be expected given the sample's characteristics.

The second overarching maltreatment measure was a dichotomous indicator that a child had experienced any of four specific types of maltreatment: physical neglect, supervisory neglect, physical abuse, or emotional abuse. These subtypes and the overarching measure are approximations of maltreatment based on parental behaviors; items approximating each subtype were drawn from a variety of sections of the age 3, 5, and 9 FFCW parent interviews and, to a lesser extent, in-home observations by the interviewer. Each measured acts or circumstances which may have occurred in the 12 months preceding the interview. Physical neglect approximated whether the parent was unable to provide sufficient food or medical care for the child (both of which were drawn from the Parent-Child Conflict Tactics Scales [CTS] child neglect subscale; Strauss et al, 1998), whether the family was recently homeless or living doubled up, whether the family lacked utilities in their home, whether the family home was observed to have interior or safety problems, and whether the focal child was observed as having poor hygiene. Supervisory neglect was indicated by an affirmative response to any of four items, including whether the parent left the child home alone and whether the parent was too intoxicated from alcohol or other drugs to care for the child (both of which were drawn from the CTS neglect subscale), as well as whether the child was exposed to domestic violence in the home and whether the parent used hard drugs or used any non-prescribed drugs on a regular basis during the year before the interview. Emotional

abuse was assessed by a dichotomous indicator, also based on CTS items, of whether the parent had threatened to kick the child out of the house, called the child disparaging names, or swore at the child on three or more occasions in the past year. Lastly, physical abuse was approximated by a dichotomous indicator of whether the parent had engaged in the following behaviors: shaking the child at any point in the past year and hitting the child with an object on three or more occasions in the past year.

While these variables do not reflect legal thresholds for child maltreatment, per se, they are conceptually aligned with the major maltreatment subtypes. As CPS-reported maltreatment likely underestimates actual maltreatment rates (Sedlak et al, 2010), using behaviorally-based constructs may be useful in identifying a larger number of families at risk for maltreatment. Other studies have used similar measures of parent behavior to approximate maltreatment risk (Berger, 2007). It is important to note, however, that the behavioral measures approximating maltreatment used the 12 months preceding the interview as the reference period, whereas the reference period for CPS investigations was the period of time since the prior interview.

It is also important to recognize that, whereas the behaviorally-approximated measures assess identical caregiver actions or omissions throughout our sample, this is not necessarily true for CPS investigations. CPS administrative structures and policies vary considerably across the U.S. Forty states (including Washington, D.C.) operate state administered, centralized CPS systems; nine states operate state supervised, county administered systems; and, two states have implemented a hybrid model. Among the 15 states in which the 20 FFCW cities are located, 10 operate state administered, centralized CPS systems; 4 operate state supervised, county administered systems; and, 1 state has implemented a hybrid model. CPS policies may vary in terms of who is considered a mandated reporter, which acts or omissions require a report, and the level of evidence required in order to investigate or substantiate a case, including whether a state offers a differential or alternative response approach that allows families to receive a CPS assessment and (voluntary) services, without a formal investigation or substantiation decision. Among the 15 states in our sample, for example, all adults are mandated to report suspected acts of maltreatment in 6 states, whereas only specified categories of adults are mandated reporters in 9 states (Child Welfare Information Gateway, 2014). Furthermore, there is variation in which acts or omissions must be reported. Most notably, states vary in whether and under what circumstances parental domestic violence or substance abuse constitutes neglect (Child Welfare Information Gateway, 2011; 2012). In 10 of the FFCW states, a preponderance of evidence is required for a case to be substantiated, whereas 5 states use other standards. Also, in 2012, at least 7 of the FFCW states had a formal differential or alternative response track (USDDHS, 2013). As such, both the likelihood of and reasons for a CPS investigation may vary across the cities in our sample. This further highlights the importance of considering behaviorally-approximated maltreatment measures as well as official CPS involvement.

Covariates—We controlled for demographic characteristics that prior research has shown to be associated with both child maltreatment and children's developmental trajectories. These variables were measured at or prior to the age-3 interview, at which time the developmental outcomes of focus were first assessed. We included measures of the mother's

race (black, Hispanic, or other, with white as the reference category), educational attainment (more or less than a high school education, with high school diploma or GED as the reference category), an indicator that the mother was employed in the past year, and her age at her first birth. We also accounted for the number of adults and children in the home, the age of the youngest child in the home, and family structure. Family structure consisted of a set of dummy variables for married to the focal child's biological father (reference category), married to a social father to the focal child, cohabiting with biological father, cohabiting with social father, and single (neither cohabiting nor married). Economic status was measured by an approximation of long-term income, operationalized by the logarithm of the mother's mean household income from the child's birth through the age-3 interview, at which point the child outcomes were first assessed. Finally, we controlled for child gender and whether the child's maternal grandparents had a history of mental or emotional problems (an exogenous proxy for the mother's mental health status). Including these covariates in our models serves to adjust for the influences of early life contexts and experiences such as socioeconomic status (income, family structure) and familial mental health problems, which are known to be associated with both child maltreatment and poor developmental outcomes. For the HLM models, all items were included in the intercept equation, whereas a more parsimonious set of covariates was used in the slope equation—race, maternal grandparent history of mental or emotional problems, age at first birth, mother's education level, and age of youngest child. We do not included time-variant covariates, such as income and family structure, measured between ages 5 and 9 in any of our models, because these variables are likely to be endogenous to (jointly determined with) child maltreatment experiences and children's developmental outcomes. Our objective was not to parse out the portion of association between maltreatment and child development that reflects concurrent changes in family characteristics and circumstances, but rather to estimate the full or omnibus associations between the two after adjusting for initial characteristics and circumstances.

Analytic Approach

We employed two methods for modeling associations between child maltreatment and children's developmental outcomes. First we estimated hierarchical linear models (HLM), wherein time was used as a second level of analysis (Bryk & Raudenbush, 1992). This approach treats the data as a series of time-specific observations nested within children and leverages both within- and between-child variation in order to identify the influences of child maltreatment experiences on children's developmental trajectories over time. It allowed us to simultaneously estimate effects of maltreatment on both the intercept (baseline outcomes) and slope (change in outcomes) of the developmental outcome. That is, we estimated initial (age 3) outcomes as a function of maltreatment prior to age 3 and an extensive set of antecedent controls, as well as the change in outcomes as a function of maltreatment occurring between ages 3 and 9, with a more parsimonious set of exogenous controls. The level 1 HLM equation took the form:

$$Y_{ti} = \beta_{0i} + \beta_{1i} AGE_{ti} + \varepsilon_{ti} \quad (\text{Eq. 1})$$

where the outcome Y for child i at age t is a function of three components. β_{0i} is an intercept that represents the estimated value of Y at age 3. β_{1i} is a slope estimating the change in

outcome Y between ages 3 and 9, which maps linearly as a function of the child's years of age. ε_{it} is an individual level error term.

The main components of the level 1 equation are estimated as level 2 equations:

$$\beta_{0i} = \delta_0 + \delta_1 MAL_{0i} + \delta_3 COV_{0i} + \varepsilon_{0i} \quad (\text{Eq. 2a})$$

$$\beta_{1i} = \delta_{t0} + \delta_{t1} MAL_{ti} + \delta_{t3} COV_{ti} + \varepsilon_{1i} \quad (\text{Eq. 2b})$$

The intercept (Eq.2a) is predicted by maltreatment prior to age 3 and a set of characteristics that were measured at or before age 3. The slope (Eq.2b) is a function of maltreatment over time (between ages 3 and 9), and the parsimonious set of characteristics that are time-constant but estimated with time-dependent effects. Notably, while these models are used to identify the association between maltreatment and developmental outcomes within and across time, they cannot be assumed to produce causal estimates or to reflect the true direction of causality. The intercept estimates may be biased by omitted time-varying and time-invariant factors that are associated with both early child maltreatment experiences and initial levels of cognitive skills and social-emotional development, whereas the slope estimates may be biased by omitted time-varying factors as well as time-invariant factors that have time-varying influences on child development. Despite that children's developmental trajectories are modeled as a function of child maltreatment experiences, the true causal direction of the estimated associations cannot be ensured because maltreatment experiences and the developmental outcomes are measured simultaneously at each interview. Hence, it is not possible to establish which occurred first, a maltreatment experience or change in a child's developmental trajectory, in the period between consecutive interview waves. As such, we view these analyses as primarily descriptive in nature.

Our second set of analyses aimed to test the causal direction of links between child maltreatment and child development. To do so, we estimated structural equation models (SEM), wherein we cross-lagged the maltreatment indicators and developmental outcomes in order to gain insight into the direction of effects. That is, we tested whether the effects of maltreatment on subsequent developmental outcomes were equal to, greater, or smaller in magnitude than the effects of earlier levels of development on subsequent maltreatment. These models controlled for the extensive set of antecedent controls when estimating age-3 maltreatment and developmental outcomes. We assumed, however, that any influences of these antecedent factors on later maltreatment and developmental outcomes would have functioned through the initial (age 3) measures. The models also fully accounted for the intra-wave covariance of maltreatment and cognitive skills or behavior problems. Figure 1 depicts our full empirical model. The primary estimates of interest are indicated as pathways β_1 through β_6 .

Results

Descriptive Statistics

Descriptive statistics, for the full sample and by whether a child experienced behaviorally-approximated maltreatment (irrespective of CPS involvement), are shown in Table 2. Children experienced behaviorally-approximated maltreatment in 23 percent of child-wave observations. By contrast, they were investigated by CPS in less than 5 percent of child-wave observations. Again, however, we note that the FFCW data likely underestimate CPS involvement because the CPS items were asked at only two time points (ages 5 and 9) and, at each time point, respondents were asked the date of only the most recent investigation. This means that we could not identify families that had a CPS investigation prior to the age 3 interview and also between the age 3 and age 5 interviews. Such families would be coded as having had an investigation only between the age 3 and age 5 interviews; we would have missed the investigation that occurred prior to the age 3 interview.

In 5.6 percent of the child-wave observations in which a child experienced behaviorally-approximated maltreatment, he or she was also investigated by CPS, whereas children were investigated by CPS in 4 percent of the child-wave observations in which they did not experience behaviorally-approximated maltreatment. On the whole, approximately 49 percent of children experienced behaviorally-approximated maltreatment and 11 percent experienced a CPS investigation at some point between age 3 and age 9; about 13 percent of children who experienced behaviorally-approximated maltreatment also experienced a CPS investigation, whereas this was true of 10 percent of children who did not experience behaviorally-approximated maltreatment (not shown in table). By comparison, recent estimates suggest that approximately 9 percent of all U.S. children will have experienced a child maltreatment substantiation by age 9 (Wildeman et al., in press).

Children who experienced behaviorally-approximated maltreatment by age 9 exhibited lower average PPVT scores and substantially higher average levels of anxious and depressed, withdrawn, and aggressive behavior problems compared with non-maltreated children. They were also more socioeconomically disadvantaged. Their families had lower incomes and their mothers had lower average levels of education and employment, and were more likely to be black, single, to have had children at a younger age, and to have more children in their household.

HLM Results

Overarching maltreatment measures—Our descriptive HLM results, which focused on whether a child had experienced any behaviorally-approximated maltreatment or a CPS investigation, are presented in Table 3. The intercept coefficients are interpreted as the association of maltreatment in the year prior to age 3 with initial (age 3) cognitive skills or behavior problems. We found consistent and modestly large associations of behaviorally-approximated maltreatment with each of the outcomes. Experiencing any form of behaviorally-approximated maltreatment by age 3 was associated with a .08 standard deviation (SD) lower PPVT score as well as with .18, .15, and .21 SDs greater anxious and depressed, withdrawn, and aggressive behavior problems, respectively. By contrast, having

been investigated by CPS by age 3 was not significantly associated with age 3 developmental outcomes in any domain.

The slope coefficients are interpreted as the per-year effect of experiencing maltreatment between ages 3 and 9 on the outcome. Note, again, that the behaviorally-approximated maltreatment measure capture incidents occurring within 12 months of the interview, whereas the CPS-investigated maltreatment measure captures incidents occurring at any point between interviews. We found no association of either having experienced behaviorally-approximated maltreatment or having had a CPS investigation between ages 3 and 9 with children's cognitive skills trajectories during that time. However, both maltreatment measures were significantly associated with all three forms of behavior problems. For example, we found behaviorally-approximated maltreatment to be associated with a .06 SD increase, and having had a CPS investigation to be associated with a .05 SD increase, in anxious and depressed behavior problems per year. These estimates suggest that by age 9, children who experienced behaviorally-approximated maltreatment exhibited, on average, .38 SDs (.063*6 years) greater anxious and depressed behavior problems than those who did not and that those who experienced a CPS investigation experienced .28 SDs greater anxious and depressed behavior problems than those who did not.

Maltreatment subtypes—HLM results for the behaviorally-approximated maltreatment subtypes are presented in Table 4. Having experienced physical neglect was associated with poorer initial age 3 cognitive skills and behavior problems (intercept) as well as with poorer cognitive skills and behavioral problems trajectories between ages 3 and 9 with regard to each outcome. The intercept coefficients suggest that experiencing behaviorally-approximated physical neglect at about age 3 was associated with .11 SDs lower PPVT scores and .08 to .11 SDs greater behavior problems. The slope coefficients suggest that, by age 9, children who experienced behaviorally-approximated physical neglect had .17 SDs lower PPVT scores and .17 to .28 SDs greater behavior problems.

Experiencing supervisory neglect at approximately age 3 was not associated with children's initial (age 3) levels of cognitive skills or behavioral problems. Experiencing supervisory neglect between ages 3 and 9, however, was associated with increased behavior problems in each domain, though not with children's cognitive skills, during that time period. Experiencing physical abuse and emotional abuse were associated with greater initial and ongoing behavior problems in each domain. Whereas experiencing emotional abuse was not associated with initial or ongoing cognitive skills, experiencing physical abuse prior to age 3 was associated with lower initial (though not ongoing) cognitive skills.

SEM Results

Despite that our HLM analyses examine associations of maltreatment with both children's initial levels of cognitive and social-emotional development and their trajectories in these domains over time, we cannot be sure of the causal direction of these associations. That is, between each interview, it is unclear whether changes in developmental outcomes preceded or followed maltreatment experiences. In order to gain insight into whether associations of maltreatment with subsequent developmental outcomes are of equal, smaller, or larger

magnitude than associations of earlier levels of development with subsequent maltreatment—and thereby the likely causal direction of these relations—we estimated cross-lagged SEM models depicted in Figure 1. These results are displayed in Table 5 (for the overarching maltreatment measures) and Table 6 (for the behaviorally-approximated maltreatment subtypes).

Overarching maltreatment measures—The anxious and depressed behavior problems results for behaviorally-approximated maltreatment revealed that age 3 maltreatment was associated with greater behavior problems at age 5 (β_2) and also that age 3 behavior problems were positively associated with experiencing maltreatment in the year prior to age 5 (β_1). The same was true at ages 5 and 9 (β_6 and β_5). Yet, an examination of the coefficients suggests that, in each case, the association of earlier maltreatment with later anxious and depressed behavior problems was larger than the association of earlier anxious and depressed behavior problems with subsequent maltreatment. This same pattern was generally present across all of the models for all of the outcomes, although the coefficients were not always statistically significant. On the whole, this suggest that, although associations between maltreatment and child development are likely bi-directional, the larger effects appear to run from maltreatment to later adverse developmental outcomes, rather than vice versa.

Maltreatment subtypes—Results for the behaviorally-approximated maltreatment subtypes are presented in Table 6. For these analyses we combined physical and emotional abuse into a single category, rather than treating them as separate categories, because they co-occurred considerably (43 percent of those experiencing physical abuse also experienced emotional abuse and 11 percent of those experiencing emotional abuse also experienced physical abuse). For physical neglect, we found a somewhat inconsistent pattern of results across developmental outcomes. The associations of earlier physical neglect with subsequent cognitive skills and withdrawn behavior problems, for example, were larger than those of earlier cognitive skills and withdrawn behavior problems with subsequent physical neglect. Yet, differences in the magnitude of associations of physical neglect with subsequent anxious and depressed and aggressive behavior problems, and vice versa, were much less clear. The pattern of results for both supervisory neglect and physical or emotional abuse was clear: the magnitude of association from earlier maltreatment to the subsequent developmental outcome was consistently larger than that from the developmental outcome to subsequent maltreatment.

Discussion

The primary aim of this study was to provide evidence on the trajectories and ordering of associations of (particular subtypes of) child maltreatment with children's cognitive and social-emotional wellbeing during early- to middle-childhood. Our analyses extend prior literature by employing two analytical approaches—HLM and SEM—to estimate these associations using a nationally representative cohort of relatively disadvantaged urban children and families. We focused on one cognitive outcome (receptive and expressive vocabulary skills) and three social-emotional outcomes (anxious and depressed, withdrawn, and aggressive behaviors). Results from our descriptive HLM analyses suggest strong

associations of early childhood maltreatment with age 3 cognitive skills and behavior problems, as well as modest associations of maltreatment between ages 3 and 9 with children's cognitive skills and behavior problems trajectories during that portion of childhood.

Physical neglect was strongly inversely associated with cognitive skills and positively associated with behavior problems. This was true for both initial levels of each outcome and the trajectory in each outcome over time. Given that physical neglect is defined by deprivation of basic material needs, these findings are consistent with theories and prior empirical evidence regarding the effects of poverty-related conditions on cognitive functioning (Dahl & Lochner, 2012; Duncan, Morris, & Rodrigues, 2011). Existing theory and research have yet to fully elucidate why physical neglect would be strongly associated with adverse social-emotional outcomes, though one possibility is that chronic stress stemming from material deprivation may adversely influence emotional well-being (Evans & Kim, 2013).

Supervisory neglect was associated with increased anxious and depressed, withdrawn, and aggressive behavior problems. This lends support to theories linking inconsistent care with inhibited social-emotional development (Dutton, 2000; Finzi et al., 2001). It is also consistent with empirical evidence linking many of the factors that comprise supervisory neglect (parental substance abuse, domestic violence) with adverse social-emotional outcomes (Evans, Davies, & DiLillo, 2008; Osborne & Berger, 2009).

Both physical and emotional abuse were also strongly inversely associated with social-emotional wellbeing. These findings are consistent with theories and prior evidence suggesting that physical abuse may impede healthy parent-child attachment (Hankin, 2005) and, thereby, healthy emotional and behavioral development (Allen et al, 2007). They are also consistent with theory and evidence suggesting that emotional abuse may lead to the development of maladaptive perceptions and responses to one's environment which, in turn, are believed to impede social-emotional functioning (Messman-Moore & Coates, 2007; Wright, Crawford, & Castillo, 2009). In addition, the findings that emotional abuse and physical abuse were both strong predictors of initial and ongoing aggressive behavior problems is consistent with trauma reenactment models of behavior transmission (van der Kolk, 1989).

In sum, we found each of the individual maltreatment subtypes (physical neglect, supervisory neglect, emotional abuse, and physical abuse), as well as both of the overarching dichotomous maltreatment indicators (having experienced any form of behaviorally-approximated maltreatment and having experienced any CPS investigation), to be associated with modestly large increases in behavior problems between ages 3 and 9. This suggests that for children's social-emotional development, particular types of maltreatment may be less important than whether or not a child has experienced any form of maltreatment, whereas cognitive development may be more influenced by specific maltreatment subtypes. That both the behaviorally-approximated and CPS-investigated maltreatment measures were similarly associated with children's behavior problems trajectories may suggest that they are tapping related constructs. At the same time, the

overarching behaviorally-approximated measure of maltreatment experienced at about age 3 is associated with children's initial (age 3) levels of cognitive skills and behavior problems, whereas this is not the case for the CPS investigation measure. This likely reflects our inability to identify CPS investigations between ages 1 and 3 for families who were also investigated between ages 3 and 5. As such, the age 3 estimates for the CPS-involvement measure are likely to be biased toward zero. However, it is also possible that CPS investigations capture different risk factors or aspects of maltreatment than behavioral measures. It is well known, for instance, that certain subtypes of maltreatment, such as emotional abuse, are common in the population and yet unlikely to be the primary focus of a CPS investigation (Chamberland et al, 2011).

Finally, findings from our SEM analyses generally support the hypothesis that associations of earlier maltreatment with later social-emotional and cognitive development are greater than associations of earlier developmental factors with the likelihood of subsequently experiencing maltreatment, although the predominant direction of these associations is somewhat less apparent with regard to physical neglect. The most consistent effects of maltreatment appear to be early on and materialize fairly quickly—that is, maltreatment between ages 1 and 3 is more strongly associated with adverse outcomes at both age 5 and age 9 outcomes, than is maltreatment between ages 3 and 5 with age 9 outcomes. This is consistent with some prior work suggesting that early maltreatment is more impactful than later maltreatment (Kaplow & Widom, 2007) and that the effects are stronger or more easily detected in the short term (Leiter, 2007; Rowe & Eckenrode, 1999).

We also found evidence of bi-directional associations between maltreatment and children's development. That is, in many cases, both the association of maltreatment with the subsequent developmental outcome and the association of the earlier level of development with subsequent maltreatment was statistically significant. In general, a standard deviation decrease in PPVT scores, or increase in anxious and depressed, withdrawn, or aggressive behaviors at age 3 and 5 predicts a 2 to 3 percentage point increase in the probability of experiencing maltreatment in the year prior to the age 5 and 9 interviews, respectively.

Limitations

Several caveats should be considered when interpreting the results of this study. Of particular note are several limitations of the maltreatment measures we used. First, both the CPS-investigated and behaviorally-approximated maltreatment measures are reported by children's primary caregiver, and thus may be subject to social desirability (and, therefore, underreporting) bias as well as faulty or incomplete recollection of events. Unfortunately, relevant information from other reporters or observers is not available in the FFCW data (with the exception that the behaviorally-approximated physical neglect measure also includes some interviewer-observed items), nor is administrative data on CPS involvement. Fortunately, such under-reporting would have biased our estimates toward zero, making them conservative in nature.

Second, the FFCW study does not include maltreatment-related measures that would have triggered a mandatory report to CPS during the interview. As noted above, this means that

the behaviorally-approximated maltreatment measures may not meet legal thresholds for abuse or neglect. It also means that no behaviorally-approximated items on sexual abuse were included in the FFCW interviews. As such, we were unable to consider it in our behaviorally-approximated maltreatment measures. Sexual abuse accounts for about 9 percent of confirmed maltreatment cases (USDHHS, 2013). It may also have unique associations with child development, about which our results are silent. Third, the behaviorally-approximated maltreatment measures captured only those actions or omissions that occurred in the year prior to each interview despite that the gap between interviews ranges from 2 years (between age 3 and age 5 interviews) to 4 years (between age 5 and age 9 interviews). These measures also assessed only whether the particular actions or omissions had ever occurred in the year preceding each interview, they did not account for other important dimensions of maltreatment such as chronicity and severity. Furthermore, we had no behaviorally-approximated maltreatment information pertaining to the first 2 years of children's lives either.

Fourth, as previously discussed, CPS-investigated maltreatment was only measured at the age 5 and age 9 interviews and, at each time point, dates were provided only for the most recent investigation. Thus, we are likely underestimating the overall prevalence of CPS investigations and, in particular, recurrent and early contacts. Moreover, it is well known that many maltreatment incidents go unreported, and many reported incidents of maltreatment cannot be confirmed. Again, however, these limitations should all serve to bias our estimates toward zero, making them conservative in nature.

Fifth, there may be other important aspects of parenting behaviors and practices, such as parents' attachments styles, for which we were unable to account in this study. Future research should investigate a wider range of parenting styles, behaviors, and practices assessed at more frequent intervals during childhood. It should also seek to explicate the role of chronicity and severity of maltreatment vis-à-vis child development.

Sixth, child maltreatment statutes differ across states (Child Welfare Information Gateway, 2011) and the proportion of reports screened-in for investigation varies across states and by county within states (USDHHS, 2013). Thus, the probability of being reported to and screened-in for a CPS investigation is likely to differ in ways not attributable to family risk factors. However, the consistency of our results when the CPS measure and the behaviorally-approximated measures were employed is reassuring given that differences in local CPS statutes and practices would not affect the behaviorally-approximated measures.

In addition to concerns about the measurement of maltreatment, like all observational studies, our estimates may be subject to omitted variable bias. In particular, our estimates of initial (age 3) levels of maltreatment and child development may be biased by the omission of relevant time invariant and time varying factors. For example, the initial likelihood that a child is abused or neglected may be influenced by a parent's history of abuse or neglect, which was not measured in the FFCW study. Because we were able to adjust for children's initial levels of maltreatment and the developmental outcomes when predicting their later levels and trajectories (at ages 5 and 9) with regard to each, however, these latter estimates should be less vulnerable to bias by omitted time invariant factors (which should be captured

in children's initial maltreatment experiences and developmental outcomes). Yet, these estimates continue to be subject to potential bias due to omitted time varying factors that may influence associations between child maltreatment and child development. As such, our estimates should not be interpreted as causal in nature.

A final limitation is that our estimates are generalizable only to relatively disadvantaged children in relatively large cities. Indeed, a comparison of the FFCW sample to the Early Childhood Longitudinal Study-Birth Cohort sample, which is representative of all births to women age 15 or older in the United States in 2001, revealed that FFCW families had lower household earnings and income, lower levels of educational attainment, and were disproportionately African American (Wagmiller, 2010). That our results are generalizable only to disadvantaged urban families may be particularly relevant with regard to physical neglect, given potentially different dynamics of urban and rural material deprivation. For example, urban areas may have more services available to help families prevent prolonged homelessness or food insufficiency. Nonetheless, given the disadvantaged and urban families are disproportionately likely to come to the attention of CPS, this is an important population to study.

Conclusions and Implications

Our findings suggest that both behaviorally-approximated and CPS-investigated maltreatment are associated with adverse developmental outcomes. Indeed, although the behaviorally-approximated measures may not reach legal thresholds for maltreatment, they are as strongly and consistently associated with poor developmental outcomes as is having had a CPS investigation, if not more so. For the child development field, these results suggest that child maltreatment—whether assessed by CPS involvement or behavioral approximations—may play a key role in developmental outcomes for a substantial proportion of American children. Yet, prior research suggests that many maltreated children are not identified by CPS (Sedlak, et al., 2010). Thus, studies using official maltreatment reports may underestimate the proportion of children affected and, thus, the extent to which maltreatment may play a role with regard to adverse child developmental outcomes. Our results also imply that low scores on commonly used parenting assessment measures may be good proxies for studying child maltreatment using population based data, which rarely include measures intended to identify whether a family has crossed a legal threshold for maltreatment. This strategy offers the opportunity to expand beyond the ways in which child maltreatment has traditionally been conceptualized and, thereby, for a more diverse set of child maltreatment measures to be incorporated in a wider range of studies in the field.

Turning to implications for policy and practice, the CPS system's capacity to identify children at risk for maltreatment is unlikely to mitigate negative developmental outcomes, given that the majority of families who are identified by CPS do not receive any subsequent services to address their ongoing maltreatment-related risk factors or to mitigate the impacts of maltreatment that has already occurred (Berger & Font, in press). It is also important to recognize that (particularly unwarranted) CPS intervention can be traumatic and costly for parents and children alike.

Outside of the CPS system, communities can improve the availability and accessibility of maltreatment prevention services as well as services that address developmental deficits. Approaches that include universal screening mechanisms may be particularly useful. Universal screening has the potential to identify families at risk and provide them with service options without the stigma of CPS involvement. A well-known example of this approach is the Durham Family Initiative, which screened all pregnant women for maltreatment risk factors and then referred them to targeted services when particular needs were identified (see Dodge et al, 2004), or its second iteration, Durham Connects, which offers limited nurse home visiting services to families following a birth (Dodge et al, 2014). For this approach to be successful, however, communities must have an adequate array of services and the interagency coordination to avoid gaps or redundancies in services. Often, this is not the case.

Other options include comprehensive, multimodal models such as the Triple P Parenting Program (Sanders, 2008), which provide considerable opportunities to identify and serve at risk families who have not become involved with CPS. Triple P may be particularly relevant to addressing the bi-directional effects of maltreatment and development because it offers distinct levels of intervention for parents of children who have (or are at risk of developing) behavioral or emotional problems. Beyond widespread screening, such programs, which approach child maltreatment as a public health problem, have several additional advantages. To begin with, they rely heavily on partnering with existing community agencies and services, including early childhood care and education programs (Head Start, Early Head Start), family resource and support agencies, and medical clinics. Thus, they have the potential to reach a large number of families with young children. Relatedly, they are relatively non-stigmatizing, which may enhance family participation. They also address developmental issues in early childhood and beyond. As such, they may help to prevent child maltreatment as well as to minimize adverse developmental consequences once abuse or neglect has occurred. Home-visiting and parent training programs may also hold promise, though models vary considerably and these programs have a mixed record of success in preventing child maltreatment (for a review, see Berger and Font, in press). Unfortunately, these programs often suffer from low participation rates among eligible families, particularly in the absence of a universal screening mechanism. Even with universal screening, however, families at the highest risk of maltreatment may be difficult to engage and retain in services. Finally, the medical community may play a crucial role in the early identification and service referral for families at risk of maltreatment, as well as in service referral for children who have experienced maltreatment.

On the whole, this study provides new evidence on the influence of maltreatment on children's developmental trajectories. Moreover, findings suggest that not only do children's maltreatment experiences affect their developmental functioning, but also that children's cognitive and social-emotional capacities have some effect on their probability of experiencing maltreatment. This suggests that a unidirectional understanding of the effects of maltreatment on development may be insufficient, given potential interplay between maltreatment and development over time. Future research and interventions should aim to further examine and address these bi-directional pathways. In part, this will require ongoing efforts to incorporate child maltreatment measures into longitudinal studies of children and

families. Finally, despite limitations in our data with respect to measuring maltreatment prior to age 3, our findings suggest that links between maltreatment on development may be stronger in early childhood; thus, early intervention may be most beneficial for mitigating the adverse effects of maltreatment.

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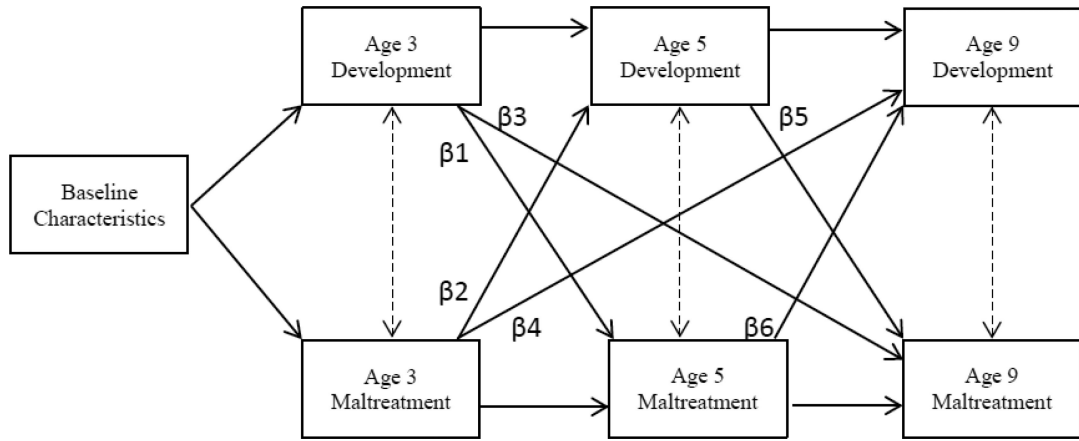


Figure 1.
Structural Equation Modeling Approach

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Table 1

Description of Cognitive Skills and Social-Emotional Wellbeing Measures and Child Maltreatment Measures

Measure	Domain(s) Assessed	Source(s) and Operationalization
<i>Cognitive Skills and Social-Emotional Wellbeing:</i>		
Cognitive Skills	Expressive and receptive vocabulary	Peabody Picture Vocabulary Test ([PPVT]; Dunn & Dunn, 2007); age standardized in 3-month intervals.
Social-emotional wellbeing: Anxious and depressed behavior problems	Self-consciousness, sadness, clinginess	Child Behavior Checklist ([CBCL] Achenbach, 2000); each item was measured on a three point scale, with response options of not true, sometimes or somewhat true, and very true or often true for this child; item scores were then summed to create a total score for the subscale. See Appendix (available from the authors) for the precise items included at each survey wave.
Social-emotional wellbeing: Withdrawn behavior problems	Lack of responsiveness to affection, low activity level, disinterest	CBCL (Achenbach, 2000); each item was measured on a three point scale, with response options of not true, sometimes or somewhat true, and very true or often true for this child; item scores were then summed to create a total score for the subscale. See Appendix (available from the authors) for the precise items included at each survey wave.
Social-emotional wellbeing: Aggressive behavior problems	Defiance, selfishness, temper	CBCL (Achenbach, 2000); each item was measured on a three point scale, with response options of not true, sometimes or somewhat true, and very true or often true for this child; item scores were then summed to create a total score for the subscale. See Appendix (available from the authors) for the precise items included at each survey wave.
<i>Child Maltreatment:</i>		
CPS involvement	Investigated by CPS since prior interview	Primary caregiver's report of whether the family had been contacted by CPS and, if so, the date of the most recent contact.
Any behaviorally approximated child maltreatment	Any abuse or neglect in the past 12 months	Dichotomous indicator that the family was coded affirmatively one or more of behaviorally-approximated maltreatment indicators (physical neglect, supervisory neglect, emotional abuse, physical abuse) described below.
Behaviorally approximated maltreatment: Physical neglect	Inadequate or unstable housing, medical neglect, child food insecurity, child hygiene problems	Parent Child Conflict Tactic Scales ([CTC-PC]; Strauss et al, 1998), as well as interviewer observations and other items in the FFCW surveys; 8 dichotomous indicators of various aspect of child maltreatment were summed to create a total score (range 0 to 8), which was then recoded such that families at or above the 90 th percentile (score of 3 or higher) were coded affirmatively for physical neglect. See Appendix (available from the authors) for precise items.
Behaviorally approximated maltreatment: Supervisory neglect	Inadequate supervision, substance abuse, criminal activity, exposure to domestic violence	CTC-PC (Strauss et al, 1998) and other items in the FFCW surveys; 6 dichotomous indicators of various aspect of child maltreatment were summed to create a total score (range 0 to 6), which was then recoded such that families at or above the 90 th percentile (score of 2 or higher) were coded affirmatively for supervisory neglect. See Appendix (available from the authors) for precise items.
Behaviorally approximated maltreatment: Emotional abuse	Threatening to kick child out of home, calling child names, swearing at child	CTC-PC (Strauss et al, 1998); families in which the caregiver reported doing at least 2 of the following were coded affirmatively for emotional abuse: ever called the child stupid, dumb or other names in the past 12 months, ever threatened to kick the child out of the house in the past 12 months, or swore at the child three or more times in the past 12 months.
Behaviorally approximated maltreatment: Physical abuse	Shaking child, hitting child with object	CTC-PC (Strauss et al, 1998); families in which the caregiver shook the child in the past 12 months and hit the child with an object three or more times in the past 12 months were coded affirmatively for physical abuse.

Table 2

Descriptive Statistics

	Full Sample		Behaviorally-Approximated Maltreatment				Sig
			No		Yes		
	M(SE)	%	M(SE)	%	M(SE)	%	
<i>Time-variant measures at ages 3,5, and 9</i>							
<i>Maltreatment:</i>							
Behaviorally-approximated maltreatment		23.11					
Physical neglect		10.00				43.26	
Supervisory neglect		10.00				43.26	
Emotional abuse		7.10				30.72	
Physical abuse		1.76				7.6	
CPS-reported maltreatment		4.38		4.00		5.64	**
<i>Cognitive skills and social-emotional development:</i>							
PPVT score (standardized)	.00 (.01)		.04 (.01)		-.14 (.03)		***
Anxious and depressed(standardized)	.00 (.01)		-.09 (.01)		.29 (.03)		***
Withdrawn (standardized)	.00 (.01)		-.08 (.01)		.27 (.03)		***
Aggressive (standardized)	.00 (.01)		-.11 (.01)		.35 (.04)		***
<i>Family characteristics at birth</i>							
Mother less than HS		30.24		30.44		29.60	ns
Mother more than HS		10.72		11.74		7.30	***
Black		47.61		46.80		50.30	*
White		20.94		21.98		17.49	***
Hispanic		27.50		27.63		27.09	ns
Other race		3.94		3.59		5.12	*
Child is female		47.56		47.77		46.86	ns
Age of mother	25.28 (.09)		25.34 (.10)		25.07 (.16)		ns
<i>Age 3 Family Characteristics</i>							
Single mother		38.77		37.62		42.58	***
Married to bio father		31.60		33.56		25.10	***
Married to social father		1.89		1.79		2.22	ns
Cohabiting with bio father		19.67		19.50		20.24	ns
Cohabiting with social father		8.07		7.54		9.86	*
Worked last year		67.60		72.07		52.72	***
Grandparents MH symptoms		32.15		31.46		34.47	*
# Adults in HH	2.07 (.02)		2.06 (.02)		2.08 (.03)		ns
# Children in HH	2.30 (.02)		2.28 (.02)		2.37 (.04)		*

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	Full Sample		Behaviorally-Approximated Maltreatment				Sig
			No		Yes		
	<u>M(SE)</u>	<u>%</u>	<u>M(SE)</u>	<u>%</u>	<u>M(SE)</u>	<u>%</u>	
Age of youngest child	2.05 (.02)		2.05 (.02)		2.08 (.04)		ns
Logged mean income (birth-to-3)	9.77 (.02)		9.85 (.02)		9.52 (.03)		***
Child-year observations	14,694		11,302		3,392		

Note: 14,694 child-year observations. Mean (and standard error) or percent are presented.

+p<.1

PPVT = Peabody Picture Vocabulary Test, CPS = child protective services

* p<.05

** p<.01

*** p<.001.

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Table 3

HLM Results for Overarching Maltreatment Measures

	PPVT		Anxiety/Depression		Withdrawn		Aggressive Behavior	
	Behaviorally-approximated	CPS-investigated	Behaviorally-approximated	CPS-investigated	Behaviorally-approximated	CPS-investigated	Behaviorally-approximated	CPS-investigated
<i>Intercept (age 3)</i>								
Maltreatment	-.078 [*] (.037)	-.048 (.088)	.180 ^{****} (.036)	-.040 (.088)	.151 ^{****} (.036)	-.007 (.083)	.210 ^{****} (.041)	.137 (.094)
<i>Slope (ages 3 to 9)</i>								
Maltreatment	.001 (.007)	.004 (.011)	.063 ^{****} (.007)	.047 ^{****} (.012)	.054 ^{****} (.007)	.033 ^{**} (.012)	.077 ^{****} (.007)	.056 ^{****} (.012)

Note: 14,694 child-year observations. Coefficients and standard errors from HLM (hierarchical linear modeling) estimations are presented. All of the family characteristics listed in Table 1 were used to predict children's initial levels of cognitive skills and social-emotional development. Controls for race, maternal grandparent history of mental/emotional problems, age at first birth, mother's education level, and age of youngest child were used to predict children's cognitive skills and social-emotional development slopes. PPVT = Peabody Picture Vocabulary Test, CPS = child protective services

+*p*<.1

* *p*<.05

** *p*<.01

*** *p*<.001

Table 4

HLM Results for Behaviorally-Approximated Maltreatment Subtypes

-	<u>PPVT</u>	<u>Anxious and depressed</u>	<u>Withdrawn</u>	<u>Aggressive</u>
Physical Neglect				
Intercept (Age 3)	-.111* (.046)	.093* (.043)	.105* (.048)	.077 ⁺ (.046)
Slope (Ages 3 to 9)	-.029* (.011)	.028* (.012)	.047*** (.012)	.033** (.011)
Supervisory Neglect				
Intercept (Age 3)	.006 (.056)	.092 (.059)	.036 (.057)	.100 (.062)
Slope (Ages 3 to 9)	.019 (.010)	.037** (.011)	.023* (.011)	.032** (.011)
Emotional Abuse				
Intercept (Age 3)	.031 (.058)	.303*** (.061)	.236*** (.062)	.374*** (.069)
Slope (Ages 3 to 9)	.005 (.008)	.071*** (.009)	.059*** (.009)	.110*** (.008)
Physical Abuse				
Intercept (Age 3)	-.172* (.083)	.178 ⁺ (.094)	.243* (.094)	.352*** (.095)
Slope (Ages 3 to 9)	-.016 (.017)	.059** (.021)	.036 ⁺ (.021)	.060** (.018)

Note: 14,694 child-year observations. Coefficients and standard errors from HLM (hierarchical linear modeling) estimations are presented. All of the family characteristics listed in Table 1 were used to predict children's initial levels of cognitive skills and social-emotional development. Controls for race, maternal grandparent history of mental/emotional problems, age at first birth, mother's education level, and age of youngest child were used to predict children's cognitive skills and social-emotional development slopes. PPVT = Peabody Picture Vocabulary Test

⁺
p<.1

*
p<.05

**
p<.01

p<.001

Table 5

SEM Results for Overarching Maltreatment Measures

	PPVT			Anxious and depressed			Withdrawn			Aggressive		
	Behaviorally - approximated	CPS - investigated	Behaviorally - approximated	Behaviorally - approximated	CPS - investigated	Behaviorally - approximated	Behaviorally - approximated	CPS - investigated	Behaviorally - approximated	CPS - investigated	Behaviorally - approximated	CPS - investigated
<i>Age 5 Maltreatment</i>												
β1: Age 3 Outcome	-.014 [*] (.006)	-.010 [*] (.004)	.025 ^{***} (.006)	.002 (.004)	.017 ^{***} (.006)	-.000 (.004)	.026 ^{***} (.006)	-.008 [*] (.004)				
<i>Age 5 Outcome</i>												
β2: Age 3 Maltreatment	-.138 ^{***} (.035)	-.029 (.109)	.123 ^{***} (.036)	.058 (.113)	.149 ^{***} (.036)	.278 [*] (.113)	.105 ^{**} (.034)	.323 ^{**} (.107)				
<i>Age 9 Maltreatment</i>												
β3: Age 3 Outcome	.004 (.007)	-.004 (.004)	.006 (.007)	-.002 (.004)	.004 (.007)	.006 ⁺ (.004)	-.002 (.007)	.000 (.004)				
<i>Age 9 Outcome</i>												
β5: Age 5 Outcome	-.015 [*] (.007)	-.001 (.004)	.030 ^{***} (.007)	.003 (.004)	.035 ^{***} (.007)	.003 (.004)	.040 ^{***} (.007)	.012 ^{**} (.004)				
<i>Age 9 Outcome</i>												
β4: Age 3 maltreatment	-.159 ^{***} (.035)	-.068 (.105)	.048 (.037)	-.073 (.112)	.054 (.037)	-.029 (.112)	.083 [*] (.036)	.042 (.109)				
β6: Age 5 maltreatment	-.003 (.032)	-.146 [*] (.060)	.055 (.034)	.120 ⁺ (.064)	.062 ⁺ (.033)	.046 (.064)	.050 (.033)	.135 [*] (.062)				

Notes: 14,694 child-year observations. Coefficients and standard errors from SEM estimations are presented. PPVT = Peabody Picture Vocabulary Test

⁺ $p < .1$

^{*} $p < .05$

^{**} $p < .01$

^{***} $p < .001$

Table 6

SEM Results for Behaviorally-Approximated Maltreatment Subtypes

-	<u>PPVT</u>	<u>Anxious and depressed</u>	<u>Withdrawn</u>	<u>Aggressive</u>
Physical Neglect				
<i>Age 5 Maltreatment</i>				
β1: Age 3 Outcome	-.015 ** (.005)	.022 *** (.005)	.023 *** (.005)	.020 *** (.005)
<i>Age 5 Outcome</i>				
β2: Age 3 Maltreatment	-.221 *** (.067)	-.002 (.067)	.116 ⁺ (.069)	.097 (.063)
<i>Age 9 Maltreatment</i>				
β3: Age 3 Outcome	.003 (.005)	-.002 (.067)	-.003 (.005)	-.012* (.005)
β5: Age 5 Outcome	-.015 ** (.005)	.054 (.057)	.011* (.005)	.016 ** (.005)
<i>Age 9 Outcome</i>				
β4: Age 3 maltreatment	-.264 *** (.065)	.000 (.005)	.033 (.066)	.038 (.064)
β6: Age 5 maltreatment	-.066 (.056)	.005 (.005)	.114* (.057)	.035 (.055)
Supervisory Neglect				
<i>Age 5 Maltreatment</i>				
β1: Age 3 Outcome	.003 (.004)	-.001 (.004)	-.003 (.004)	-.001 (.004)
<i>Age 5 Outcome</i>				
β2: Age 3 Maltreatment	-.042 (.083)	.232 ** (.084)	.169* (.086)	.116 (.079)
<i>Age 9 Maltreatment</i>				
β3: Age 3 Outcome	-.001 (.006)	.011 ⁺ (.006)	.004 (.006)	-.004 (.006)
β5: Age 5 Outcome	-.008 (.006)	.011 ⁺ (.006)	.017 ** (.006)	.003 (.006)
<i>Age 9 Outcome</i>				
β4: Age 3 maltreatment	-.145 ⁺ (.084)	.269 ** (.085)	.109 (.084)	.138 ⁺ (.080)
β6: Age 5 maltreatment	.116 (.080)	.062 (.081)	.119 (.080)	-.088 (.077)
Physical or Emotional Abuse				
<i>Age 5 Maltreatment</i>				
β1: Age 3 Outcome	-.002 (.004)	.012 ** (.004)	.008 ⁺ (.004)	.012 ** (.004)
<i>Age 5 Outcome</i>				
β2: Age 3 Maltreatment	-.119 (.086)	.301 *** (.018)	.037 (.089)	.138 (.085)
<i>Age 9 Maltreatment</i>				
β3: Age 3 Outcome	-.001 (.006)	-.003 (.006)	.006 (.006)	.005 (.006)
β5: Age 5 Outcome	.007 (.006)	.017 ** (.006)	.006 (.006)	.030 *** (.006)
<i>Age 9 Outcome</i>				
β4: Age 3 maltreatment	-.155 ⁺ (.088)	.109 (.090)	.197* (.088)	.299 *** (.085)
β6: Age 5 maltreatment	-.115 (.073)	.068 (.075)	-.012 (.073)	.044 (.073)

Notes: Sample size varies by model given that the sample each model was restricted such that comparison group is no maltreatment (rather than no maltreatment or another subtype of maltreatment). Coefficients and standard errors from SEM estimations are presented.

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PPVT = Peabody Picture Vocabulary Test

+
 $p < .1$

*
 $p < .05$

**
 $p < .01$

 $p < .001$

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