Associations among Adolescent Mothers' Environmental Stressors and their Children's Executive Function: Understanding the Role of Maternal Sensitivity

A thesis submitted by

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Abstract

Within my Master's thesis I explored the associations among the exposure to individual level and contextual level stressors early in life and children's executive function (EF) within a population of adolescent mothers. Specifically, I examined maternal sensitivity as mediating the relations between environmental stressors and children's EF. Participants comprising my thesis sample included adolescent mothers and their first-born children who were partaking in an evaluation of a home visiting parenting program, Healthy Families Massachusetts (HFM). Findings indicated that adolescent mothers' earlier sensitive parenting was positively associated with children's EF in early childhood. Additionally, my findings pointed to a non-significant trend between exposure to contextual stressors and children's EF. However, environmental stressors were not associated with maternal sensitivity. As there is a dearth of research examining the nature of the associations among stressors, sensitive parenting and EF for adolescent mothers and their children, my Master's thesis aimed to fill in these gaps in order to promote children's optimal EF development.

Keywords: stressors, maternal sensitivity, executive function, adolescent mothers, resilience

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Contemporary theories of human development move away from a reductionist stance, and instead take a relational perspective (e.g., Shonkoff et al., 2012). Within this view, development emerges from the mutually constitutive relations between children and their multiple contexts (Overton, 2015). In examining the emergence of children's self-regulatory skills, children's contexts can be considered as regulatory settings as young children have nascent coping abilities and are dependent upon external contexts for regulation (Bernier, Carlson, Deschênes, & Matte-Gagné, 2012; McClelland, Geldhof, Cameron, & Wanless, 2015). In addition, very young children are indirectly exposed to broader contextual factors within their most proximal context, the caregiving context, through processes such as parenting behavior (Bernier et al., 2012).

In situations of contextual adversity, the early caregiving context, here operationalized as the mother-child dyad, serves the roles of mediating children's broader stressors, providing external regulation, and acting as a setting for children's acquisition of executive function (EF, Blair et al., 2011). EF, as a construct, consists of three interrelated higher-order cognitive processes, working memory, cognitive flexibility, and inhibitory control (Diamond, 2014). These components of EF are associated with positive socio-emotional adaptation in adverse and unstable circumstances (Diamond, 2014; Masten, 2014). Thus, fostering EF development may promote resilient functioning or positive adaptation despite challenging or adverse circumstances (Masten, 2014).

Extant research is limited in considering the relations among EF, parenting, and broader stressors. For example, research in this field is primarily guided by reductionist

frameworks, which classify parenting behavior both as a static construct and as the mechanism through which early life stressors impact children's EF (Shonkoff et al., 2012). In taking this deficit-based view of caregivers as conferring the effects of stressors on children's development, the transactions among the existence of stressors in multiple levels of an individual's context, as well as the dynamism of the processes of parenting are downplayed.

In contrast, studies examining the same associations that are guided by a relational framework view parenting as an active process influenced by proximal factors, such as stressors within the individual context, as well as distal factors, such as stressors within the broader context. Further, studies guided by a relational framework more profoundly consider stressors that are present at numerous levels in children and parents' settings. Thus, taking a relational perspective acknowledges that the associations among stressors and children's EF are complex and protean, such as can be seen through the processes involving parenting behavior in relation to children's EF.

With a relational perspective, researchers, policymakers, and practitioners interested in examining the associations among parenting behavior and children's EF development in the context of environmental stressors can begin to move away from limited, reductionist constructs of parenting behavior, and instead move towards using more relational constructs. This acknowledges the complex transactions that co-occur between each level of the ecology of human development. Though researchers may not be able to fully empirically depict the complex transactions highlighted within a relational perspective, taking a relational approach to formulating research questions about to how to better support the development of children's EF more accurately captures

the complexity of these associations. From this broader theoretical perspective, researchers can then examine the same deficit-based questions of the role of broader adversity on children's development while also acknowledging the limitations of these questions due to the implicit understanding of the intricacies of the transactions that make up human development.

There is very little research that explores these complex relations among adolescent mothers and their children. As adolescent motherhood often co-occurs with stressors such as financial strain and residential instability (e.g., Mollborn & Dennis, 2012) understanding the stressors present for adolescent mothers and their children can allow policymakers and practitioners to more effectively develop strategies to buffer children against the experience of these stressors and in turn enhance children's EF for this particular at-risk population. Therefore, in this Master's thesis I argued for an examination of the complex associations between stressors in different layers of adolescent mothers' context, parenting behavior, and children's EF in a sample of adolescent mothers to support a deeper understanding of how to optimize EF for children in adverse contexts. Accordingly, the model presented in Figure 1 framed this work. This model illustrates the links among the broader ecology of human development and the caregiver-child relationship as they influence EF and, in turn, how EF impacts cognitive, behavioral, and socio-emotional outcomes. Through this frame, I hoped to provide a better understanding of whether adolescent mothers' sensitive parenting behavior, situated in the broader ecology of human development, mediated the associations between stressors at either the individual or contextual level, and their children's EF.

Using a relational developmental systems perspective, in the introduction to this

work I contend that the mother-child dyad serves as an important context to optimize EF in the presence of stressors embedded in multiple layers of an individual's context. Specifically, I describe research highlighting the impact of stressors on the mother-child dyad and subsequent EF development. Next, I discuss the interactionist perspective (Conger & Donnellan, 2007) as a theoretical framework to unpack the role of caregivers in contexts marked with adversity. I then used a relational developmental systems perspective (Lerner, Lerner, Bowers, & Geldhof, 2015; Overton, 2015) to discuss how extant research that considers the role of caregivers in adverse contexts (e.g., those containing numerous stressors) fails to consider the existence of stressors in multiple layers of an individual's contexts and the implications this may have then on understanding the associations among these stressors and the mother-child dyad. I conclude with a discussion of the need to further elucidate the role of caregiving context on children's EF, specifically considering an at-risk population of adolescent mothers and their children, and how this Master's thesis aims to fill in the gaps in this line of research.

Impacts of Environmental Stressors on Early Development

Within this section, I discuss research regarding the effects of exposure to stressors early in life and later neural development, specifically focusing on EF. As modern theories of child development consider development as emergent from the dynamic mix of genetic and environmental factors, aspects of the environment can be examined as potential influences of children's development trajectories (Shonkoff et al., 2012). Especially with the knowledge that the exposure to certain factors in the early care environment may lead to epigenetic processes that can alter gene expression (e.g.,

Meaney, 2001), taking the approach of probing children's broader contexts is key in understanding how to enhance children's development (Shonkoff et al., 2012).

Though epigenetic changes can be both beneficial, such as those resulting from exposure to enriching contexts (e.g., Meaney, 2001), contexts embedded with stressors, or aspects of the environment that invoke the stress response, may lead to detrimental epigenetic alterations that can impede optimal development (Evans, 2003; Grant et al., 2003; Shonkoff et al., 2012). Understanding stress as a biological construct can elucidate the mechanisms by which stress is harmful to optimal development. When the stress systems, particularly the hypothalamic-pituitary adrenocortical axis (HPA), are activated, the body is flooded with stress hormones such as cortisol, norepinephrine, and adrenaline (McEwen, 2007). The presence of these hormones redirects metabolic resources to activate the mechanisms of the stress response, as well as prepare for the eventual down-regulation of the stress system (McEwen, 2007).

This process of the activation of stress systems and return to baseline functioning is called allostasis (McEwen, 2007). When allostatic mechanisms are burdened by the continual presence of stressors—a situation called allostatic load— stress systems do not have adequate opportunities to disengage, creating a new baseline stress response which expects that stressors will consistently present (McEwen, 2007). Subsequently, situations of continual exposure to stressors lead to higher levels of circulating stress hormones which promotes maladaptive long-term stress responses, such as either an over- or under-activation of the HPA axis (Shonkoff et al., 2012). A maladaptive stress response is detrimental to developing systems, for as the body redirects metabolic resources in response to the activation of the sympathetic nervous system, resources are taken away

from other regions, such as in brain regions implicated in learning and memory (Fox, Levitt, & Nelson, 2010; McEwen, 2007). Continued activation of the inflammatory cortisol response alters brain circuitry; this process is documented in both animal studies and human neuroimaging studies with institutionalized and maltreated children (Evans, 2003; Fox et al., 2010; Lee & Sawa, 2015; Tottenham et al., 2010).

In light of the aforementioned neuroimaging work, the experience of chronic stress for young children can be understood as particularly detrimental, for developing brain regions can lack adequate resources needed for growth (Shonkoff et al., 2012). As a result of the negative impacts linked to the chronic experience of stressors and subsequent prolonged stress activation, researchers have given a name to this kind of stress experienced in early childhood, toxic stress (Center on the Developing Child at Harvard University, 2011). The experience of toxic stress is associated with later health disparities, conduct problems, and cognitive deficits (Fox et al., 2010; Music, 2011). Further, exposure to toxic stress can impact processes, such as EF, that are shaped by the social environment (Shonkoff et al., 2012).

EF in Early Life

In the following section, I discuss the processes that constitute EF, EF development, and the importance of fostering early life EF as a key component of resilience processes. EF, as a construct, consists of the interrelated higher-order cognitive processes underlying self-regulatory behavior (Diamond, 2014; McClelland, Geldhof, Cameron & Wanless, 2015). Self-regulation refers to conscious control processes that allow for the integration of information towards adaptive, goal-directed behavior and is implicated in resilient functioning across the life span (Masten, 2014; McClelland et al.,

2015). Fostering EF development in early childhood is essential as EF undergoes an extended maturation process in which brain pathways related to EF become increasingly diversified and efficient across time (Shonkoff et al., 2012).

It is important to support EF development in early childhood as the first period of proliferation of EF-related brain pathways occurs from birth to approximately three years of age (Shonkoff et al., 2012). Thus, individual differences in early EF can cascade and influence EF development at other sensitive periods of EF emergence such as in adolescence (Hook, Lawson, & Farah, 2013; Shonkoff et al., 2012). Accordingly, supporting early EF development can have lasting impacts on children's self-regulatory capacities and thus can enhance resilient functioning.

In adulthood, EF consists of three distinct but interrelated processes: working memory, cognitive flexibility, and inhibitory control (Zelazo et al., 2003). Though these processes exist in an emergent capacity in childhood, each component is not as differentiated as it is in adulthood (Wiebe et al., 2011; Wiebe, Espy, & Charak, 2008). Examining each of these components can explain why EF is implicated in positive adaptation in challenging or adverse circumstances. The dimension of working memory refers to the ability to retain and recall information when needed (Baddeley, 1992; Baddeley & Hitch, 1994; D'Esposito et al., 1998; Zelazo et al., 2003). Thus, it is used for complex processes such as planning (Diamond, 2014). Inhibitory control refers to the ability to resist impulses that may impede a present task (Diamond, 2014; Macdonald, Beauchamp, Crigan, & Anderson, 2014; Zelazo et al., 2003). This domain is then linked with self-control behaviors such as the adherence to social norms (Diamond, 2014). Finally, cognitive flexibility refers to the ability to alter behavior and thoughts when

appropriate such as due to a changed situation or different task demands (Center on the Developing Child at Harvard University, 2011; Zelazo et al., 2003). Implications of this domain are far-reaching, as cognitive flexibility allows for behaviors such as problem solving and social interactions (Diamond, 2014).

As a whole, EF is associated with abstract thinking, planning, and behavioral response flexibility that are related to positive adaptation in challenging and shifting circumstances (Diamond, 2014; Masten, 2014). Thus, fostering EF development may enhance resilient functioning among children living in adverse contexts (Masten, 2014). Charting the growth and development in the major components of EF can elucidate the roles that this set of processes plays in affecting a wide range of outcomes. EF matures in stages with rapid development first from birth to early childhood, and again in adolescence (Anderson, 2002). As the processes involved in EF are related to the increasing connectivity of the prefrontal cortex, which does not reach maturation until early adulthood, EF remains a nascent process throughout most of childhood (Lenroot & Giedd, 2011). Even more, the neocortical regions of the brain are experience-dependent, and thus form connections based on both biological inputs and external stimuli (Calkins & Fox, 2002; Calkins & Marcovitch, 2010; Diamond, 2002; Fuster, 2002). Given that the first period of proliferation of the EF pathways occurs from birth to about three years of age, experiences early in life can shift developmental trajectories to yield individual differences in EF later on (Grant et al., 2003).

As EF has a relatively prolonged maturation, with periods of stasis and periods of proliferation, the neuronal pathways implicated in optimal EF have numerous opportunities to be influenced by environmental factors (Fay-Stammbach, Hawes, &

Meredith, 2014). Specifically, infancy and early childhood are critical periods when the foundation for EF pathways begins to be laid down (Shonkoff et al., 2012). The experience of stress on the developing brain is one way in which events early in life may have lasting detrimental effects. As discussed previously, the experience of toxic stress can alter the connectivity of neural pathways leading to structural differences that contribute to individual differences in EF performance (National Scientific Council on the Developing Child, 2005). These individual differences have been theorized to widen over time, creating even greater lags in what is considered to be typical EF development, underscoring the importance in protecting against toxic stress (Shonkoff et al., 2012).

Certain contexts, such as those of children living in poverty, have been associated with numerous stressors, (Evans, 2003). Researchers have depicted a relation between economic strain and higher levels of resting cortisol in young children and subsequent impaired performance in measures of EF at 3 years (Blair et al., 2011). Even more, the theorized negative effects of high levels of basal cortisol, concurrent with the experience of poverty, on brain pathways related to EF have also been substantiated with neuroimaging studies (Hair, Hanson, Wolfe, & Pollack, 2015). These works demonstrate that children living below the poverty line have structural differences in brain architecture, such as smaller hippocampi, frontal, and temporal lobes, as well as overall less gray matter, which is associated with neuronal efficiency (Hair et al., 2015). Therefore, the contexts children experience in early in life may have lasting impacts on brain structures implicated in EF as well as EF related outcomes (Hook et al., 2013).

Examining Early Life Stressors

In this section, I discuss specific stressors young children may experience in their

early life contexts in light of the associations between stress and EF. Further, I discuss how the transactions among stressors present in numerous levels of a child's ecology can have cumulative effects for children. Next, I discuss how extant research fails to fully consider the stressors faced by adolescent mothers and their children. I then consider individual level and contextual level stressors associated with adolescent parenting.

In examining the negative relations between the endogenous experience of stress and development, the exogenous factors in a child's environment that induce stress, stressors, must be considered (Grant et al., 2003). Taking a relational perspective of development, stressors may appear in each level of a child's context, from distal, community level factors such as neighborhood violence, pollution, population density, and economic disadvantage, to more proximal factors, such as neglect, caregiver psychopathology, and household overcrowding (Blair et al., 2011; Evans, 2003; Evans & Kim, 2013; Fishbein et al., 2009; Grant et al., 2006; Leventhal & Brooks-Gunn, 2000; Yates, Obradovic, & Egeland, 2010). Though these stressors exist in varied proximities, children also interact with and shape the interplay of the various levels of their ecology (Sameroff, 2010). Thus, one stressor cannot be considered in isolation, as it is likely to interact with various other stressors, leading to a greater effect (Dong et al., 2004; Leventhal & Brooks-Gunn, 2000; Shonkoff et al., 2012).

Knowing that the confluence of stressors can negatively impact development, researchers have examined the relations between multiple levels of stressors and child outcomes. Numerous studies consider various stressors as risk factors and compiled them into risk indexes (Burchinal, Roberts, Hooper, & Zeisel, 2000; Evans, 2003; Lengua et al., 2014; Mistry, Benner, Biesanz, Clark, & Howes, 2010; Riley, Scaramella, &

McGoron, 2014). These studies consistently depict that a higher risk index early in life increases the likelihood of negative outcomes such as cognitive and social-emotional problems in middle childhood and adolescence (Brooks-Gunn & Duncan, 1997; Burchinal et al., 2000; Copeland-Linder, Lambert, Chen, & Ialongo, 2010; Hackman, Gallop, Evans, & Farah, 2015; Hall et al., 2010). Furthermore, there are settings where several risk factors are likely to be present, such as in the case of individuals experiencing poverty, and thus, researchers have explored the associations between of early life poverty experiences and children's development (e.g., Evans, 2003).

Though the contexts associated with poverty have been examined in relation to children's development, certain other situations that contain unique stressors have not fully been researched. For example, adolescent parents and their children face distinctive circumstances that yield particular stressors (Mollborn & Dennis, 2012). Even though some of the stressors associated with adolescent parenthood are similar to those experienced by adult parents in impoverished circumstances, researchers have not thoroughly explored the potentially unique stressors of adolescent parents.

Contextual stressors associated with adolescent parenthood. In the following section, I provide an overview of the context of adolescent parenthood as well as the stressors associated with adolescent parenthood at a broader contextual level. Adolescent parenting often occurs in contexts that are marked by numerous stressors at multiple levels of the ecology of human development (Mollborn & Dennis, 2012). When viewing the broader contextual factors that are associated with adolescent parenthood, research using the Early Childhood Longitudinal Study Birth-Cohort find that adolescent parents were highly overrepresented within the lowest 40% of the sample in terms of average

income and were more likely to be receiving welfare assistance or governmental subsidized housing (Mollborn & Dennis, 2012). These settings of disadvantage thus translate into negative outcomes for the children the adolescent parents experience greater food insecurity as well as less access to early learning and literacy materials compared with their peers (Mollborn & Dennis, 2012).

Additionally, the living conditions of adolescent parents and their children are often associated with distinctive stressors such as residential instability and neighborhood safety. When considering residential instability, Thompson, Bender, Lewis, and Watkins (2008) demonstrated that homeless and highly mobile youth were at disproportionate risk for becoming pregnant. Also, when considering the total population of highly mobile youth, Thompson and colleagues (2008) noted that a staggering 5 percent of homeless youth were also concurrently parenting. Furthermore, Moore, Vandivere, and Ehrle (2000) suggested that as periods of homelessness are likely to continue past pregnancy into children's early life, the stressors associated with residential instability may translate into emotional and behavioral problems for young children who experience homelessness early in life (Moore et al., 2000).

Another living arrangement stressor that is often experienced by adolescent parents is household overcrowding. Therefore, even among adolescent parents with stable living circumstances, living conditions can manifest as a stressor. In a report for the American Academy of Pediatrics, Pinzon and colleagues (2012) noted that adolescent parents disproportionally lived with their own parents as compared to adult parents. Further, adolescent parents living with their parents and their young children were likely to endorse their settings as being overcrowded (Pinzon et al., 2012). Household

overcrowding is consistently linked with negative socio-emotional for both adolescent parents as well as their children (Evans, Lepore, Shejwal, & Palsane, 1998).

Furthermore, another broader contextual stressor that is commonly experienced by adolescent parents is an unsafe neighborhood context (Pinzon et al., 2012). In a sample of adolescents in Minnesota, Kozhimannil and colleagues (2015) found significant associations between endorsements of unsafe neighborhood contexts and adolescent pregnancy. This work is supported by other studies demonstrating the associations between unsafe neighborhood contexts and adolescent parenthood (e.g., South & Baumer, 2000). As adolescent parents and their children reside in these unsafe neighborhood contexts, the experiences they have within them are important to consider as potential stressors. The experience of unsafe neighborhoods may directly impact young children who witness community violence and may also indirectly impact children through their caregivers' own experiences in the unsafe neighborhood context. Caregivers negotiating the threats from unsafe neighborhoods may be inhibited in their ability to respond to their children optimally, due to the cognitive burden of managing threats to safety (Bradley & Corwyn, 2002). This sub-optimal caregiving behavior may impact the emergence of systems underlying children's own self-regulatory capacities, such as EF (Bernier et al., 2012).

Individual level stressors associated with adolescent parenthood. In the following section I provide an overview of the proximal contexts of adolescent parenthood and associated individual level stressors. Taking a relational approach highlights the importance of examining individual and contextual stressors separately to acknowledge transactions between and the co-occurrence of these stressors. There are

several unique individual level stressors associated with adolescent parenthood and considering these stressors separately allows for a nuanced view of how to best buffer against the experience of stressors for adolescent parents and their children.

One example of a unique individual level stressor for adolescent parents is the act of parenting itself. Adolescent parents may experience disproportionate parenting stress, especially in light of both broader circumstances (e.g., unsafe neighborhood contexts) as well as the actual act of parenting as an adolescent (Larson, 2004; Mollborn & Dennis, 2012). The act of parenting may be especially stressful to adolescent parents for parenting occurs before the full maturation of the prefrontal cortex implicated in adult functioning (Berlin, Brady-Smith, & Brooks-Gunn, 2002; Mollborn & Dennis, 2012). As adolescent parents face the transition to parenthood during the life-stage where the normative developmental priority is the transition to adulthood, they must manage the burden of negotiating these two challenges simultaneously (Steinberg, 2000). These challenges may lead to a cognitive and emotional burden for adolescent parents which would allow for less energy to be devoted towards optimal parent child interaction and thus potentiating parenting stress (Berlin et al., 2002; Jacobs et al., 2015). The subsequent increased parenting stress may in turn impede parenting behavior, such that adolescent parents not only interact less with their children but also have less sensitive and more hostile interactions with their children than their non-adolescent parenting peers (Berlin et al., 2002; Mollborn & Dennis, 2012).

Another individual level stressor that may be unique to adolescent parents is intimate partner violence. Adolescent parents are more likely to have experienced intimate partner violence (IPV) as compared to their non-adolescent counterparts

(Halpern, Spriggs, Martin, & Kupper, 2009; Harrykissoon, Rickert, & Wiemann, 2002). Further, the experience of IPV can be detrimental to young children either through the direct witnessing of the act of violence or through its indirect effects by harsher or punitive parenting behavior (Easterbrooks, Katz, Kotake, Stelmach, & Chaudhuri, 2015). IPV is not a homogenous phenomenon as it can manifest as either physical or psychological abuse (Straus & Douglas, 2004). Making this distinction between psychological and physical aggression is important, for psychological aggression may be more prevalent than the act of physical violence, yet similarly detrimental to parents and their children (Easterbrooks et al., 2015). In a sample of adolescent mothers and their children, approximately 80% of the sample experienced psychological aggression while approximately 30% of the sample experienced physical assault (Easterbrooks et al., 2015). Further, both minor and severe psychological and physical IPV were associated with children's emotional and behavioral problems (Easterbrooks et al., 2015).

Another stressor commonly experienced by adolescent parents is low social support (Pinzon et al., 2012). In a report for the American Academy of Pediatrics, Pinzon and colleagues (2012) noted that first-time adolescent parents were likely to experience lower social support compared to first time adult parents. Furthermore, adolescent parents who experienced less social support were more likely to display punitive parenting behavior towards their children (Pinzon et al., 2012). Moreover, researchers also found lower levels of social support for adolescent mothers as compared to adult mothers in as sample of Canadian adolescent mothers (Kim, Connolly, & Tamim, 2014). In addition, adolescent mothers who experienced the least social support were increasingly likely to experience major depression (Kim et al., 2014). These findings linking low social support

among adolescent mothers to depressive symptomology are especially important in light of the knowledge that depression is a risk factor for non-optimal parenting behavior and even child maltreatment (Easterbrooks et al., 2013)**.**

Associations between stressors experienced by adolescent parents and children's development. Though the experience of environmental stressors may be more readily felt by adolescent parents, the children of adolescent parents also interact with and are influenced by the same stressors. Taking the experience of neighborhood safety, community violence may be directly experienced by the children who witness it and also indirectly experienced by caregivers' behavior in regards to the same stressor (Aisenberg & Herrenkohl, 2008; Kohen et al., 2008). A caregiver negotiating the threat of community violence may experience a cognitive burden in dealing with this stressor, and in turn may act in either a less responsive or overly protective towards his or child (Grant et al., 2006). Further, young children in particular require caregiver assistance in physical and emotional regulation (Sheridan & Nelson, 2009). When caregivers experience adversity, their role as regulatory conduits for their children may be compromised due to the cognitive and emotional burdens of dealing with adversity (e.g., Grant et al., 2006). Sub-optimal caregiving behavior may relate with the emergence of systems underlying children's own self-regulatory capacities, such as EF (Bernier et al., 2012).

Thus, the indirect experience of stressors through caregiving behavior can be examined as one of the pathways through which environmental stressors are associated with children's development. Despite studies depicting the lasting relations between the exposure to negative life events, it is also known that the exposure to beneficial experiences early in life can promote optimal EF, specifically when considering the

dynamic interaction of caregivers and children (Bernier et al., 2012; Glaser, 2000; Nelson & Bloom, 1997; Schore, 2001).

The Role of Parenting on the Development of EF in Early Childhood

Within this section, I explicate the interactionist perspective (Conger & Donnellan, 2007) as a theoretical framework to unpack the role of caregivers in contexts marked with adversity. Further, I discuss the construct of maternal sensitivity from a relational perspective, specifically in regards to its role as a mediator of children's broader stressors. Next, I discuss the need to elucidate the associations among broader stressors and the caregiving context in influencing EF. Finally, I conclude with the necessity of conducting studies examining stress, maternal sensitivity, and children's EF among adolescent mothers and their children, in order to learn how to best promote their children's EF development.

Using the interactionist perspective to understand the relations among parenting and EF in adverse contexts. The most proximal contexts for young children are the home and caregiver contexts (Kohen et al., 2008). Through these settings, the effects of broader geopolitical and social contexts are thought to filter down and interact with children (Bradley & Corwyn, 2002; Duncan, Brooks-Gunn, & Klebanov, 1994; Kohen et al., 2008; Yates et al., 2010). Analyses examining how children interact with community level stressors supports a filter down theory, for robust direct relations between broader environmental stressors and child outcomes are usually not supported; rather, indirect effects are supported through the role of the home environment which includes the caregiving relationship (Blair et al., 2011, 2014; Coley et al., 2013; Farah et al., 2010; Grant et al., 2006; Guo & Harris, 2000; Hackman et al., 2015).

One model applied to the role of the parent in promoting child outcomes is the interactionist perspective (Conger & Donnellan, 2007). The interactionist perspective acknowledges the postulations of the family investment model, which underscores the role of parents in providing physical resources in order to cultivate and foster optimal child development (Conger & Donnellan, 2007). These resources include physical expenditures such as money spent on food, housing, and learning tools needed for cognitive stimulation, but also resources such as a parent's investment of time with their child (Conger & Donnellan, 2007). This perspective holds that when a child receives more resources, better outcomes result (Guo & Harris, 2000; Linver, Brooks-Gunn, & Kohen, 2002; Mistry et al., 2010). In the experience of poverty where numerous stressors are present for a family, parents are presumably less able to invest physical or time resources (Conger & Donnellan, 2007). The interactionist perspective, however, integrates the postulations of the family investment model with the family stress model, which acknowledges the influence of parenting behavior as influencing children's developing systems (Carlson, 2009; Conger & Donnellan, 2007).

Within the interactionist perspective, contexts marked by numerous stressors like community violence or substandard housing, are considered as inducing strain for parents, which may hinder optimal parenting practices (Blair et al., 2011; Conger & Donnellan, 2007; Kohen et al., 2008). The presence of stress for parents can influence parenting behavior, for the effort devoted to dealing with a stressor leaves less effort to devote to parenting (Conger & Donnellan, 2007; Sampson, Morenoff, & Gannon-Rowley, 2002). In turn, parental behavior can become less responsive (Fox et al., 2010). As young children have not fully developed the means to self-regulate, they are

dependent on a caregiver; situations where caregivers respond inappropriately then induce stress for a developing child (Perry, Mackler, Calkins, & Keane, 2014; Sameroff, 2010). Knowing that EF development may be associated with social and environmental factors, using an interactionist perspective highlights the importance of examining caregiving behavior to promote optimal EF development.

Maternal sensitivity and EF development. The dimension of maternal sensitivity has been identified as strongly related to optimal EF (Carlson, 2003). Maternal sensitivity focuses on a parent's ability to respond to the cues of her child in an appropriate and contingent manner (Ainsworth & Bell, 1970; Carlson, 2003). Sensitivity plays a dual role by providing children a framework in which they can learn to self-regulate as well as to assist in the regulation of young children's stress response (Calkins, 2004). When parents act sensitively towards their children not only are they providing optimal input for EF development, but they are also managing threats such as the over-activation of the stress response (Gunnar & Quevedo, 2007).

When examining the role of sensitive parenting behavior, the experience of sensitive interactions with a caregiver can work to mitigate the associations between negative environmental factors and EF (Blair et al., 2014; Carlson, 2003; Grant et al., 2006). However, in light of the impacts of broader stressors on parenting behavior, sensitive parenting can be compromised in contexts marked with numerous stressors, leading to parenting behavior that may be more insensitive (Carlson, 2009). Non-optimal parenting behaviors such as insensitivity are linked to negative child outcomes including increased behavioral problems and compromised academic achievement in adolescence (Blair, 2010; FLP Key Investigators, 2013).

Parenting behaviors do not need to fall into the realm of severe insensitivity to be associated with negative child outcomes; normative variants in parenting behaviors can influence EF (Bernier et al., 2012; Hammond, Müller, Carpendale, Bibok, & Liebermann-Finestone, 2012). For example, Hane & Fox (2006) found that 9 month-old infants who received slightly less sensitive parenting displayed different patterns of frontal lobe activation than infants receiving slightly higher quality parenting. As the frontal lobes are implicated in the efficiency of EF processing, these findings underscore how sensitive EF is to variants in parenting behavior (Bernier et al., 2012; Hane & Fox, 2006). Bearing in mind the postulations of the interactionist perspective, the experience of stress places a burden on parents that hinders their ability to interact with their children in a sensitive and responsive manner. Even if these hindrances are minor, the resulting variants in parenting are important to consider in relation to the complex transactions that undergird the emergence of children's EF.

Taking a relational perspective towards the role of sensitive parenting and EF emergence. Knowing the role that parenting plays in fostering optimal development as well as conferring environmental effects, it is critical to unpack the role of maternal sensitivity in the presence of numerous environmental stressors as it relates to children's EF development. The caregiving context can be thought of not only as a setting through which the effects of the external setting may pass down to outcomes for children, but also as a context connecting broader environmental stressors more proximally to children (Grant et al., 2006). Positive and sensitive parenting in the context of economic disadvantage has been associated with attenuated negative influences of economic disadvantage on outcomes such as lower rates of problem behaviors in adolescence, in

relation to harsh, punitive and insensitive parenting (Chung & Steinberg, 2006; Copeland-Linder et al., 2010; Grant et al., 2005; Lengua, Honorado, & Bush, 2007). However, studies have found mixed effects when considering the relation between parenting and children's outcomes in adverse circumstances (Bates, Luster, & Vandenbelt, 2003; FLP Key Investigators, 2013; Grant et al., 2006; Riley et al., 2014). For example, some studies have not found robust associations between parenting and children's development in the presence of adversity, while others have uncovered strong relations between parenting and children's development among those experiencing exceedingly high levels of contextual risks (Bates et al., 2003; Riley et al., 2014).

One reason for the equivocal view of parents' roles in stressful contexts on children's EF is the fact that studies are limited by combining both individual level and contextual level stressors present for individuals (e.g., Riley et al., 2014). Taking a more a nuanced relational perspective may allow for a deeper examination of the dynamic transactions between factors at different levels of an individual's context. Even more, among the studies which examine the associations among broader stressors and children's EF, relatively few focus on dynamic parenting processes, such as maternal sensitivity as mediating these associations. As explicated earlier, maternal sensitivity may work to mitigate children's experience of stress, which in turn may promote children's EF. However, for mothers who experience numerous stressors, the cognitive and emotional burden of managing these stressors can lead to more insensitive parenting behavior, which, in turn, may also act as a stressor for children's developing EF systems. Thus, in order to best support the EF of children who grow up in highly stressful contexts, more work must be done to unpack these associations.

Furthermore, the associations among environmental stressors, sensitive parenting, and children's EF have not been fully explored for adolescent mothers and their children. Studies that examine EF development in stressful contexts often view adolescent parenthood as a stressor (e.g., Carneiro, Meghir, & Parey, 2013; Farah et al., 2010; Guo & Harris, 2000; Hall et al., 2010; Jeon, Buettner, & Hur, 2014; Lengua et al., 2014, 2007; Sarsour et al., 2011; Trentacosta et al., 2008; Wade, Moore, Astington, Frampton, & Jenkins, 2015). However, as explicated earlier, adolescent mothers often face unique circumstances and corresponding stressors that are not fully captured by labeling the experience of adolescent parenthood, on a whole, as a risk. Also, research that views adolescent parenthood as a stressor in and of itself often assumes homogeneity in the experiences and outcomes of adolescent parents and their children (Easterbrooks, Chaudhuri, Bartlett, & Copeman, 2011). In fact, examinations of the trajectories of adolescent mothers depict variability in outcomes, with some groups of adolescent mothers performing adequately or even optimally in the face of the considerable risks related with adolescent childbearing (Easterbrooks et al., 2011; Oxford et al., 2005).

Present Study

Given the limitations in the knowledge regarding the stressors faced by adolescent parents as and the role of parenting behavior in supporting their children's EF, I hope to illuminate these associations. Taking a relational developmental systems perspective, I described research focusing on the transactions between environmental stressors present within the ecology of the mother-child dyad and subsequent EF development. Further, using an interactionist perspective (Conger & Donnellan, 2007), I unpacked the roles of caregivers in context marked by adversity. Specifically, I discussed the unique

circumstances and stressors associated with to adolescent motherhood. Then using a relational developmental systems perspective, I discussed how extant research is equivocal on the role of parenting behaviors, such as maternal sensitivity, in the context of stressors.

Knowing that there are distinctive contexts and resultant stressors that may co-occur with adolescent parenthood, understanding the stressors present for adolescent mothers and their children can allow for an identification of contextual assets that may buffer against these stressors and in turn enhance children's EF. Therefore, in this Master's thesis I argued for a deeper examination of the complex associations between stressors in multiple levels of adolescent mothers' context, maternal sensitivity, and children's EF in order to support an understanding of how to optimize EF for children in adverse contexts.

Research Question

In this thesis, I addressed the following research questions within a population of adolescent mothers and their firstborn children.

- Research Question 1: Do adolescent mothers' sensitive parenting behaviors mediate the associations among individual level stressors experienced in infancy and children's EF in early childhood?
- Research Question 2: Do adolescent mothers' sensitive parenting behaviors mediate the associations among contextual level stressors experienced in infancy and children's EF in early childhood?
    - Hypothesis: I expected to find direct negative associations between both individual level stressors and maternal sensitivity, as well as between

contextual level stressors and maternal sensitivity. In addition, I also expected to find direct positive associations between maternal sensitivity and children's EF. Finally, I expected to find indirect effects of both individual and contextual level stressors and children's EF through maternal sensitivity.

Method

Participants and Procedure

My thesis sample consisted of adolescent mothers and their firstborn children enrolled in a longitudinal evaluation of Healthy Families Massachusetts (HFM). HFM is a voluntary statewide home visiting program for first-time parents under the age of 20 years old (Tufts Interdisciplinary Evaluation Research, 2015). As HFM aims to provide parenting support, participants in HFM are eligible for a wide range of services, including home visitation, goal-setting and group based activities, and referrals to other resources. Together, these service components address the five stated goal areas of the HFM program:

1. To prevent child abuse and neglect, by supporting positive, effective parenting;
2. To achieve optimal health, growth, and development in infancy and early childhood;
3. To encourage educational attainment, job, and life skills among parents;
4. To prevent repeat pregnancies during the teen years;
5. To promote parental health and well-being (Tufts Interdisciplinary Evaluation Research, 2015).

The participants for this thesis sample came from the second cohort of a

longitudinal evaluation of the HFM program, the Massachusetts Healthy Families Evaluation-2 (MHFE-2) and its early childhood follow-up evaluation, Massachusetts Healthy Families Evaluation-2 Early-Childhood (MHFE-2EC). MHFE-2 was a randomized controlled trial chartered to see whether HFM was meeting its goal areas (Tufts Interdisciplinary Evaluation Research, 2015). Accordingly, MHFE-2 collected information about program operations and the extent to which HFM was meeting the 5 program goals along with the contextual factors of the first time adolescent mothers enrolled in the evaluation in order to see the influence of these factors on program participation and outcomes (Tufts Interdisciplinary Evaluation Research, 2015).

MHFE-2EC is an on-going follow up to the original MHFE-2 study. This evaluation focuses on examining the longitudinal effects of the HFM program on mothers and children within the five main HFM domains. Information was collected about maternal characteristics and children's cognitive and socio-emotional development. Altogether, MHFE-2 and MHFE-2EC include five time points of data collection starting approximately one month after enrollment (T1), 12 months after enrollment (T2), 24 months after enrollment (T3), 72 months after enrollment (T4), and 84 months after enrollment (T5) (Tufts Interdisciplinary Evaluation Research, 2015). T1-T3 were part of MHFE-2; T4-T5 were part of the MHFE-2EC and collected extensive assessments of children's developmental functioning. This project used data from T2-T4.

A total of 837 participants were recruited (Tufts Interdisciplinary Evaluation Research, 2015). Participants were required to be at least 16 years of age, to not have received any home visiting services in the past, to be fluent in English or Spanish, and to be able to provide cognitively sound consent (Tufts Interdisciplinary Evaluation

Research, 2015). In order to assess program effectiveness, participants were randomly assigned to either the treatment group, which received home visiting services, (HVS, N = 517), or the control group, which received referrals to other services and information only (RIO, N = 320). However, 133 mothers either withdrew prior to data collection or were deemed ineligible, leaving a final study size of 704 (HVS, N = 417; RIO, N = 267) (Tufts Interdisciplinary Evaluation Research, 2015).

Upon enrollment in the evaluation, individuals were given two options for participation, leading the study sample to be further subdivided into "impact" and "integrative" samples. Regardless of study option, all participants completed a semi-structured intake phone interview focusing on information surrounding maternal family arrangements, finances, health, and usage of services, along with paternal involvement and child socio-emotional development and health. Additionally, researchers requested access for participant's state public agency data such as information from the Department of Children and Families (DCF), the Department of Elementary and Secondary Education (DESE), the Department of Public Health (DPH), and the Department of Transitional Services (DTA). Participants who only completed these portions of the study were classified as the impact sub-sample (Tufts Interdisciplinary Evaluation Research, 2015).

The other study option included the above data collection process as well as an in-home research interview. This option consisted of a semi-structured interview, written survey measures, and videotaped mother-child interactions (Tufts Interdisciplinary Evaluation Research, 2015). In addition, at T4 and T5 child assessments were done in order to examine children's social-emotional development as well as executive function. Participants who selected this option were part of the integrative sub-sample. Selected

study demographics, including sample sizes for the program and control groups, are provided in Table 1. Table 2 provides information about study attrition and the corresponding sample sizes for T1-T4 (Tufts Interdisciplinary Evaluation Research, 2015). In this thesis, I used data from the T4 child assessments as the primary outcome measure, thus my thesis sample size consisted of 326 integrative participants who had consented to child assessments.

Measures

Stressor indexes. Indicators for the stressor indexes came from the T2 intake and research interviews, when all participants were parenting. However, data were only used if participants had T4 data as well. Accordingly, the stressor indexes were limited to the T4 sample of 326 integrative participants. The creation of the stressor index followed a procedure similar to that outlined by Burchinal and colleagues (2000), Evans and colleagues (2013), Trentacosta and colleagues (2008), and Riley and colleagues (2014). Stress and risk indexes are often used to overcome multicollinearity among individual stressors (Burchinal et al., 2000; Evans et al., 2013). Critiques of stressor indexes focus on the loss of information from the reduction of data into a single score; however, in studies where the number of stressors is not the primary outcome of interest, indexes are equally predictive as factor scores (Burchinal et al., 2000; Evans et al., 2013). Additionally, the use of a stressor index is appropriate when sample sizes are moderate to large, which is the case for this project (Burchinal et al., 2000). For this thesis, stressors were separated between individual level stressors and contextual level stressors. Thus, the following sections detail the T2 indicators used in index creation.

Individual level stressors. Individual level stressors consisted of measures from

the T2 research interview. Specifically, maternal self-reported parenting stress, intimate partner violence, and social support were included in the stressor index. Within the following section, I provide greater detail about each survey measure utilized.

Parenting Stress Index Short Form (PSI-SF). The PSI-SF is a 36-item survey designed to examine the levels of participants' perceived parenting stress (Abidin, 1995). Participants indicated the extent to which statements related to the stress of parenting applied to them (e.g., "I feel trapped by my responsibilities as a parent; having a child has caused more problems than I expected in my relationship with my partner") (PSI-SF; Abidin, 1995). Participants answered on a five point scale: (1) strongly disagree; (2) disagree; (3) neutral; (4) agree; (5) strongly agree (PSI-SF; Abidin, 1995). The measure yielded a total sum score as well as three subscale scores: parental distress, difficult child; parent-child dysfunctional interaction (PSI-SF; Abidin, 1995). For my thesis analyses, I used the overall sum score in stressor index creation.

In terms of psychometrics of the PSI-SF, adequate test retest reliability has been established (α=.68-.85) as well as very good internal reliability (α=.80-.95) in a multitude of studies (Abidin, 1995; Haskett, Ahern, Ward, & Allaire, 2006). Further, as this measure is utilized in numerous studies in conjunction with other measures of stressful function, the PSI-SF demonstrates strong convergent and predictive validity (Abidin, 1995; Haskett, Ahern, Ward, & Allaire, 2006).

Personal Network Matrix (PNM). This measure provided an indicator of maternal perceived social support. The PNM is a 48-item questionnaire designed to examine and assess participants' social support networks (Trivette & Dunst, 1988). The first part (Form A) provided participants with 24 potential sources of social support (e.g.,

family, friends, social agencies) and prompted participants to indicate how much frequency they had with each support source in the past month: (1) not at all; (2) once or twice; (3) at least 10 times; (4) at least 20 times; (5) almost every day. The second form (Form B) provided participants the same 24 sources of social support and asked participants to indicate how much they felt that they could depend on each source: (1) not at all; (2) sometimes; (3) occasionally; (4) most of the time; (5) all of the time. Four subscales were calculated: breadth of social circle, which was a count score of all the sources in Form A that the participant reported as having some contact with; frequency of contact, which was a sum score of the frequencies endorsed in Form A, including those that were endorsed as not applicable; depth of social circle, which was a mean score of the frequencies endorsed in Form A, excluding those that were endorsed as not applicable; and dependability of social support subscale, which was a mean score of the dependability ratings in Form B that were applicable given participants' Form A responses. For my thesis, I used the dependability of social support subscale in order to calculate mothers' perceptions of social support.

The PNM measure has neither been extensively validated nor examined for external reliability; further, the summary scores detailed earlier were created by MHFE analysts. Despite this fact, the measure demonstrated adequate internal reliability for the dependability of social support subscale (α=.72).

Conflict Tactics Scale- Partner Revised Short Form (CTS2S). The indicators of intimate partner violence came from the CTS2S survey administered at T2. This survey consisted of 20 items that probed the degree to which couples experienced different types of intimate partner violence (e.g., psychological assault, physical assault, sexual assault)

(Straus & Douglas, 2004). Participants were asked to differentiate between the perpetrator of each act (e.g., self or partner), the number of times each act occurred in the past year (e.g., once, twice, 3-5 times, 6-10 times, 11-20 times, and more than 20 times), and if the act had occurred in the past but not in the past year. Subscales were divided by types of intimate partner violence, perpetrator of violent act, severity of violence, prevalence of violence, and chronicity of violence (Straus & Douglas, 2004). For this thesis, the past year prevalence of partner-perpetrated psychological aggression and physical assault subscales were used to capture the heterogeneity of the experience of intimate partner violence (Dixon & Browne, 2007). The CTS2S was validated against its long-form counterpart, the Conflict Tactics Scale (Straus, Hamby, Boney-McCoy, & Sugarman, 1996) and demonstrated strong correlations in the expected directions between the shortened subscales on the CTS2S and the long-form version (Straus & Douglas, 2004). Further, within the MHFE sample, the full measure has adequate internal reliability (α=.84).

Contextual Level Stressors. Contextual level stressors consisted of measures from the T2 intake and research interview. Specifically, items assessing household overcrowding, and residential mobility, from the intake interview questions were used, while financial strain and neighborhood safety, from the research interview surveys, were used. The following section discusses these indicators in greater detail.

Family Resources Scale (FRS). This measure was used as a marker of financial difficulty. The FRS asked participants about their perceived adequacy of their household resources. There were 31 items addressing adequacy of economic resources (e.g., food), support (e.g., with childcare), and personal resources (e.g., time for oneself). Participants

answered on a five point scale: (1) not enough; (2) seldom enough; (3) sometimes enough; (4) usually enough; (5) almost always enough (FRS; Dunst & Leet, 1985). A total score of perceived financial resource adequacy was created by summing the following items asking about having enough money for: food for two meals a day, house or apartment, money to buy necessities, enough clothes for your family, heat for your house or apartment, indoor plumbing/water, money to pay monthly bills, medical for your family, dependable transportation (own car or provided by others), furniture for your home or apartment, telephone or access to a phone, money to buy special equipment/supplies for child, dental care for your family, and toys for child (FRS; Dunst & Leet, 1985). Additionally, the measure creators proposed using cut-off adequacy score, based on a sample standardized score, that divided respondents into adequate or below adequate.

Internal reliability for the original FRS measure was established in a sample of 45 mothers of preschoolers enrolled in Early Intervention (Dunst & Leet, 1985). The measure demonstrates strong internal reliability (α=.92) as well as adequate test-reliability in a 3 month testing interval (α=.52) (Dunst & Leet, 1985). Within the MHFE sample, the measure has demonstrated adequate internal reliability, α=.84.

Neighborhood Social Capital Scale (NSCS). The indicator of neighborhood safety came from the Neighborhood Social Capital Scale (NSCS*)* from T2. The NSCS was created by MHFE to assess participants' perceptions of their community safety, resources, and connection. For this thesis only the questions assessing neighborhood safety were used (e.g., "How safe do you feel living in this area"; "How safe do you feel walking alone in this area during the daytime"; "How safe do you feel walking in this

area after dark"). For these questions, participants responded on a scale of 1-5: (1) very safe; (2) fairly safe; (3) a bit unsafe; (4) very unsafe; (5) don't know. As this survey was created by MHFE staff, extensive validation has not been conducted. However, in assessing the neighborhood safety questions used in this thesis, the measure demonstrates strong internal reliability (α=.98).

Intake Questions. The indicators of household crowding and residential instability came from the intake interview at T2. In terms of household crowding, mothers were asked to endorse whether they considered their housing situation crowded or not (0= No, 1 = Yes). For the marker of residential instability, mothers were asked how many places they had lived in the past year, and were given the choice of choosing either between 1-10, or 10, 20, or greater than 20.

Child EF measures. This project used four measures from the T4 child assessment to construct a latent measure of EF. Details on model specification are discussed in the results section. The child tasks were designed to tap into multiple variants of EF and are discussed in detail in the following section.

Corsi block-tapping task. This task assessed children's working memory and cognitive flexibility from a visospatial domain (Corsi, 1972). Children were presented nine plastic cubes, with numbers facing the examiner. The task, in turn, consisted of two conditions: the Corsi Block Task and the Backward Corsi Block task. In the Corsi Block Task, examiners tapped the blocks in a predetermined sequence while children observed. Then children were asked to replicate the correct sequence of taps. In the Backward Corsi Block task, children were asked to replicate the sequence in the reverse order of the examiners' taps. In both tasks, as children correctly reproduced sequences, the task

progressed in difficulty (e.g. adding an extra tap to the sequence). Both tasks were made up of levels, with two sequences per level. The number of blocks tapped per level in the Corsi Block-Task started with two and went to nine, while Backward Corsi- Block also started with two but went to eight (Corsi, 1972).

In both tasks children needed to get one out of two sequences correct to move to the next level. All together, the task consisted of 30 trials: 16 on the Corsi Block Task and 14 on the Backward Corsi Block Task (Corsi, 1972). A proportion score for each task was calculated to reflect the highest level of blocks children achieved relative to the total number of levels per task. In this project, I used the weighted proportion score for further analysis. Though the Corsi task is widely used in neuropsychological assessments, extensive validation of this measure has not been done, partially due to inconsistencies in scoring the measure (Kessels, van Zandvoort, Postma, Kappelle, & de Haan, 2000; Vecchi & Richardson, 2001). Despite this lack of examination, some work to validate the measure has been done. For example, the Corsi test performance was equated with the Wechsler Intelligence Scale for Children—Revised (WISC-R) via principle components analysis, and showed that the Corsi scores loaded highly onto the factor that that represented processing and working memory, thus establishing convergent validity (Orsini, 1994) As this measure is scored by counts, a measure of internal reliability was not applicable.

Dimensional Change Card Sort Task (DCCS). This assessment was designed to tap into children's cognitive flexibility (DCCS; Zelazo, 2006). In this task, examiners showed children cards that could be sorted based on the dimensions of shape and color. Examiners then asked children to sort cards into dimensions in a predetermined order.

The task consisted of three phases. In first phase, the pre-switch phase, children were asked to sort six cards based on color. In the second phase, the post-switch phase, the same six cards were presented but then children were asked to sort the cards based on shape. Finally, if children got five out of six correct on the post-switch phase, they passed to the third phase, the border phase. In this phase, children were presented 12 cards, some which included borders, and were asked to sort the cards by a border if there was one, or by shape if there was no border. For each phase, children got one point for each correctly completed trial (DCCS; Zelazo, 2006). The total correct sum score on the post-switch phase were used for later analyses.

DCCS has high test-retest reliability; Beck et al. (2012) found high intraclass correlations (ICCs; 0.75-0.80) for DCCS in numerous testing conditions. The DCCS also demonstrates significant convergent validity as assessed by high associations with scores on Wechsler Preschool and Primary Scale of Intelligence Block Design subtest in 3-6 year olds, which is a well-established assessment of fluid cognition (Zelazo et al., 2013). As this measure is based on counts, internal reliability was not examined.

Digit Span (DS). This task was designed to tap into working memory from an auditory modality (DS; Levine, 1984). The task included two conditions, digits forward (DF) and digits backward (DB). Each condition of the task was made up of levels—eight in DF and four in DB—with six lists per level. In turn, each list was made up of a certain number of digits, starting with two digits. Examiners read children a sequence of digits and children were asked to recall and repeat the sequence. In DB, children were asked to repeat the sequence the examiner said in the reverse order. In both conditions, if children correctly repeated four out of the six lists in a level, they moved to the next level, which

increased in difficulty by adding another digit to each list sequence. Children received one point for each list completed (DS; Levine, 1984). I used the total number correct in both DF and DB for my analyses.

The DS measure is comparable to the digit span sub-section of the Wechsler Intelligence Scale for Children – 3rd edition (WISC-III; Wechsler, 1991). The WISC-III has adequate reliability (α =.78) among children in middle childhood (Beebe, Pfiffner, & McBurnett, 2000; Levine, 1984; Wechsler, 1974). Further, WISC-III has been shown to have adequate test-retest reliability in both the forward task (ICC=.69) and the backward task (ICC=.60) (Beebe et al., 2000; Levine, 1984; Wechsler, 1974). As this measure is based on counts, internal reliability was not calculated.

Less is More. This task was designed specifically to test children's emergent inhibitory control (Less is More; Carlson, Davis, & Leach, 2005). This task used a highly motivating stimulus—candy—to challenge children's inhibition. First, examiners placed two trays with different amounts of candy in front of children (one candy versus three candies). Children were then asked to point to the tray they wanted. Once children indicated the tray with more candy was more desirable, the examiner brought out a stuffed animal and said, "This is a naughty monkey, and his name is Chris. He likes to get all the treats for himself. That's why he's naughty" (Less is More; Carlson et al., 2005). Then examiners introduced a new rule telling children that each time they pointed to a tray Chris would get the candy in that tray and the child would get the candy in the other tray. In order for children to get more candy, they had to inhibit the response to point to the tray with the greater amount of candy. The task consisted of 16 trials, with the first eight having a prompt after each trial where the examiner reinforced the reverse rules.

The second eight did not have any reinforcement. Children received one point for every correct choice. When children made six consecutive correct choices, the task ended (Less is More; Carlson et al., 2005). As the number of trials varied based on children's performance, a proportion score was calculated with number correct divided by the number of trials possible for each child. I used the proportion score for further analyses..

Less is More has statistically significant convergent validity with other measures of EF, as scores on Less is More are positively associated with scores on other measures of inhibitory control and working memory such as the Dimensional Change Card Sort (Carlson et al., 2005). Internal consistency was not reported for this measure as it is derived from counts.

Parenting behavior. The measure of maternal sensitivity came from observations of filmed parent-child interactions in the home setting taken at T3. Specifically, the Emotional Availability Scales were used in assessing maternal sensitivity.

Emotional Availability (EA). Participants who consented to be filmed were recorded along with their children in two five-minute interactions. In the first interaction mothers were instructed to play freely with their children as they typically would ("Free-Play"). In the second interaction, mothers were instructed to teach their children to accomplish a task that would be difficult for children (of their chronological age) to accomplish on their own ("Teaching Task"). Though the specific materials used for the "Teaching Task" varied by child age, the tasks available were either completing a puzzle or placing beads on a string. The interactions were coded using the EA scales for maternal sensitivity and maternal non-hostility (EA; Biringen, Robinson, & Emde, 1998). High maternal sensitivity was classified by interactions where mothers were able to

accurately read children's behavioral cues and cognitions (EA; Biringen et al., 1998). Further, shared positive emotional exchanges were included in the measure of sensitivity (EA; Biringen et al., 1998). Scores on the EA sensitivity subscale ranged from 1 ("highly insensitive") to 9 ("highly sensitive") (EA; Biringen et al., 1998). For this thesis, I used the average of maternal sensitivity ratings from both the "Teaching Task" as well as the "Free-play Task". The sensitivity ratings were significantly correlated with one another ($r = .81$, $p < .001$) and demonstrated high internal reliability ($\alpha = .90$).

Controls

Control variables included child age (in years), to account for age-related performance issues on the child assessment, maternal race/ ethnicity, as well as maternal depression at T2. Maternal depression, assessed by the Center for Epidemiological Studies Depression Scale ("Feelings Questionnaire) (CES-D; Radloff, 1977), was used as a control to account for any negative attribution bias that participants may have had in answering the items that made up the stressor index. The CES-D is a well-validated 20-item self-report questionnaire aimed to quantify depressive symptoms. Participants indicated the extent to which certain statements (e.g., "I felt that I could not shake off the blues even with help from my family or friends; I felt lonely") applied to them on a 4 point scale: (1) not at all (2) a little (3) occasionally (4) a lot. A cut-off for participants whose total score is above 16 indicates depressive symptoms and is considered "clinically significant." (CES-D; Radloff, 1977). Though this measure is self-report, the "clinically significant" score has strong convergent validity with a clinical diagnosis of depression (Naughton & Wiklund, 1993; Sharp & Lipsky, 2002). In this thesis, the clinical cut-off score was used as the marker of depression. In the general population, the CES-D was

found to be internally reliable (α = .85), and was also found to be internally reliable specifically among clinically diagnosed depressed adults (α = .90; Radloff, 1977).

Results

Preliminary Analyses

Prior to addressing the main research questions, preliminary analyses were conducted in order to create the two stressor indexes as well as a composite EF score.

Stressor Indexes.

Individual Stressor Index. The individual stressor index was created by using the four indicators of individual level stress at T2: (1) total parenting stress from the PSI-SF, (2) past year prevalence of partner perpetrated psychological aggression from the CTS2S, (3) past year prevalence of partner perpetrated physical aggression from the CTS2S, and (4) endorsement of low social support from the PNM. All indicators were dichotomized into (1) stressor or (0) no stressor. For past year prevalence of partner perpetrated psychological aggression and past year prevalence of partner perpetrated physical aggression or injury indicators, mothers who endorsed any prevalence were assigned "stressor," while no prevalence was assigned "no stressor." For the continuous indicators, parenting stress and social support, indicators were dichotomized based on quartiles. For parenting stress, mothers whose scores included and fell above the third quartile were assigned "stressor;" for social support, however, higher scores indicated more endorsed support and thus mothers who received scores at or below the first quartile were assigned "stressor." After all scores were dichotomized, each indicator was summed to create the individual stressor index, ranging from 0-4.

Contextual Stressor Index. The contextual stressor index was created by using the four indicators of contextual level stress at T2: (1) financial resource adequacy from the FRS, (2) mean neighborhood safety from the NSCS, (3) maternal self-reported household crowdedness, and (4) maternal self-reported residential instability. Financial resource adequacy was dichotomized using the FRS creators' adequacy cut-off score. Thus, mothers who received a score of "not adequate" were assigned "stressor." Neighborhood safety, a continuous measure, was dichotomized based on quartiles, thus, mothers who scored at or above the third quartile in neighborhood safety were assigned "stressor." Household crowdedness was dichotomized based on maternal endorsed household crowdedness. Mothers who endorsed that their household was crowded were assigned "stressor." Finally, residential instability was dichotomized based on whether mothers endorsed moving more than once in the span of a year. Therefore, mothers who responded that they had moved more than once were assigned "stressor." After all scores were dichotomized, each indicator was summed to create the contextual stressor index, ranging from 0-4.

EF Score

In order to create a composite EF score, confirmatory factor analysis using the child EF measures was conducted. The CFA model successfully converged on the higher order latent factor of EF. Results using a robust ML estimator demonstrated good model fit, SB-χ^2(df = 15, N = 326) = 276.50, p < .001, SRMR =.020, RMSEA = . 001 (.001-0.06), CFI = .998, TLI = .999. Additionally, the final model demonstrated improved model fit over a baseline model with no restrictions, χ^2 (2)= 16.08, p<.001. Children's performance on LIM and DCCS contributed the most to the EF construct, with

standardized factor loadings of .724 and 2.72 respectively. These high loadings suggest that indicators tapping into children's inhibitory control may have been contributing the most to the latent construct of EF within this sample. Upon model creation, the standardized factor score of the higher order EF construct was extracted and saved for use in further analyses. Figure 2 provides full model information.

Descriptive Analyses

Prior to conducting the main analyses, descriptive analyses were conducted to examine the distributional properties of all variables of interest. Table 3 provides the means, standard deviations, and zero-order correlations among all main study constructs. On average, adolescent mothers within the sample displayed modest sensitive parenting behavior, with moderate variability overall. On average, adolescent mothers within the sample endorsed at least one contextual stressor and almost two individual level stressors. There was modest variability in mothers' endorsement of stressors both at the individual and contextual level.

Preliminary correlation analyses demonstrated a significant negative association between EF (T4) and contextual stress (T2), $p < .05$. In addition, EF and sensitivity (T3) were positively associated, $p < .05$. Contrary to my original hypothesis, the purported mediator, maternal sensitivity, was not significantly related to either set of predictors, individual stress (T2) or contextual stress. Individual stress was not associated with children's EF.

Missing data patterns were examined to determine whether the missing data in the sample was significantly associated with any observable characteristics in order to examine potential bias in the sample due to missing data. Tables 4 and 5 provide

correlation analyses between patterns of missing data and observable sample characteristics, while Tables 6 and 7 provide the results of logistic regression analyses attempting to predict patterns of missing data. As there were no significant associations between the main constructs and sample characteristics, listwise deletion was used in main analyses. Thus, the contextual stressor index sample contained 296 cases and the individual stressor index sample contained 247 cases.

Main Analyses

In order to address the two research questions, whether maternal sensitivity mediated the association among both individual and contextual stressors and children's EF, preliminary regression analyses were conducted to establish whether the criteria for mediation were met (Baron & Kenney, 1986; MacKinnon, Fairchild, & Fritz, 2007). Results of all regression models are presented in Tables 8, 9, and 10. The first regression model, presented in Table 8, examined whether path *c* for mediation was met by examining the associations between the two separate predictors (individual stressors and contextual stressors) and children's EF factor score (Baron & Kenney, 1986; MacKinnon et al., 2007). Results indicated that when controlling for maternal depression, maternal race/ethnicity, and child age, the association between contextual stressors and children's EF, demonstrated a non-significant negative trend (β = -.01, $p < .10$). However, when controlling for maternal depression, maternal race/ethnicity, and child age, the relation between individual level stressors and EF was non-significant (β = -.003, $p > .10$).

Despite the fact that direct associations between the purported predictors and outcome were not significant, mediation could still be examined (e.g., MacKinnon et al., 2007; MacKinnon, 2008). Thus, the two remaining paths were examined: the *a* path, or

the associations between individual stressors and maternal sensitivity, as well as between contextual stressors and maternal sensitivity (both presented in Table 9), and the *b* path (presented in Table 10), or the association between maternal sensitivity and EF. However, when controlling for maternal depression, maternal race/ethnicity, and child age, there were no significant associations when using either contextual stressors or individual stressors as the predictors of the purported mediator; therefore, indirect effects were not tested. However, when examining the associations among maternal sensitivity and children's EF, controlling for child age, maternal race/ethnicity, and maternal depression, there was a significant association ($\beta = .001$, $p < .05$), indicating that higher maternal sensitivity at T3 was associated with higher child EF performance at T4.

Discussion

Extant research has been limited in fully unpacking the associations among the stressors present for adolescent parents in relation to their sensitive parenting behavior along with their children's EF. Further, current studies exploring the stressor-parenting associations among adolescent mothers are narrow in scope as they combine individual and contextual-level stressors when examining effects on parents and children. Within this thesis, I aimed to elucidate this line of work by separately considering individual and contextual level stressors present for adolescent mothers, the relations between these stressors and maternal sensitivity, and finally the overall relations of stressors, maternal sensitivity, and children's EF. I hypothesized that there would be an indirect relation between both individual and contextual stressors and children's EF through maternal sensitivity in behavioral interactions with their children. Despite the fact that prior research has demonstrated the indirect associations of broader stressors on children

through parenting behavior (e.g., Aisenberg & Herrenkohl, 2008; Kohen et al., 2008; Grant et al., 2006), within my thesis the criterion for examining a mediation model was not established. Nonetheless, my findings provided partial support for my hypothesis and underscore the complex transactions that exist among the presence of stressors, parenting, and children's EF. Within this section, I review my findings with a focus on the implications of my work and conclude with the limitations of this thesis and future research directions.

Associations between maternal sensitivity and child EF

Despite the fact that in preliminary data analyses the purported mediator, maternal sensitivity, was not significantly associated with the predictor variables, individual level stressors (prevalence of psychological aggression, prevalence of physical aggression, parenting stress, and low social support) or contextual level stressors (residential instability, household overcrowding, financial strain, and community safety), regression analyses were still conducted with the exclusion of examinations of indirect effects. My results depicted a significant positive association between mothers' sensitive interactions with their children at T3 and the latent construct of children's EF at T4, holding the effects of child age, gender, maternal race, and maternal depression constant.

My results fall in line with previous work demonstrating the positive associations between sensitive parenting in early life and children's EF abilities in early childhood (Bernier, 2010). Mothers' sensitive parenting behavior has been theorized to support children's EF development in part by providing children assistance in self-regulation as well as scaffolding in effective self-regulatory behaviors (Calkins, 2004). Thus, acts of sensitive parenting both provide optimal input for EF development but also work to

mitigate children's stress responses which, when chronically activated, can serve as a potential insult to EF development (Gunnar & Quevedo, 2007; Shonkoff et al., 2012). The aforementioned role of sensitive parenting behavior is especially important for the children of adolescent mothers, as they often live in contexts marked with numerous stressors (Mollborn & Dennis, 2012). As EF underlies self-regulatory behavior and has been associated with positive socio-emotional and behavioral adaptation in challenging circumstances (e.g., Masten & Obradovic, 2006), supporting maternal sensitivity can support EF development among children experiencing numerous extrinsic stressors.

Given that promoting optimal EF in early life may be one of the factors that lays the groundwork for positive socio-emotional development throughout the life span, efforts to promote EF development early in life may have numerous positive returns (Shonkoff et al., 2012). Thus, finding that maternal sensitivity was positively associated with EF within this sample of adolescent mothers and their children is especially important. As explicated earlier, adolescent parenthood is often associated with numerous stressors that may impact optimal parenting (e.g., Larson, 2004; Mollborn & Dennis, 2012; Moore et al., 2000). In examining the individual and contextual level stressor indexes, there was considerable variability in both index scores. This variation falls in line with work that points to the wide heterogeneity in the experiences of adolescent mothers (e.g., Easterbrooks et al., 2013; Easterbrooks et al., 2011; Jacobs et al., 2015) and confirms the need to explore the contexts of adolescent mothers in greater detail.

Associations among Individual and Contextual Stressors and EF

In examining the associations among the early exposure to environmental stressors and children's EF, neither individual level stressors nor contextual level

stressors were significant predictors of children's EF. However, there was a marginally significant association between contextual stressors and children's EF. The lack of strong relations between contextual stressors and children's EF has been substantiated by previous work demonstrating significant associations, yet small effect sizes, between broader contextual risk factors and child outcomes as compared to more proximal individual level risk factors and child outcomes (e.g., Hackman et al., 2015). However, prior research has also demonstrated direct, enduring, associations among maternal endorsement of the presence of early financial strain and child socio-emotional outcomes (Yates et al., 2010). Given the equivocal nature of these previous works, researchers should continue to examine the impacts of broader environmental stressors on early childhood outcomes.

One way in which contextual effects are typically explained is as mediated through parenting behavior; however, it is also important to recognize the complexity by which factors at each level of a child's ecology relate with one another (Sameroff, 2010). For example, when thinking through one of the markers of my contextual level stressor index, financial strain, the broader contextual factors associated with financial strain can coact with factors in the proximal setting, thereby increasing parenting stress (Gyamfi, Brooks-Gunn, & Jackson, 2001). Unpacking these relations becomes increasingly complicated when including the transactions among children and their parents in relation to their broader contexts. For instance, the increased parenting stress associated with financial hardship is often concomitant with harsher and more insensitive parenting behavior as well as more socio-emotional behavior problems among children (e.g., Chilton, Chyatte, & Breaux, 2007). Further, as studies have demonstrated associations

between non-optimal parenting behavior and children's socio-emotional and behavioral problems (e.g., Wang, Christ, Mills-Koonce, Garrett-Peters, & Cox, 2013) it may be that children's own behavior can induce greater parenting stress for parents, thus creating a feedback loop.

The complexity of these associations suggests that future work must unpack the dynamic transactions that occur among both individual and contextual stressors in jointly interacting with the mother-child dyad. Despite the fact that the relations among contextual stressors and children's EF may not have been strong, the marginally significant trend pointing towards a negative association underscores the importance of understanding the stressors faced by adolescent parents and their children, in order to learn how to buffer against children's experience of contextual stressors early in life in promoting optimal EF.

Similarly, the knowledge of the complex transactions between stressors within the individual and contextual level can also help to interpret the lack of significant relations between individual level stressors and children's EF. The items that consisted of the individual level stressor index (prevalence of psychological aggression, prevalence of physical aggression, parenting stress, and low social support) may be enmeshed with some of the stressors in the contextual level stressor index (residential instability, household overcrowding, financial strain, and community safety). For example, living in unsafe neighborhood contexts has been theorized to relate with an overall lower perceived social support (e.g, Booth, Ayers, & Marsiglia, 2012). Thus in separating out stressors at the macro-level from those at the micro-level without accounting for transactions between the two may have masked my findings. Even more, the failure to

account for transactions between environmental stressors may explain why there was a marginally significant trend between the contextual stressor index and children's EF rather than the individual level stressor index and children's EF. As explicated earlier, the indicators making up the contextual level stressor index (residential instability, household overcrowding, financial strain, and community safety) may have implicitly captured more proximal level stressors as well (e.g., financial strain as it relates to parenting stress and neighborhood safety is it relates to perceived social support). Thus, a more nuanced examination, at the indicator level, between stressors at different layers of a child's context, may inform the selection of better indicators for both stressor indexes.

Contrary to the aforementioned explanations of the lack of direct associations between individual level stressors and children's EF, my original research hypothesis may also make sense of these particular null findings. For instance, the stressors at the individual level may have been more directly experienced by parents rather than their children (Grant et al., 2005). Taking this approach, I would not have expected to find a direct association between individual level stressors and children's EF but rather an indirect association through parenting behavior. Though I theorized that indirect associations of both individual and contextual stressors would be experienced through adolescent mothers' sensitive parenting behaviors, I was not able to depict associations between mothers' endorsement of stressors and their sensitive parenting behavior.

Associations among Individual and Contextual Stressors and Maternal Sensitivity

In spite of my hypothesis that there would be negative associations between experience of stress and sensitive parenting behavior, I did not find significant relations between either of the stress indexes and maternal sensitivity. Given that there is

considerable work linking the negative impacts of stressors on sensitive and responsive parenting behavior (e.g., Blair, 2010; Hackman et al., 2015; Riley et al., 2014), the null findings between stressors and sensitive parenting within my thesis may suggest a more complex picture than could be captured with the analyses I conducted. On average, mothers within my sample demonstrated "inconsistently sensitive" parenting behavior (Biringen et al., 1998). This pattern of "inconsistently sensitive" behavior has been seen in other studies that found adolescent mothers to display lower sensitive parenting behaviors as compared to adult mothers (Lemelin, Tarabulsy, & Provost, 2006). These studies examining the parenting behavior of adolescent parents theorize that higher prevalence of insensitive parenting behavior among adolescent mothers is emergent from complex interactions between psychosocial risk factors such as poverty, psychopathology, as well as intimate partner violence (Dahmen, Firk, & Herpertz-Dahlmann, 2013). Further, studies examining this particular sample of adolescent mothers have also confirmed the presence of several of these aforementioned risk factors such as elevated rates of depression and IPV (e.g., Easterbrooks et al., 2013; Easterbrooks et al., 2015; Jacobs et al., 2015).

Despite these theorizations of the relations between psychosocial risk and sensitivity, I did not find associations between similar risk factors as captured by both stressor indexes and maternal sensitivity. Thus, the lack of robust associations between broader psychosocial risks and maternal sensitivity suggests that a more nuanced approach to understanding the factors that may influence adolescent mother's insensitive parenting behavior. For instance, I only included external factors as stressors within each stressor index. Future work may instead consider examining intrinsic factors as they may

relate to mother's experience of stressors. For example, higher levels of endorsed social support as well as higher levels of maternal self-efficacy have been shown to act as a buffer against the experience of contextual strain on optimal parenting behavior (Crnic & Low, 2002). Examining factors that may moderate the experience of stressors on mother's parenting behavior may help to better understand the complex factors that lead to the association between the experience of adolescent parenting and insensitive parenting behavior.

Furthermore, the construct of sensitive parenting behavior that I used within my thesis may have been limited. Maternal sensitivity was assessed by two five-minute video-taped interactions. Though the coding system used to assess sensitivity has been well validated (EA; Biringen et al., 1998), the usage of video-coding to tap into mother's sensitive parenting behavior is limited to only the sensitive parenting behavior within those interactions. These video-taped interactions may not be an accurate depiction of mothers' overall sensitive parenting behaviors as there are numerous factors not present for mothers and children in their day to day interactions (e.g., having a research team present). In addition, for this thesis, I used an average sensitivity score between the teaching interaction as well as the free-play interaction. However, by doing so I may have been masking some variability in mothers' sensitive parenting behavior. As the teaching task required mothers to help children with a toy that was slightly beyond their developmental reach, children may have required more scaffolding and support. Thus, this interaction may have allowed mothers to act more sensitively than the free-play interaction. Given the issues with assessment through video-coding as well as with

collapsing the free-play and teaching interactions together, the construct of sensitivity as assessed within this thesis may have not been the most optimal.

Notwithstanding the fact that adolescent mothers within this thesis sample displayed inconsistently sensitive parenting behavior, I still found that mothers within my sample who demonstrated higher sensitive parenting behavior had children with higher EF scores. This positive association between adolescent mothers' sensitive parenting behavior and children's EF underscores the importance of understanding factors that may relate to variations in adolescent mother's sensitive parenting behavior, such as negative factors like environmental stressors, as well as factors that may buffer against the experience of these stressors such as social support (Crnic & Low, 2002). By understanding what factors are associated with adolescent mothers' sensitivity, researchers, policy makers and practitioners may better understand not only how to support children but also adolescent mothers. Taking a nuanced approach to understanding factors related to adolescent mothers' sensitive parenting behavior is important as prior research has depicted that adolescent mother's resilient parenting behavior came "at a cost" to mothers' psychological functioning in terms of higher depressive symptomatology (Easterbrooks et al., 2011). Thus, future work may consider exploring what both external and internal factors may influence adolescent mothers' sensitive parenting behavior in order to support not only optimal child well being, but also optimal maternal wellbeing. As mentioned earlier, factors such as maternal self-efficacy as well as maternal social support may serve as buffering factors against the experience of individual and contextual stressors for mothers and their children.

Limitations and Future Directions

Though I sought to deepen knowledge about the associations between environmental stressors and parenting behavior in order to support children's EF development, there are important limitations to my work, such as in the measures used for analysis as well as the analytic approach itself. First of all, the markers for the stressor index were all maternal self-report, meaning that the extent to which these stressors were truly present for their children could not be fully ascertained. However, in an attempt to account for an overall negative attribution bias, I controlled for maternal depressive symptomatology (Gotlib, Lewinsohn, Seeley, Rohde, & Redner, 1993). Even more, in the creation of the stressor indexes I may have underestimated the experience of stressors. As I followed procedures to create stressor indexes similar to those proposed by researchers who created risk indexes, I used an arbitrary 75th percentile cut-off (e.g., Evans et al., 2013) to divide continuous indicators into stressors. By taking this approach, the stressor indexes I created categorized individuals' experience of stressors based on the overall sample of adolescent mothers. However, as the experience of adolescent parenting often occurs in contexts marked by numerous stressors as compared to those of adult parents (e.g., Mollborn & Dennis, 2012), using a sample specific stressor index may have underreported stressors within my study population.

Although my work is a crucial first step towards understanding the relations among stressors, maternal sensitivity, and children's EF within a sample of adolescent mothers and their children, my work fails to fully capture the complexity of these associations. Although I considered individual and contextual level stressors separately, I failed to account for the transactions between stressors at numerous levels and how this may influence both maternal sensitivity as well as children's EF. As discussed earlier, by

separating indicators into contextual level and individual level, I was not able to capture the reciprocal bi-directional associations between stressors, (e.g., how financial strain may relate to parenting stress). In addition, I did not consider the dynamic role that children themselves have in affecting their context and the dynamic transactions that lead to the emergence of children's EF. Thus, in future work I will model these associations within a latent framework to capture the bi-directionality among all my constructs. Furthermore, within future work I will examine potential moderators of the associations between stressors and maternal sensitivity and consider whether factors (e.g., maternal self-efficacy and maternal social support) may be moderating the indirect effects of maternal sensitivity on the associations between stressors and children's EF (Crnic & Low, 2002).

Finally, as I found different patterns of associations between both of my stressor indexes with maternal sensitivity and EF, within future work I will tease apart these differences both by looking at each stressor individually as well as by doing subgroup analyses based on the numbers and types of stressors experienced by the mothers within this sample. By examining the associations between maternal sensitivity and children's EF in relation to particular stressors, I may be able to tease apart differential contributions of stressors for mothers and their children. For instance, certain stressors, either at the individual or contextual level, may play a bigger role in relation to maternal sensitivity or children's EF. Furthermore, by conducting subgroup analyses, I may be able to ascertain whether there may be different associations between the experience of numerous individual or contextual stressors in relation to parenting behavior; for example, mothers experiencing numerous contextual stressors but very few individual level stressors may

display different parenting behaviors than mothers who experience numerous contextual and individual stressors.

Program and Policy Implications

Findings from my thesis have implications that may inform future program and policy creation. Foremost, the findings from my thesis may help to improve the services provided by HFM. Results from my thesis indicated a positive association between adolescent mothers' sensitive interactions with their children and their children's EF. As HFM aims to promote positive child development and as EF is a core component in positive socio-emotional development, these findings are especially noteworthy. HFM may consider focusing on the construct of maternal sensitivity in its service content by implementing a parenting sensitivity curriculum for home visitors to discuss with participants.

Additionally, results from my thesis may help to inform policy initiatives seeking to mitigate the effects of contextual stressors on parents and children. Within my work I found a marginally significant negative trend among the presence of broader contextual stressors (residential instability, household overcrowding, financial strain, and community safety) in infancy and children's EF in early childhood. Thus, my work can serve as evidence for the necessity of continuing to develop services and initiatives aiming to create stable housing, financial security, and neighborhood security in efforts to promote child well-being among children growing up in adverse circumstances.

Conclusions

Given the dearth of research examining the stressors faced by adolescent parents as well as the specifics of the role of sensitive parenting behavior in supporting children's

EF, within my Master's thesis I hoped to elucidate these associations. My findings indicated that mothers' sensitive parenting behavior was positively associated with children's EF, as well as a non-significant association between the early experience of contextual stressors and children's EF. Additionally, my thesis work is important in advancing a deeper understanding of the contexts of adolescent headed families and the characteristics of the stressors that may be embedded within these contexts. Moreover, as I did not find support for the association among either individual or contextual level stressors and sensitive parenting behavior, future work should examine complex transactions between stressors at different levels of the mother-child context, as well as other intrinsic and extrinsic factors that may relate to adolescent mother's sensitive parenting behavior.

Thus, the results of this thesis work to fill a gap in the understanding of the stressors experienced by adolescent mothers and their children, as well as the positive associations of sensitive parenting on children's EF in spite of stressful circumstances. Future endeavors aiming to support children's EF development in highly stressful or adverse contexts may consider supporting optimal parenting behavior as well, given its associations with positive EF outcomes.

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Table 1

Sample demographic information

Sample Size	*n* = 326
Maternal Characteristics	
Age at Birth (in years)	*M* = 18.81, *SD* =1.28
Race, %	
White	35%
African American	22%
Hispanic	35%
Other	8%
Child Characteristics	
Age (in years)	*M* = 4.93, *SD* =0.48
Sex, %	
Male	52%
Female	48%

Table 2

Sample sizes at each time point

	Impact Sub-Sample	Integrative Sub-Sample
T1	684 (97%)	473[a]
T2	564 (80%)	401 (86%)
T3	594 (84%)	409 (87%)
T4	490 (69%)	433 (90%)

Note. Parentheses indicate the percentage of full sample.
[a]Participants were given the option of additionally participating in the integrative study at T1 and thus the T1 sample size provides the basis for the integrative sample.

Table 3

Means, standard deviations, and correlations of main study constructs

Variable	*M*	*SD*	1	2	3
1. Maternal Sensitivity	4.82	1.31			
2. Contextual Stressors	1.22	0.94	-.06		
3. Individual Stressors	1.73	0.83	.01	.03	
4. EF Score	0.01	0.07	.24**	-.13*	-.00

Note. * indicates $p < .05$; ** indicates $p < .01$.

Table 4

Means, standard deviations, and correlations among missing maternal measures

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9
1. Maternal age (T1)	18.81	1.28									
2. Child age (T4)	4.93	0.47	-.06								
3. Missing on PSI	0.40	0.49	-.00	.02							
4. Missing on PNM	0.29	0.45	-.02	.06	.78**						
5. Missing on intake	0.09	0.29	-.04	.09*	.34**	.43**					
6. Missing on FRS	0.17	0.38	-.02	.08	.25**	.34**	.63**				
7. Child sex	0.47	0.50	.06	-.00	-.01	-.02	-.06	-.03			
8. Race/ethnicity	8.75	3.15	-.19**	.05	-.06	-.06	-.01	-.02	-.02		
9. Immigrant status	2.66	1.08	.11*	-.03	-.02	.03	-.04	.01	.08	-.35**	

10. Missing on NSCS	0.30	0.46	-.03	.07	.75**	.97**	.42**	.33**	-.04	-.02	.01

Note. *M* and *SD* are used to represent mean and standard deviation, respectively.
* $p < .05$. ** $p < .01$

Table 5

Means, standard deviations, and correlations among missing child measures

Variable	*M*	*SD*	1	2	3	4	5	6	7	8
1. Child sex	0.49	0.50								
2. Maternal age	0.47	0.50	-.07							
3. Race/ethnicity	1.36	0.48	-.05	-.14**						
4. Immigrant status	1.45	0.81	.07	-.14**	.54**					
5. Maternal depression	13.56	10.55	.04	-.01	.02	.05				
6. Child age (T4)	4.83	0.45	.04	-.04	.00	-.06	-.08			
7. Missing on HTKS	0.40	0.49	-.05	-.00	-.01	.07	.05	-.03		
8. Missing on Corsi	0.33	0.47	-.00	-.01	-.03	.05	.07	.03	.81**	
9. Missing on DCCS	0.31	0.46	-.01	-.01	-.06	.03	.06	.10	.80**	.93**

Note. *M* and *SD* are used to represent mean and standard deviation, respectively.
* $p < .05$. ** $p < .01$.

Table 6

Results of logistic regressions to predict missing on maternal measures

Variables	*β*	SE	Wald test	*p*-Value	OR (95% CI)
Missing on PSI					
Race	-0.95	1.00	0.14	0.89	0.37 (0.04 - 2.63)
Immigrant status	0.05	0.34	0.15	0.89	1.05 (0.54 - 2.08)
Maternal age	-0.02	0.08	-0.29	0.77	0.98 (0.83 - 1.14)
Child sex	-0.04	0.20	-0.19	0.85	0.96 (0.65 - 1.43)
Child age	0.08	0.21	0.37	0.71	1.08 (0.71 - 1.64)
Missing on CTS					
Race	-0.04	2.06	-0.83	0.40	0. 18 (0.89- 1.03)
Immigrant status	0.04	0.10	0.38	0.71	1.04 (0.83 - 1.26)
Maternal age	-0.04	0.08	-0.47	0.64	0.64 (0.81- 1.14)
Child sex	0.04	0.21	0.19	0.85	1.04 (0.9 - 1.59)
Child age	0.38	0.22	1.70	0.08	1.46 (0.94 - 2.26)
Missing on NSC					
Race	-0.02	2.06	-0.60	0.55	0.98 (0.91- 1.05)
Immigrant status	0.02	0.10	0.23	0.82	1.02 (0.85 - 1.28)
Maternal age	-0.05	0.08	-0.60	0.55	0.95 (0.81 - 1.13)
Child sex	-0.18	0.21	-0.84	0.40	0.84 (0.55 - 1.27)
Child age	0.32	0.22	1.42	0.15	1.37 (0.89 - 2.12)
Missing on PNM					
Race	-0.04	2.10	-0.60	0.55	0.96 (0.89 - 1.02)
Immigrant status	0.04	0.11	0.37	0.71	1.03 (0.85- 1.28)
Maternal age	-0.05	0.09	-0.52	0.60	0.96 (0.81 - 1.13)
Child sex	-0.11	0.21	0.49	0.62	0.90 (0.58 - 1.38)
Child age	0.31	0.23	1.35	0.18	1.36 (0.87 - 2.12)

Missing on Intake Measures					
Race	-0.05	0.06	-0.98	0.33	0.95 (0.86 - 1.06)
Immigrant status	-0.12	0.16	-0.71	0.48	0.95 (0.64 -1.23)
Maternal age	-0.10	0.14	-0.74	0.46	0.95 (0.69 - 1.18)
Child sex	-0.48	0.35	-1.36	0.17	0.62 (0.30- 1.22)
Child age	0.64	0.33	1.88	0.06	1.89 (0.97 - 3.64)

Note. β = standardized regression weights; *SE* = standard error of the unstandardized regression weights; OR = odds-ratio.
* $p < .05$. ** $p < .01$.

Table 7

Results of logistic regressions to predict missing on child measures

Variables	*β*	SE	Wald test	*p*-Value	OR (95% CI)
Missing on LIM					
Race	-0.56	0.38	-1.48	0.14	0.57 (0.26. -1.17)
Immigrant status	0.23	0.22	1.03	0.31	1.25 (0.81- 1.92)
Maternal education	-0.14	0.30	-0.47	0.64	0.87 (0.49 -1.55)
Child sex	-0.35	0.31	-1.21	0.23	0.87 (0.39 - 1.24)
Child age	0.14	0.32	0.44	0.66	1.15 (0.61 - 2.16)
Missing on CORSI					
Race	-0.34	0.39	-0.87	0.38	0.71 (0.32- 1.50)
Immigrant status	0.14	0.23	0.63	0.53	1.15 (0.73 - 1.79)
Maternal education	-0.09	0.31	-0.30	0.76	0.91 (0.49- 1.67)
Child sex	-0.22	0.21	-0.73	0.47	0.80 (0.44 - 1.45)
Child age	-0.02	0.34	-0.05	0.96	0.98 (0.50 - 1.90)
Missing on DCCS					
Race	-0.50	0.42	-1.19	0.24	0.61 (0.26 - 1.35)
Immigrant status	0.08	0.25	0.33	0.74	1.09 (0.65 - 1.76)
Maternal education	-0.04	0.32	-0.11	0.91	0.96 (0.51 - 1.82)
Child sex	-0.28	0.32	-0.86	0.39	0.76 (0.40 - 1.42)
Child age	0.47	0.35	1.34	0.18	1.60 (0.80 - 3.16)

Note. β = standardized regression weights; *SE* = standard error of the unstandardized regression weights; OR = odds-ratio.
* $p < .05$. ** $p < .01$.

Table 8

Regression results predicting EF.

	b	*SE*	*β*	95% CI	r^2
Model 1					0.23
(Intercept)	-0.33**	0.05		(-0.43 - 0.24)	
Contextual Stress	-0.01	0.00	-0.12	(-0.02 - 0.00)	
Maternal Depression	0.00	0.00	0.08	(-0.01 - 0.01)	
Child Age	0.07**	0.01	0.47	(0.05 - 0.09)	
Race/ethnicity	-0.00	0.00	-0.11	(-0.04 - 0.01)	
Model 2					0.22
(Intercept)	-0.34**	0.05		(-0.45 - 0.23)	
Individual Stress	-0.00	0.01	-0.03	(-0.02 - 0.01)	
Maternal Depression	0.00	0.00	0.08	(-0.01 - 0.01)	
Child Age	0.08**	0.01	0.48	(0.05 - 0.09)	
Race/ethnicity	-0.00*	0.00	-0.13	(-0.05 - 0.02)	

Note. b = unstandardized regression weights; *SE* = standard error of the unstandardized regression weights; β = standardized regression weights.
* $p < .05$. ** $p < .01$
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Table 9

Regression results predicting maternal sensitivity.

	b	*SE*	*β*	95% CI	r^2
Model 1					0.04
(Intercept)	2.58*	1.12		(0.38 – 4.79)	
Contextual Stress	-0.08	0.11	-0.06	(-0.30 - 0.14)	
Maternal Depression	0.00	0.01	0.03	(-0.02 - 0.02)	
Race/ethnicity	-0.00	0.03	-0.01	(-0.06 - 0.05)	
Child Age	0.48*	0.22	0.17	(0.05 - 0.09)	
Model 2					0.02
(Intercept)	2.77*	1.21		(0.37 – 5.17)	
Individual Stress	-0.02	0.13	-0.01	(-0.27 –0.23)	
Maternal Depression	0.00	0.01	0.03	(-0.02 - 0.03)	
Race/ethnicity	-0.02	0.03	-0.05	(-0.09 - 0.05)	
Child Age	0.44	0.24	0.15	(-0.03 - 0.92)	

Note. b = unstandardized regression weights; *SE* = standard error of the unstandardized regression weights; β = standardized regression weights.
* $p < .05$. ** $p < .01$

Table 10

Regression results predicting EF.

	b	*SE*	*β*	95% CI	r^2
					0.31
(Intercept)	-0.39**	0.06		(-0.50- 0.27)	
Sensitivity	0.01*	0.00	0.15	(0.01 - 0.01)	
Maternal Depression	0.00	0.00	0.03	(-0.00 - 0.01)	
Race/ethnicity	-0.00*	0.00	-0.16	(-0.01 - 0.00)	
Child Age	0.08**	0.01	0.50	(0.05 - 0.10)	

Note. b = unstandardized regression weights; *SE* = standard error of the unstandardized regression weights; β = standardized regression weights.
* $p < .05$. ** $p < .01$

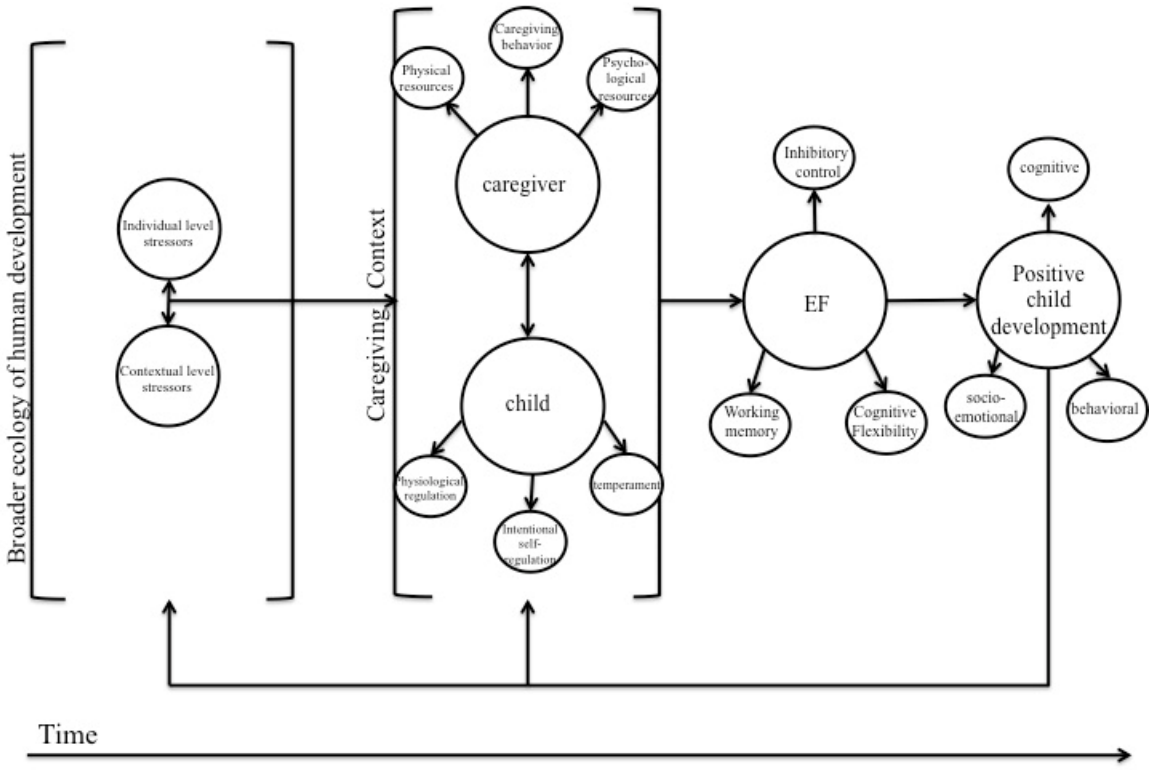

Figure 1. A relational developmental systems theory framework of individual-context relations: the contextually situated interactions within the caregiving context as influencing children's EF, and subsequently positive child development.

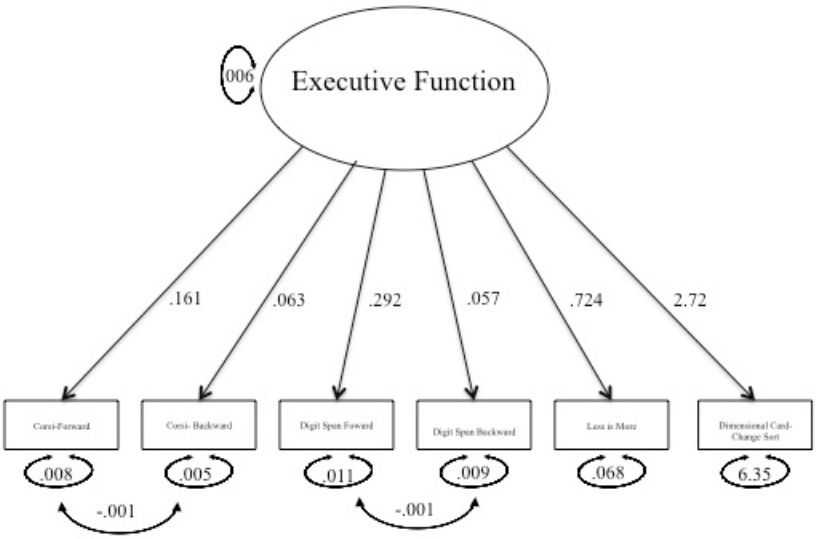

Figure 2. EF Model. This figure provides model fit information from the CFA constructing the final latent construct of EF. All estimates reported are standardized.