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Predicting Social-Emotional and Cognitive Development at 24 Months: The Impact of Postnatal Maternal Anxiety and Depressive Symptoms, and Mother-Child Relationship

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PREDICTING SOCIAL-EMOTIONAL AND COGNITIVE DEVELOPMENT AT 24 MONTHS: THE IMPACT OF POSTNATAL MATERNAL ANXIETY AND DEPRESSIVE SYMPTOMS, AND MOTHER-CHILD RELATIONSHIPS

by

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Abstract

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Early childhood is a particularly sensitive time for development, and experiences during this time of life have a lasting impact on later development (Shonkoff & Phillips, 2000). As part of these early experiences, mother-child relationships often become important influences on young children's social-emotional and cognitive development (e.g., Laible & Thompson, 2007; Osofsky & Liebernman, 2011). Similarly, mothers' mental health can impact their relationships with their children (e.g., Nicol-Harber, Harvey, & Stein, 2007; Stein et al., 2008) and their children's development (e.g., Grace, Evindar, & Stewart, 2003; Skylerman et al., 2007). The purpose of this study was to explore the influences of postnatal maternal anxiety (PMA) and postnatal maternal depression (PMD) on children's social-emotional and cognitive development at 24 months of age. In addition, mother-child relationships (MCR) were examined as a potential mediator between mothers' postnatal symptoms and children's development. This study analyzed archival data on 395 healthy mother-child dyads resembling the population of Shelby County, Tennessee. The dyads were followed from mothers' third trimester of pregnancy to their children's 24th month. Many of the results do not support previous research linking postnatal depressive and anxiety symptoms, mother-child relationships, and children's development. For example, this study did not find significant relations between postnatal depressive symptoms and mother-child relationships, nor did it find an association between mother-child relationships at 24 months and children's

emotional and behavioral problems. The findings did support previous research indicating that mothers' postnatal anxiety and depressive symptoms predicted children's emotional and behavioral problems. In addition, an interesting connection was found between children's social competence and their cognitive development. The findings' implications for counseling psychology, future research directions, and study limitations are discussed.

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CHAPTER 1: Statement of the Problem

Introduction

During their first years children go through incredible growth and development unmatched by growth at any other time of life (Child Care Aware, 2010). Infants progress from suckling and other reactive movement to walking and speaking in just a few years. The experiences that young children have during these years influence their social-emotional and cognitive development in either positive or negative ways, and that development lays the foundation for later development and lifetime well-being (Center on the Developing Child at Harvard University [CDCHU], 2007; Nelson & Mann, 2011; Shonkoff & Phillips, 2000). While child development is complex with multiple factors influencing it, extensive evidence shows that the relationships children have with their primary caregivers is one of the most important factors affecting social-emotional and cognitive development in the first few years (e.g., CDCHU, 2007; Osofsky & Liebernman, 2011). Furthermore, caregivers' psychological health profoundly affects the quality of the relationship between them and their children (Osofsky & Lieberman, 2011).

When children are born, their mothers – the most common primary caregiver – tend to be psychologically able to engage in growth fostering and relationship strengthening interactions with their infants. However, between 10% and 28% of mothers experience clinically significant depressive symptoms during the first few years of their children's lives (Augusto, Kumar, Calheiros, Matos, & Figueiredo, 1996; Ballard, Davis, Cullen, Mohan, & Dean, 1994; Grazioli & Terry, 2000; Robertson, Grace, Wallington, & Stewart, 2004). Research indicates that the presence of postnatal maternal depression

(PMD) is associated with poor quality of interactions between mothers and their children (Carter, Garrity-Rokous, Chazan-Cohen, Little, & Briggs-Gowan, 2001) as well as mother-child attachment or bonding (Dawson, Ashman, Carver, 2000; McMahon, Barnett, Kowalenko, Tennant, & Don, 2001). Moreover, PMD has been shown to negatively affect children's development, including socio-emotional and cognitive development in young children (e.g., Beck, 1999; Grace, Evindar, & Stewart, 2003). Research findings have established the critical influence of PMD on children; however, Carter et al. (2001) found that the effects of depression were partially accounted for by comorbid psychological diagnoses (e.g., anxiety disorders). Empirical knowledge concerning the relationship between other maternal psychological distress, including anxiety, and young children's development during this vulnerable time is limited (Glasheen, Richardson, & Fabio, 2010).

Though less research has been conducted on postnatal maternal anxiety (PMA) symptoms (e.g., worry, feeling tense, and increased heart rate), they may have considerable influence on mothers and their children. Feelings, thoughts, and behaviors related to anxiety can interrupt mother-child attachment formation (Dawson et al., 2000), and the few studies that have been conducted examining the influences of PMA on child development have had conflicting results. Some study results indicate that PMA symptoms have negative influences on mother-child interactions (e.g., Felman et al., 2009) and children's social-emotional (e.g., Barnett, Schaffsma, Guzman, & Parker, 1991) and overall development (Galler, Harrison, Ramsey, Forde, & Butler, 2000). Other studies found no relationship between PMA and cognitive development (e.g., Slykerman et al., 2007). Additionally, there were several limitations to these studies, including not

accounting for postnatal depression, using cross-sectional designs, or small sample sizes (Glasheen et al., 2010). Thus, the current study sought to enhance the understanding of how PMA and PMD symptoms influence children's social-emotional and cognitive development. Specifically, the study examined whether PMA and PMD symptoms in mothers at 12 and 24 months after delivery influenced their relationships with their children, and in turn, influenced their children's social-emotional and cognitive development at 24 months of age.

Early Childhood Development

Healthy early childhood development during the early years of life entails a great deal of social-emotional and cognitive development. Positive early childhood social-emotional development consists of the growing capacity of young children "to experience, express, and regulate emotions; form close and secure relationships; and explore the environment and learn" (Osofsky & Lieberman, 2011, p. 120). Closely connected to young children's social-emotional development, early cognitive development requires that children are able to explore their environment to learn. In the first few years of life, children's cognitive development is based on their sensory-perceptual abilities, language development, and memory and learning abilities as well as their motor development (Bayley, 2006). These early skills lay the foundation for children to continue to grow across many developmental areas later in life.

The critical influence of early childhood on later lifetime development and well-being arises from neurodevelopment and the plasticity of young children's brain (i.e., its immense capacity to change; Child Care Aware, 2010; Shonkoff & Phillips, 2000). There is extensive evidence that during the first three years of children's lives, significant brain

development occurs, and young children's neurodevelopment is closely connected to their social-emotional and cognitive development (CDCHU, 2007; Shonkoff & Phillips, 2000). During this developmental period, the brain is primed to create connections between the brain cells, or neurons. These connections allow the neurons to transmit information and prepare for future development. At the same time, the brain is pruning neurons and connections that are not regularly used; this pruning process generally allows for more efficient development. However, when young children do not have adequate experiences to stimulate their social-emotion and cognitive development, important neuron connections are never made or pruned away (National Scientific Council on the Developing Child [NSCDC], 2004; NSCDC, 2005; Shonkoff & Phillips, 2000). As a result of the intense neural changes that occur at this time, the early childhood experiences can have lasting positive or negative consequences for children (Dawson et al., 2000; NSCDC, 2004; NSCDC, 2005; Rolnick & Grunewald, 2007; Shonkoff & Phillips, 2000).

Mother-Child Relationship

Early experiences determine whether children's brain structures will provide strong or weak foundations for all future learning, behavior, and development. All of young children's experiences influence their social-emotional and cognitive development (Sroufe, Carlson, Levy, & Egeland 1999); however, their relationships with their primary caregivers provide the most important experiences affecting their development in the first few years (e.g., CDCHU, 2007; Osofsky & Liebernman, 2011). Since mothers are often the primary caregiver, they tend to have a uniquely close and important relationship with their children (Cassidy & Shaver, 1999; Shonkoff & Phillips, 2000; Sroufe et al., 1999).

Subsequently, much of the research in this area focuses on the mother-child relationship and interactions. This study also focuses on the mother as the primary caregiver.

Mother-child interactions take on a "serve and return" nature, in which both mothers and children initiate interactions, and attend to and respond to each other (e.g., Bradley & Caldwell, 1995; Shonkoff & Phillips, 1999). These interactions help mothers and children develop deep enduring attachments or emotional bonds starting at birth. This bonding process is the primary objective in young children's social-emotional development and the quality of the mother-child attachment in infancy predicts children's later mental health and social-emotional development (Cassidy & Shaver, 1999; Sroufe et al., 1999). Children with quality or secure attachments to their mothers tend to view the world as more safe, are better able to regulate their emotions and handle stress, and tend to be more independent (Cassidy & Shaver, 1999; Sroufe et al., 1999). As a result, they feel safer to explore their world allowing for learning opportunities and better cognitive development. However, when children do not form a quality attachment, they feel less safe to explore their world, and subsequently fail to develop adaptive social-emotional skills and have delayed cognitive development (Bradley & Caldwell, 1995; Cassidy & Shaver, 1999). Maternal mental health and emotional well-being greatly influence quality of the mother-child attachment (Nicol-Harper, Harvey, & Stein, 2007; Osofsky & Lieberman, 2011). The following sections review findings about how maternal mental health problems influence children's development.

Postnatal Maternal Depression and Its Effects on Child Development

Although most mothers are generally happy and healthy after they give birth, some mothers experience depression or depressive symptoms postnatally (Sohr-Preston

& Scaramella, 2006). Experiencing depression up to one year after childbirth is often called postpartum depression in the popular press, but researchers regularly use both "postpartum" and "postnatal" to describe this time period. Depression can be characterized as a lack of interest and pleasure in normally enjoyed activities, lack of energy, and a general low mood. Often people who are depressed experience significant weight changes, insomnia or excessive sleeping, and difficulty concentrating. In more severe cases, people have feelings of worthlessness or excessive guilt and thoughts of suicide (Kazdin, 2000). Studies have found that 10% to 28% of mothers experience clinically significant depressive symptoms during the first few years of their children's lives (Augusto et al., 1996; Ballard et al., 1994; Grazioli & Terry, 2000; Robertson et al., 2004). In addition, considerable research has looked at what variables predict PMD; and while many variables contribute to experiencing PMD (Beck, 2001), depression and anxiety during or prior to pregnancy have been shown to be the strongest predictors of PMD symptoms (Banti et al., 2009; Beck, 2001). Mothers who experience depressive symptoms often have difficulty connecting with their young children and this difficulty can negatively affect their children's development. The next section addresses this impact.

Experiencing depressive symptoms can be devastating, making it more difficult for mothers to care for their young children and engage in the "serve and return" interactions that strengthen the mother-child attachment or relationship (Goodman & Gotlib, 1999; Lovejoy, Graczyk, O'Hare, & Neuman, 2000). Postnatal maternal depression is associated with negative cognitive and socio-emotional development in young children (e.g., Beck, 1999; Grace et al., 2003). These children tend to have more

negative affect, poorer affect regulation, more behavior problems, poorer social skills, and poorer cognitive and language functioning (e.g., Carter et al., 2001). Research indicates that the risks to children's development in the presence of postnatal maternal depressive symptoms are associated with poor quality of interactions between mothers and their children (Carter et al., 2001; Lovejoy et al., 2000) as well as mother-child attachment (Dawson et al., 2000; McMahon et al., 2001; Nicol-Harper et al., 2007). Although there is substantial evidence that maternal depressive symptoms are associated with poor outcomes for young children, research also indicates that the effects of depression may be partially explained by comorbid psychological diagnoses, including anxiety disorders (Carter et al., 2001).

Postnatal Maternal Anxiety and Its Effects on Childhood Development

Although fewer research studies have focused on PMA symptoms, up to 35% of mothers may experience these symptoms when they have young children (Matthey, Barnett, Howie, & Kavanagh, 2003; McMahon et al., 2001). Further, PMA symptoms can co-occur with depressive symptoms. One study found that 4% of mothers experienced some level of anxiety with depressive symptoms and 6% of mothers experienced depressive symptoms alone, while 16% of mothers experienced symptoms of anxiety alone (Matthey et al., 2003). Additionally, PMA symptoms are often preceded by prenatal maternal anxiety symptoms (Howell, Mora, DiBonaventura, & Leventhal, 2009). Anxiety can be understood as a future-oriented cognitive and emotional state in which individuals perceive events to be uncontrollable and unpredictable (Morissette, Tull, Gulliver, Kamholz, & Zimering, 2007). Anxiety symptoms include nervousness, feelings of fear and tension, worried thoughts, and physical changes (e.g., increased blood

pressure, sweating). People with anxiety disorders often have recurring intrusive thoughts or concerns (Kazdin, 2000) and the symptoms can vary considerably depending on severity. Thus, the actual effect on mothers' behaviors will differ depending on the type of symptom or amount of anxiety.

Varying amounts of worry and concern will affect mother-child interaction differently. Only two studies have examined the relationship between PMA and the way mothers and children interact. Nicol-Harper et al. (2007) and Felman et al. (2009) found that mothers with high levels of PMA had fewer interactions that strengthen mother-child attachment, including less maternal responsiveness, lower emotional tone, and less child engagement. This association was found even after statistically controlling for depressive symptoms. Although these researchers did not measure child development variables, these results provide evidence that maternal anxiety symptoms may affect children's development by reducing the quality of the relationship between mothers and children. However, the extant literature reports conflicting results about the relationships between PMA and social-emotional and cognitive development. Slykerman et al. (2007) found that maternal stress (a variable highly correlated with anxiety) did not correlate with children's cognitive and developmental delays at 12 months; however, Galler et al. (2000) found that PMA at seven weeks and six months was associated with delays in children's overall development. One study found that children's exposure to PMA at eight weeks old predicted emotional and conduct problems at four and six years old, but was not associated with hyperactivity or inattention (Goodman & Scott, 1999). On the other hand, Barnett et al. (1991) found that PMA symptoms did influence children's activity levels in addition to social competence and problem behaviors. Each of these

studies have significant limitations, including not accounting for depressive symptoms, and thus further research is needed to have a better understanding of the relationship between maternal anxiety and children's social-emotional and cognitive development.

Research Hypotheses

Research shows that mothers' depression during the first few years of children's lives negatively influences their development by hindering the mother-child attachment (Stein et al., 2008). It has also been shown that maternal depression often occurs in the presence of anxiety symptoms (Carter et al., 2001) and that many mothers experience anxiety symptoms during the postnatal period (Matthey et al., 2003). While Nicol-Harper et al. (2007) found that high levels of postnatal maternal anxiety are associated with poor mother-child relationships even after controlling for depressive symptoms, the influence of anxiety symptoms during this time on children's development remains unclear. Furthermore, among the few studies that have examined the relationship between anxiety symptoms and child development, the results are inconsistent and they have several limitations. Moreover, previous studies tended to compare mothers with clinically elevated symptoms to those who did not have symptoms that reached clinical levels. It could be that experiencing varying degrees of distressing symptoms may also influence mothers and their children. Finally, no studies have explored the combined effects of postnatal anxiety and depressive symptoms in mothers on either mother-child interactions or children's early development. This study investigated the role of maternal anxiety symptoms on mother-child relationships and child social-emotional and cognitive development in relation to maternal depressive symptoms. The following hypotheses were tested by estimating three separate structural equation models.

- **Hypothesis A.** Postnatal maternal anxiety (PMA) symptoms will negatively influence children's cognitive development and children's socio-emotional development; this relationship will be partially mediated through the mother-child relationships (Figure 1).
- **Hypothesis B.** Postnatal maternal depression (PMD) symptoms will negatively influence children's cognitive development and children's socio-emotional development; this relationship will be partially mediated through the mother-child relationships (Figure 2).
- **Hypothesis C.** There will be an interaction effect between PMA and PMD (Figure 3).

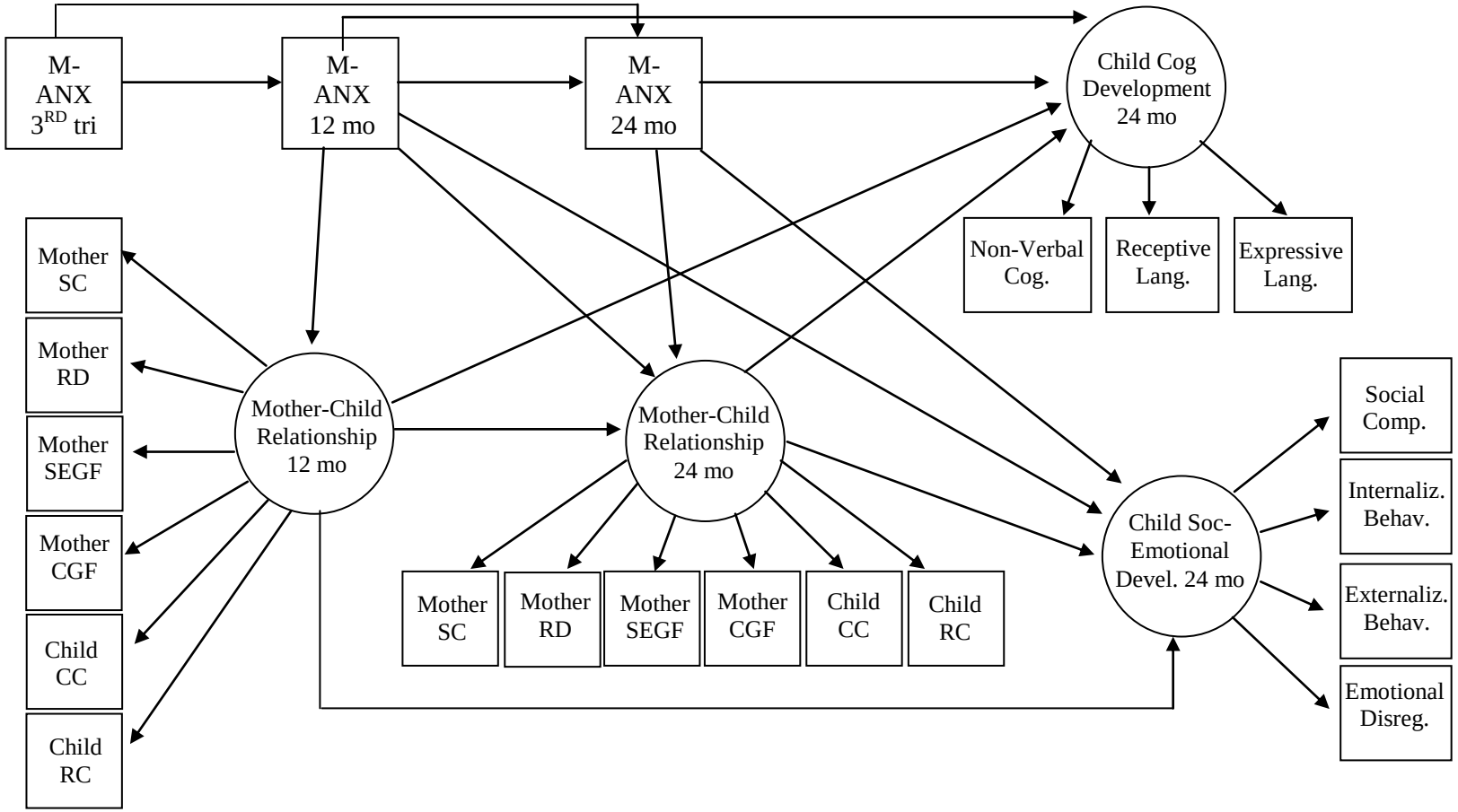

Figure 1. Conceptual Model A illustrating the hypothesized relationships between time varying PMA symptoms and mother-child interactions, as well as child cognitive and social-emotional development. Note: SC = sensitivity to cues, RD = response to child distress, SEGF = social-emotional growth fostering, CGF = cognitive growth fostering, CC = clarity of cues, and RC responsiveness to caregiver.

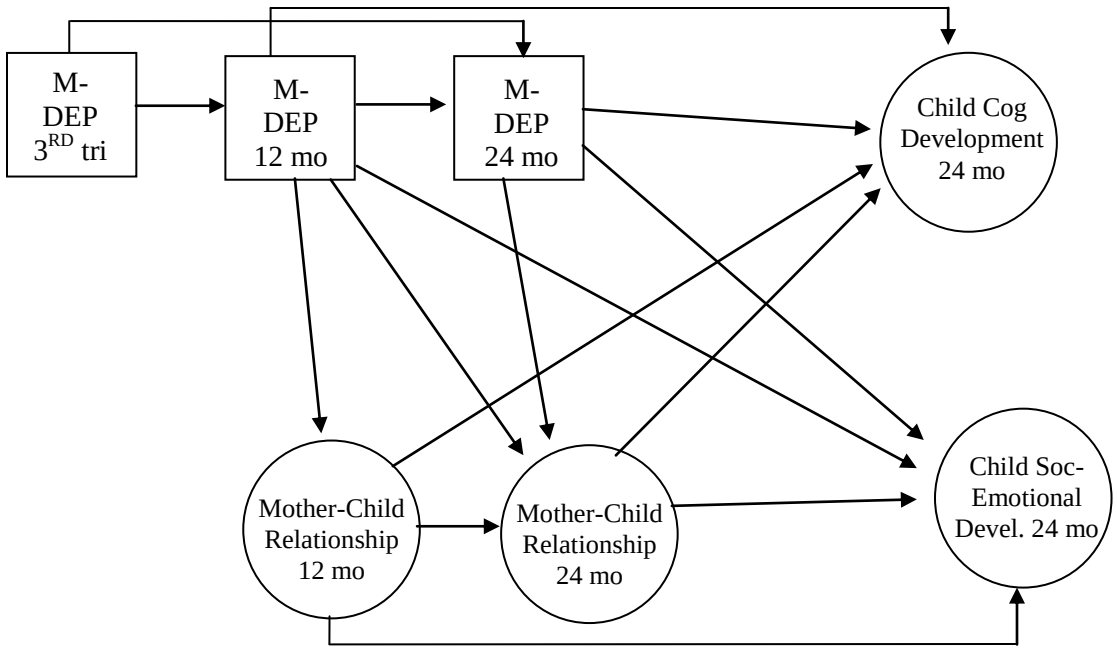

Figure 2. Conceptual Model B illustrating the hypothesized relationships between time varying PMD symptoms and mother-child interactions, as well as child cognitive and social-emotional development.

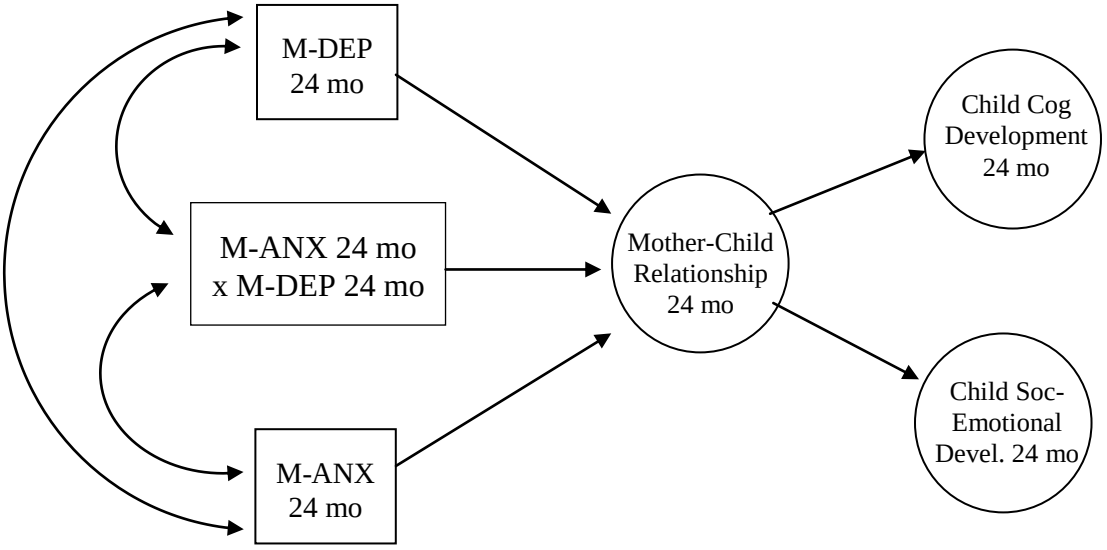

Figure 3. Conceptual Model C illustrating the hypothesized cross-sectional (at 24 months) relationships between PMA symptoms, PMD symptoms, their interaction term, mother-child interactions, and child cognitive and social-emotional development.

CHAPTER 2: Review of the Literature

Introduction

The focus of the current study was to expand on the existing knowledge of how postnatal maternal anxiety (PMA) and postnatal maternal depression (PMD) symptoms influence mother-child relationships at 12 and 24 months. In addition, this study aimed to further understand how these symptoms directly and indirectly (through the mother-child relationships) affect social-emotional and cognitive development in children at 24 months. Children's experiences from birth to three years have lasting effects, contributing to their early social-emotional and cognitive development and establishing the basis for later health, relational well-being, and academic achievement (CDCHU, 2007; Nelson & Mann, 2011; Shonkoff & Phillips, 2000).

One of the most important factors influencing children's early development is their relationship with their primary caregivers, often their mother (e.g., CDCHU, 2007; Osofsky & Liebernman, 2011). As a result, this study investigated PMA and PMD as mediated by the quality of mother-child relationships. These early experiences are critical to establishing strong foundations for healthy social-emotional and cognitive development during those years (and later in life). In the past decade, early childhood development has gained increasing attention because studies have found that problems and delays in the first years of life can last into later childhood and adulthood. Often, children's academic and social problems in school can be identified early, before they start school (e.g., Briggs-Gowan & Carter, 2006; Caselman & Self, 2008). Consequently, the American Academy of Pediatrics recommends routine screening for developmental

delays in pediatric primary care settings to identify problems and intervene early (Briggs-Gowan & Carter, 2006).

Early Childhood Development

Although healthy, normal development can vary considerably in early childhood, there are some skills that children generally develop by the time they reach 24 months. Cognitive development can be nonverbal or verbal and is related to children's attention and memory, including how quickly they understand commands, if they can identify common objects and colors, and basic problem solving during play. At age 24 months, children are developing executive functioning and working memory capable of responding to serial directions. Toddlers must be able to retrieve vocabulary they have learned to answer questions, an executive functioning task (Bayley, 2006).

In addition to children's cognitive development, at 24 months children can demonstrate both positive and problematic social-emotional behaviors. Children this old begin to be able to tolerate frustration, they try to manage their own behavior, they watch and briefly play with others, and they sometimes display prosocial helping behaviors (Briggs-Gowan & Carter, 2006). Furthermore, children at 24 months tend to start to express their desires and emotions. Children who display considerable amounts of aggression, are not able to be soothed, and cannot regulate their frustration could be developing problematic social-emotional behaviors (Briggs-Gowan & Carter, 2006). Healthy social-emotional development is strongly related to their attachment with their primary caregiver (e.g., Carter et al., 2001).

Mother-Child Relationships in Early Childhood

For most people, the mother-child relationship is uniquely close and long lasting, and their early interactions form the basis of their relationship or attachment (e.g., Cassidy & Shaver, 1999; Shonkoff & Phillips, 2000; Sroufe et al., 1999). Becoming securely attached to a primary caregiver marks an important milestone to achieve by the end of the first year of life (Cerezo, Pons-Salvador, & Trenado 2008) and not meeting this milestone can be the direct result of mother's lack of sensitivity (Cerezo et al., 2008), hostility or intrusiveness, or disengagement (CDCHU, 2009). An abundant body of research supports the notion that mothers' sensitivity to their infants and toddlers influence the social–emotional development of the children infant (e.g., Carter et al., 2001; Dawson et al., 2000; McMahon et al., 2001; Landry, Smith, Swank, Assel, & Vellet, 2001; Morgan, Farkas, Hillemeier, & Maczuga, 2009). Maternal sensitivity can be broken into responsiveness and contingency, or how mothers' respond to their children's cues (e.g., crying, calling, or crawling after; Landry, Smith, & Swank, 2006; Landry et al., 2001). These maternal behaviors provide modeled behavior for children to mimic and frameworks for understanding social interactions (Landry et al., 2006; McElwain & Booth-LaForce, 2006). Furthermore, through their interactions (i.e., sensitivity, contingency, and responsiveness), mothers provide verbal and nonverbal stimulation for children; thus, contributing to children's cognitive and language development (Landry et al., 2006; Lemelin, Tarabulsy, & Provost, 2006; Page, Wilhelm, Gamble, & Card, 2010).

Mothers under psychological distress may find it more difficult to engage in appropriate, positive, and sensitive interactions with their children. As a result, postnatal maternal anxiety (PMA) and postnatal maternal depressive (PMD) symptoms have the

potential to be damaging to children's early development because children's relationships with their primary caregivers provide the most important experiences for healthy development in the first few years of life (e.g., CDCHU, 2007; Osofsky & Liebernman, 2011; Sroufe et al., 1999).

Effects of PMD and PMA on Mother-Child Relationships. Stein et al. (2008) conducted a study in England with 944 mother-child dyads from diverse socioeconomic statuses to examine the relationships between postnatal depression, maternal caregiving, and socioeconomic factors in affecting their children's language development at 36 months old. Path analysis was used to test whether socioeconomic status moderated the effects of depression on caregiving and language development. The mothers had singleton pregnancies (i.e., carrying only one child) and the children were born healthy. Maternal depression was assessed at 3, 10, and 36 months; maternal caregiving at 10 and 36 months; and children's language development at 36 months through direct observation. These researchers found that PMD negatively influenced caregiving during the first few years among a large cohort of mothers. Caregiving, defined as both responsiveness and opportunities for learning, in turn, had a positive relationship with children's language development at 36 months old (Stein et al., 2008).

Similarly, in a meta-analysis of 46 studies, Lovejoy et al. (2000) examined the effects of PMD on mothers' parenting behaviors. Among the studies, participants in 26% of them were considered disadvantaged while participants in 65% of studies were non-disadvantaged. The children in these studies ranged from 2 days old to 16 years old (with the majority of studies involving children under 6 years old) and the time researchers observed mother-child dyads (either in their homes or in laboratories) ranged from 2

minutes to 720 minutes. The authors of the meta-analysis classified mothers behaviors observed as: “negative” if they involved negative maternal affect, hostility, or coercive behavior on the part of the mother; “disengaged” if the mother was uninvolved with her child, but showed a neutral affect; or “positive” if the mother was pleasant and enthusiastic (Lovejoy et al., 2000).

Lovejoy et al. (2000) found varying results of PMD’s influence on maternal behaviors; correlations between depression and negative behaviors ranged from -0.44 to 0.58, while correlations between depression and disengaged behaviors versus positive behaviors fell within the ranges of -0.12-.50 and -0.13-0.69, respectively. Thirty studies reported negative maternal behaviors; of these 40% found that there was a statistically significant positive relationship between PMD and these behaviors, three percent found a negative relationship, and 57% no significant relationship. Further, 45% of the 20 studies that reported on disengaged maternal behavior found significant positive associations, while 55% did not find a significant relationship. Finally, of the 34 studies reporting on positive maternal behavior, 24% found negative relationships and 76% did not find significant associations (Lovejoy et al., 2000). These authors did find that effect sizes for negative behaviors were moderated by whether mothers’ depressive symptoms occurred prior to the assessment of parenting behaviors or at the time of the observations. Studies that reported looking at current symptoms had higher effect sizes. Additionally, maternal depression affected positive maternal behaviors differently depending on socioeconomic status, age of child, length of observation, and type of observation (home or laboratory). Effect sizes were larger when children were infants (birth to 1 year) than if they were toddlers and preschools ($Q = 6.78$, $p < .01$). Overall, the authors indicated that there is a

moderate relationship between maternal depression and negative parenting behaviors, a small to moderate association for disengaged behavior, and a small effect for positive behaviors (Lovejoy et al., 2000).

While many studies have examined the relationship between PMD and mother-child interactions, the scientific literature about the effects of PMA on mother-child interactions is less abundant. However, two studies have provided some evidence that PMA may have a negative influence on mother-child interactions. Nicol-Harper et al. (2007) recruited 32 mothers with high-trait anxiety and 32 mothers with moderate to low-trait anxiety to study how anxiety symptoms influenced mothers' interactions with their children. These mothers had children who were between 10 and 14 months old. High-trait anxiety mothers were those who scored at or above the 70th percentile on the State-Trait Anxiety Inventory (STAI-T; Spielberger, 1983). Even after controlling for the effects of depressive symptoms, the researchers found that mothers with high levels of anxiety had less maternal sensitive responsiveness (p = .02) and lower emotional tone (p = .01) than those with moderate to low anxiety levels. No relationship, however, was found for mothers' focus on the infant or the infants' emotional tone (Nicol-Harper et al., 2007).

Other researchers considered influences of both PMD and PMA mother-child interactions (Felman et al., 2009). Among a sample of 100 dyads followed by researchers, 22 mothers had a major depressive disorder, 19 mothers had an anxiety disorder, and a matched cohort of 59 mothers without symptoms, but who were similar to the mothers with clinical distress on areas of age, education, parenting experience (prima/multipara), and infant birth weight and sex. (Dyads in which PMA and PMD were both present were excluded from the analysis.) Assessment of maternal depression and

anxiety, mother-child interaction, and child fear regulation occurred at two days, six months, and nine months postpartum.

Maternal anxiety and depressive symptoms were correlated at each time point (r = 0.43-0.57, $p < .001$). The major analyses looked at whether mothers who were depressed, anxious, or neither at the first assessment differed from each other in their mother-child interactions and the children's fear regulation. They found that mothers' sensitivity was higher among the control groups than the anxious mothers, which were higher in sensitivity than the mothers with depression ($p < .05$). They also found that mothers with anxiety disorders were more intrusive than the other two groups ($p < .01$) and mothers with depressive disorders were more withdrawn than the other two groups ($p < .01$). Finally, children's social engagement was lowest among the children of the mothers with a depressive disorder and highest among the control group ($p < .05$). They did not find that PMA was associated with children's fear or regulatory behaviors, but PMD was significantly associated with these behaviors ($p < .05$; Felman et al., 2009).

Given these findings, there is strong evidence of the negative relationship between PMD and mother-child interactions in early childhood. Additionally, these results suggest that some important interactions can also be negatively influenced by PMA. Because mother-child interactions are so crucial to their relationship and, thus, children's development, studies would logically examine the relationships between PMD and PMA with children's development. For PMD, there is extensive literature to suggest that maternal depressive symptoms can negative effect children during the first few years and later in life.

Postnatal Maternal Depression and Child Development

Having symptoms of depression can be a difficult part of bringing a child home for the first time, with many mothers experiencing what has often been called the "baby blues" (Banti et al., 2009; CDCHU, 2009; Nicolson, 1990). Rapid hormonal shifts from pregnancy to postpartum explain much of these symptoms (Banti et al., 2009), which occur for only a brief time after delivery, and are characterized by weepiness, mood lability, and general anxiety (Banti et al., 2009; Nicolson, 1990). Baby blues are different, however, from more chronic and more severe PMD symptoms (CDCHU, 2009; Nicolson, 1990), which have been associated with negative cognitive and socio-emotional development in young children (e.g., Beck, 1999; Cummings, Davies, & Campbell, 2000; Goodman & Gotlib, 1999).

Two meta-analytic reviews have looked at influences of PMD on children's development; one focused on cognitive and emotional development and the other focused on behavioral problems. The first study reviewed nine studies (n = 1,473), in which participants came from Sweden, the United States, and Great Britain (Beck, 1998). Children's development was measured at 18 months to 14 years, and regardless of child's age, PMD had a small, but significant, negative effect on the children's cognitive and emotional development (r ranged from .12 to .34 and d ranged from .24 to .72). Further, when studies controlled for current maternal depression, PMD had smaller effect sizes (Beck, 1998). In the second study, the researcher conducted a meta-analysis with 33 studies and 4,561 total mother-child dyads from the United States, Great Britain, New Zealand, and Canada (Beck, 1999). Children's behavior problems were studied from when they were 1 to 18 years old. Again, PMD seemed to have a negative effect on

children's development regardless of the age, with moderate effect sizes (*r* ranged from .29 to .35 and *d* ranged from .61 to .75; Beck, 1999).

More recently, Grace et al. (2003) reviewed the literature for the effects of PMD on children's cognitive and behavioral development. These authors only looked at articles published since 1990 and excluded studies with weaker methodologies. They included seven articles examining the relationship between PMD and children's cognitive development, with over 6,500 participating dyads. Grace et al. (2003) also reported on findings of six studies, which included over 5,000 dyads, exploring how PMD influenced children's behavioral development. The studies were conducted in Great Britain, Germany, Australia, the United States, and Canada. Study participants varied greatly as did the measures used, but PMD was measured between two days and one year.

Grace et al. (2003) reported that studies show strong negative effects of PMD on children's cognitive development, measured in multiple ways (e.g., Bayley's scales and Piaget's object concept task), up to 18 months old. These effects appear to be particularly strong for boys. Studies looking at older children, ages 5 to 7 years old, find less robust effects. Mediating factors, such as socioeconomic status, mothers' interactions with their infants, and chronic or severe depressive symptoms, explained more variance in these older children's cognitive development. Even still, boys continued to be at greater risk for cognitive deficits or delays if their mothers had postnatal depression (Grace et al., 2003).

This meta-analysis also included studies about problem behaviors at age five and infant crying and sleeping behaviors. Together, they support a small negative effect of PMD on the behavior of children (Grace et al., 2003). Teachers rated 5-year-old children

whose mothers had PMD as significantly behaviorally disturbed (i.e., more distractible, antisocial, or neurotic) than child of mothers who did not experience PMD. Among infants, PMD was positively associated with crying more quickly, louder, and longer in response to stimuli. PMD also predicted mother-reported sleep problems between 6 and 12 months (Grace et al., 2003).

Since the earlier meta-analyses, Stein et al. (2008) conducted a study with a large sample size that examined the relationships between mother's levels of depression (at 3, 10, and 36 months), maternal caregiving quality, and children's language development. These authors found that maternal depressive symptoms at 3 ($p < .01$) and 10 months ($p < .01$), but not at 36 months, were negatively associated with children's language scores at 36 months. Additionally, higher quality maternal caregiving at 10 and 36 months predicted higher language scores ($p < .001$ at both time points), and depression at both time points was related to concurrent caregiving ($p < .05$ and $p < .001$ for 10 and 36 months, respectively). They also found that girls had higher language scores than boys and monolingual children had higher scores than bilingual children (Stein et al., 2008). Finally, Stein et al. (2008) found that socioeconomic status appeared to influence the effects of depression on caregiving and language development. They found stronger associations between depression at 10 and 36 months on concurrent caregiving for the group of disadvantaged mother-child dyads ($b = -0.21$; $p < 0.01$ and $b = -0.27$; $p < 0.001$, respectively), than for the group of advantaged mother-child dyads ($b = -0.13$; $p < 0.05$ and not significant, respectively). They did not, however, find that effects of caregiving differed for the groups. High quality caregiving was similarly positively related to children's language development for the two groups.

The findings previously reported provide considerable empirical evidence for the significant impact PMD has on children's social-emotional and cognitive development. Additionally, they suggest that symptoms of depression at varying times in the first few years can influence development differently. Furthermore, there is evidence that other factors, such as socioeconomic status and gender, can moderate the effects of depression. Less research, however, has been conducted investigating the effects of anxiety symptoms – and the findings are mixed.

Postnatal Maternal Anxiety and Child Development

Some studies examining the relation between postnatal maternal anxiety and child development focused on the effects of PMA symptoms on somatic outcomes, including infant colic, food refusal, recurrent abdominal pain, and overall health. Carey (1963) and Akman et al. (2006) reported that maternal PMA symptoms were positively associated with infant colic. Further, Coulthard and Harris (2003) found that state anxiety (but not trait anxiety) at one and 11 months after birth was associated with unresolved food refusal. One large, community-based cohort study found 6-year-old children were more likely to have recurrent abdominal pain if their mothers experiences PMA between 6 and 8 months after delivery (Ramchandani, Stein, Hotopf, & Wiles, 2006). Finally, maternal stress at 6 months was found to predict mothers' reports of their children's overall health at 18 months (Fowles & Walker, 2009).

Among psychological child outcome measures, PMA's influence on children's temperament is the most commonly studied (Glasheen et al., 2010). Researchers examined children's temperament from 3 months old to 3 years old and findings were mixed. Some researchers found that PMA within six months of delivery was associated

with difficult child temperaments at three (Coplan, O'Neil, & Arbeau, 2005), 4 (McMahon et al., 2001), and 6 months old (Pesonen, Raikkonen, Standberg, & Jarvenpaa, 2005); while other researchers did not find any association (Davis et al., 2004; Diener, Goldstein, & Mangelsdorf, 1995; Galler, Harrison, Ramsey, Butler, & Forde, 2004; Susman, Schmeelk, Poniraki, & Gariepy, 2001).

Temperaments are rather stable throughout development, particularly compared to social-emotional development (Thompson, Winer, & Goodwin, 2011). Although children's temperaments tend to influence children's social-emotional development (Coplan et al., 2005), social-emotional development is distinct from temperament (Thompson et al., 2011). Two studies looked at the influences of PMA on children's social-emotional development in early childhood. Barnett et al. (1991) followed mothers who experienced varying levels of anxiety (i.e., low, moderate, high) three or four days postnatally for five years after their children were born. At the five-year follow-up, mothers (n = 100), fathers (n = 68), and children's teachers (n = 65) reported on the children's social and behavior development, with the Child Behavior Checklist (CBCL; cite). CBCL scores for children with highly anxious mothers soon after birth were compared to children with low or moderately anxious mothers soon after birth and there were significant differences ($p < .05$) found among mother- and father-reported behaviors. Mother who had high anxiety reported that their children were less active (t = 1.70), less socially competent (t = 1.71), and boys were less mature (t = 1.76) and more delinquent (t = 1.89). Fathers of children with highly anxious mothers reported that their children were less socially competent (t = 1.88), more delinquent (t = 1.80), and more schizoid (t = 1.80). There were no significant differences in teacher ratings (Barnett et al.,

1991). Furthermore, PMD at three or four days after delivery predicted higher levels of externalizing behaviors in children at five years old (Barnett et al., 1991).

Another study examined effects of PMA symptoms on child social-emotional development. Galler et al. (2000) conducted a study with 226 mother-child dyads in Barbados. The mothers were described as typical of Barbados childbearing women: on average 25 years old and had a mean of 2.3 children (including the child in the study). They assessed PMA and PMD at 7 weeks and 3 months postpartum and measured children's personal-social development at 7 weeks, 3 months, and 6 months. After controlling for environmental factors, such as maternal health, family income, and maternal information-seeking, both PMA and PMD at 7 weeks were negatively associated with children's social development at three months ($p < .001$), but not 6 months (Galler et al., 2000). Not only did Galler et al. (2000) study the effects of PMA on children's social-emotional development, but they also examined the influence on children's cognitive development. They found that PMD at 7 weeks, but not PMA, was positively associated with total child cognitive development at 3 months ($p < .01$).

Two studies have looked at how stress and stressful events (constructs correlated with anxiety) influence young children's cognitive development. Slykerman et al. (2007) analyzed whether New Zealand mothers' ($n = 1,714$) perceived stress in their last month of pregnancy was associated with children's intelligence at three and a half years. They also considered mothers' perceived stress at the time they measured the children's intelligence. They found that higher levels of perceived stress during pregnancy were negatively associated with children's intelligence ($p = .01$), measured by Stanford Binet Intelligence Scale Fourth Edition (Thorndike, Hagen, & Sattler, 1986). However,

maternal stress measured when the child was three and a half years was not found to be associated with their children's intelligence (p = .28). A different study, conducted in London, tested postnatal stress, PMA, and PMD as control variables for whether their prenatal counterparts predicted children's cognitive development 14 to 19 months old. In this study, children's cognitive development was assessed using the Bayley Scales of Infant Development-Second Edition (BSID-II; Bayley, 1993). Of the 123 mother-child dyads, none of the postnatal factors uniquely contributed to the children's cognitive development. In both studies, infants were healthy, full-term babies from singleton pregnancies (Bergman, Sarkar, O'Connor, Modi, & Glover, 2007; Slykerman et al., 2007). While these studies reported using stress, stressors, or stressful life events as a proxy for anxiety, anxiety is sometimes a response to stress and involves considerable negative affect (Morissette et al., 2007). Thus, these results may or may not translate to looking at PMA. Additionally, anxiety and depressive symptoms often co-occur and the presence of comorbidity is often a marker of severity. These findings are less conclusive and there seems to be gaps in the areas of social-emotional and cognitive development.

Comorbidity between Anxiety and Depression

The potential effects of comorbid psychological distress, such as anxiety disorders have not been addressed in relation to parent-child relationships and child development early in life, even though researchers have found that depression and anxiety often co-occur (Andrews, Sanderson, Slade, Issakidis, 2000; Carter et al., 2001; Matthey et al., 2003; Miller, Pallant, & Negri, 2006). Among one sample of mothers, at six weeks postpartum, 25.9% of mothers experienced some level of anxiety; 16.2%, 5.6%, and 4.2% met criteria for an anxiety disorder only, a depressive disorder only, and comorbid

depression, respectively (Matthey et al., 2003). Given that anxiety and depression both involve overlapping symptoms (e.g., negative affect), comorbidity is understandable (Morissette et al., 2007). In light of this connection between anxiety and depression, it seems odd that more studies have not looked at child outcomes in the context of both constructs of psychological distress.

Findings supporting PMD's impact on early childhood development may be confounded by the presence of anxiety symptoms (Carter et al., 2001). Researchers have used factor analyses to demonstrate that the Edinburgh Postnatal Depression Scale (Murray & Carothers, 1990), one of the most widely used measures for PMD, also measures anxiety symptoms (Phillips, Charles, Sharpe, & Matthey, 2009; Tuohy & McVey, 2008). Further, the presence of comorbidity is a marker of severity (Andrews et al., 2000; Glasheen et al., 2010; Matthey et al., 2003; Miller et al., 2006); as such, mothers who experience both anxiety and depressive symptoms after birth may find parenting particularly difficult, above and beyond that of mothers who experience only PMA or only PMD. However, no studies have investigated the effects the interaction of these symptoms might have on mother-child relationships or children's development.

Summary

As noted, early childhood social-emotional and cognitive development can have lasting effects in childhood and later in life. Mothers and the relationships they have with their children provide some of the most important experiences for children's healthy development. However, up to 45% of mothers experience some elevated level of psychological distress (i.e., depression, anxiety) postnatally (Matthey et al., 2003); and the symptoms of anxiety and depression have been shown to negatively impact the way

mothers and children interact with each other. Additionally, while extensive literature indicates that depressive symptoms negatively influence children's social-emotional and cognitive development, fewer studies have examined the effects of anxiety symptoms – and the findings are mixed. Furthermore, anxiety and depressive symptoms often co-occur and the presence of comorbidity is often a marker of severity. Yet, no study has looked at the combined influences of anxiety and depressive symptoms on the parent-child relationships or children's development. This study aims to fill in some of the remaining gaps in this area to better understand: how both PMA and PMD symptoms influence mother-child relationships at 12 and 24 months, how these symptoms and the mother-child relationship influence children's social-emotional and cognitive development in the first 24 months, and to explore whether there is an relationship between PMA and PMD symptoms.

CHAPTER 3: Methodology

Study Design

The purpose of the present study was to enhance the understanding of the influences of postnatal maternal anxiety (PMA) and postnatal maternal depression (PMD) on children's social-emotional and cognitive development at 24 months of age. In addition, the potential mediating role of mother-child relationships was also explored. The study used archival data collected as part of the Conditions Affecting Neurocognitive Development and Learning in Early Childhood (CANDLE) Study, using a naturalistic design. The data was analyzed using structural equation modeling analyses. Mothers' symptoms from their third trimester of pregnancy through their children's 24th month were examined, as well as how these symptoms affected their children's social-emotional and cognitive development at 24 months of age. In the hypothesized models, these effects were expected to be mediated by the mother-child relationships at 12 and 24 months (see Figures 1 and 2). Furthermore, it was hypothesized that there would be an interaction effect between anxiety symptoms and depressive symptoms (see Figure 3).

Prior to the analyses, the use of the archival data was approved by the University of Memphis Institutional Review Board. Additionally, this study was approved by personnel from the CANDLE Study. These personnel included the principal investigator, a formal approval committee, and a biostatistician.

Sample Size

Kline (2011) recommends that any Structural Equation Modeling analysis obtain a minimum sample size of 200; however, model complexity influences the sample size necessary to have high enough statistical power. Jackson (2003) suggested the N:q rule

for models that use the maximum likelihood estimation method. This rule recommends that researchers consider the ratio for number of participants (N) by number of parameters to be estimated in the model (q), with a minimum ratio of 10:1 and preferably up to 20:1. The proposed models for Hypotheses A and B include 56 estimated parameters; thus, a minimum of 560 participants will be needed. The model for Hypothesis C only has 37 estimated parameters and, therefore, requires 370 or more participants.

Participants

The study analyzed information collected on mother-child dyads participating in the CANDLE Study. The CANDLE Study recruited a convenient sample of 1500 healthy women with singleton pregnancies in Shelby County, Tennessee. In this study, 512 dyads had completed their 24-month follow-up. Among these dyads, 397 of them had complete data; these dyads were included in the analyses. Participating mothers range from 16 years old to 40 years old, with a mean of 26.4 years old; 63.7% of participants report Black for their race, 34.3% reported White, and 2.0% report some other race (e.g., Asian, Native American, Hispanic). This breakdown of participants is important because it represents the racial make-up of Shelby County with relative accuracy (Tennessee Department of Health Vital Statistic, as cited in The CANDLE Study, 2012). Moreover, investigating PMA, PMD, and their influences on early childhood with a large population of Black women has never been done before, and much less is known about how these symptoms impact these families (see Table 1).

Table 1

Demographic Descriptive Statistics (N = 397)

Variable	*M*	*SD*	Min-Max
Mother's age (years)	26.44	5.40	16.00-40.00
Child's gestational age (weeks)	38.91	1.44	31.50-41.60
Child's birthweight (pounds)	7.25	1.49	2.71-10.89

Mother's Marital Status		**Mothers' Education Level**	
Married	43.6%	Less than high school	9.6%
Living with partner	39.5%	GED/high school diploma	46.3%
Separated	0.3%	Technical school	10.1%
Divorced	1.3%	College degree	20.9%
Widowed	0.3%	Graduate/professional degree	12.8%
Never married	14.9%		

Annual Income		**Number of Prior Pregnancies Delivered**	
$0-4999	14.4%	None	166 (41.8%)
$5000-9999	6.0%	1	108 (27.2%)
$10000-14999	6.0%	2	70 (17.6%)
$15,000-19999	5.8%	3	30 (7.6%)
$20000-24999	6.0%	4	12 (3.0%)
$25000-34999	10.3%	5	6 (1.5%)
$35000-44999	6.8%	6	3 (0.8%)
$45000-55999	8.1%	7	2 (0.5%)
$55000-64999	3.8%		
$65000-74999	9.3%		
$75000 and over	15.6%		

In some of these ways, the women in this study have acquired protective factors that may increase their ability to provide for themselves and their children. Single-parenthood and low maternal education are among the most commonly discussed risk factors for developmental delays in children (Shonkoff, 2010; Shonkoff, Boyce, & McEwen, 2009). More mothers in this cohort identified a significant partner during pregnancy than Shelby County mothers giving birth; about 43.6% were married and an additional 39.5% had partners who lived with them. Additionally, these women were

more highly educated than new mothers in Shelby County. Only 9.6% of the women in this study had less than a high school education whereas nearly 30% of new mothers in Shelby County have no high school diploma or GED. Furthermore, 33.7% had either a college, graduate, or professional degree compared to only 20% of Shelby County (Tennessee Department of Health Vital Statistic, as cited in The CANDLE Study, 2012).

Nevertheless, many of these mothers also experience the hardship of poverty. The income-level of these mothers ranged greatly, with the highest three income categories being more than $75,000 a year (15.6%), less than $5,000 (14.4%), and 25,000-34,999 (10.3%). Just under half of the participants are considered low-income (making less than $35,000 annually; The CANDLE Study, 2012). Meanwhile, about a quarter of the mothers reported an annual family income of less than $15,000 a year. These findings are quite comparable to those in Shelby County (Tennessee Department of Health Vital Statistic, as cited in The CANDLE Study, 2012). Spending one's first three years in poverty is known to be associated with significant amounts of stress and fewer enriching experiences (Shonkoff, 2010; Shonkoff et al., 2009). Thus, overcoming the struggles of poverty is a major issue for families and the community.

Just over half (52.6%) of the children in study are boys and 47.4% are girls. They were born between the 31st and 42nd week of pregnancy, and were between 2.71 and 10.89 pounds at birth. Finally, 41.8% of the mothers were first-time mothers; another 45% of the mothers had one or two older children, and 13.4% had between three and seven children prior to this child.

Most of the mothers in this study remained within normal levels of anxiety and depressive symptoms throughout the study; however, about 27% of mothers experienced

clinical or sub-clinical levels of symptoms at some point. The percent of mothers with at least sub-clinical depressive symptoms remained stable over the two-year period at just over 11%, while fewer mothers seemed to experience anxiety symptoms over the years - falling from 9.6% to 6.3%. A smaller proportion of mothers (4.8 to 6.0%) experienced elevated levels of both anxiety and depression at the same time. Additionally, as children grew older, the trained-observers detected more problems with mother-child relationships, increasing from 9.1% to 13.6% in just one year. Finally, only 8.6% of the mother-reported scores indicated that their children were at-risk on the social competence scale, while 22.4% of children may be at-risk for behavior for behavior problems (see Table 2).

Table 2

Mental Health Descriptive Statistics (N=397)

Sub-Clinical to Clinical Maternal Anxiety and Depressive Symptoms (T-scores ≥ 60)			
	3rd trimester	12 months	24 months
Anxiety	9.6%	8.3%	6.3%
Depression	11.6%	11.3%	11.6%
Anxiety & Depression	6.0%	4.8%	5.8%
"Worrisome" Mother-Child Relationship Interactions (cutoff = 10%ile)			
		12 months	24 months
Equal to cutoff		2.3%	4.3%
Below cutoff		9.1%	13.6%
At-Risk for Problems or Delays in Child Development			
			24 months
Social competence (lowest 15%ile)			8.6%
Behavior problems (lowest 25%ile)			22.4%
At-Risk for Cognitive and Language Delays (lowest 25%ile)			
			24 months
Non-verbal cognitive development			35.5%
Language development			29.6%

Procedures

The CANDLE Study, sponsored by The Urban Child Institute, The University of Tennessee, and The University of Memphis, recruited healthy women, with low-risk pregnancies and who plan to be the primary caregivers for their children. They were enrolled in the study before their 28th week of pregnancy. This project is currently ongoing, CANDLE Study researchers follow these women until their children are 48 months old (this analysis only contains data collected up to the 24th month), while the women continue to receive prenatal care, pediatric care, and education from their regular physicians. Participants are not asked to change their medical, nutritional, or other health habits in any way for the purposes of the study.

The mothers can receive more than $500 worth of gift cards for participating in multiple data collection time-points throughout the study. These data collection time-points include two prenatal CANDLE clinic visits, hospital collected birth information, four follow-up CANDLE clinic visits for mother and baby (at 12, 24, 36, and 48 months after delivery), two home visit (at 1 and 24 months after delivery), and brief phone calls periodically. The CANDLE Study collects information about multiple variables on both the mothers and children across the study, including physical health, cognitive, and psychosocial variables. However, this analysis only examines demographics and scores on five psychosocial variables. These include the mothers' reports of their anxiety symptoms and depressive symptoms when the mothers are in their third trimesters of pregnancy, and then 12 and 24 months after delivery. The mother-child relationships are observed and scored at 12 and 24 months after delivery and the children's social-emotional and cognitive development are collected when the children are 24 months old.

Measures

Participating mothers completed the following measures (described below): a demographic questionnaire at all three time points (see Appendix A); the Brief Symptom Inventory, which includes anxiety and depression scales (BSI; Derogatis, 1993; see Appendix B); and the Brief Infant Toddler Social Emotional Assessment (BITSEA; Briggs-Gowan & Carter, 2006; see Appendix C). Additionally, trained examiners completed the Bayley Scales of Infant and Toddler Development, Third Edition Screening Test (BSID-III; Bayley, 2006; see Appendix D) for each of the children and the Nursing Child Assessment Satellite Training Parent-Child Interaction – Teaching Scale (NCAST PCI-T; Summer & Spietz, 1994; see Appendix E) for each of the parent-child dyads (see below for details). All of the trained examiners had field experience prior to this study, and they underwent a 6-hour training for the specific measures used as part of the CANDLE Study. Furthermore, the examiners conducted all of their assessments under the supervision of a more experienced examiner for their first two to four weeks and obtained a 90% interrater reliability with this supervisor during this time. Interrater reliability was retested every six months.

Demographic questionnaire. At baseline, CANDLE Study investigators asked mothers questions related to demographic information, including questions about mother's age, marital status, income, educational attainment, and number of children she previously delivered. Additionally, the child's gender, gestation age, and birth weight were documented at birth.

Maternal depressive symptoms and anxiety symptoms. Maternal anxiety and depressive symptoms were measured during the mothers' third trimester of pregnancy,

and 12 and 24 months after delivery, using the BSI depression and anxiety subscales (Derogatis, 1993). This self-report, symptom inventory was designed to detect current (within seven days of testing) psychological distress, and these subscales each include six distinct items. Answers for items range from 0 = "not at all," to 4 = "extremely" and raw scores are calculated by adding the values of each answer and dividing by the number of items answered.

Raw scores were converted to T-scores, with a mean of 50 and a standard deviation of 10. A T-score of 60 has been used in to indicate sub-clinical levels (Haas et al., 2005; Stewart et al., 2010). To standardize scores, norms were developed by gender using samples of individual from diverse backgrounds, including 1,423 adult psychiatric patients, 974 adult nonpatients and 2,408 adolescent nonpatients (Derogatis, 1993). Derogatis and Savitz (2000) reported that the subscales have high internal consistency (Cronbach's alpha: .81 for anxiety and .85 for depression) and two-week test-retest reliability (r = .79 and .84, respectively). Additionally, the author indicated that each of the scales had adequate convergent, discriminant, and construct validity (Derogatis, 1993). For the present study, the both scales showed a high internal consistency at each time point. The Cronbach's alphas for the depression scale were .84, .85, and .85 for the prenatal, 12-month, and 24 month visits, respectively. For the anxiety scale the Cronbach's alphas were .75, .82, and .83, respectfully.

Mother-child relationships. Mother-child relationship was measured by observing their interaction during a clinic visit using the NCAST PCI-T (Sumner & Spietz, 1994) when the children were 12 and 24 months old. This measure was designed to measure parent-child interactions during a standardized teaching incident, generating a

quantitative measure representing the parent-child relationship. The scale contains 73 items scored as observed (1) or not observed (0). There are 50 parent cues and 23 child cues that were documented if they were seen during the parent-child interaction. The constructs measured include five subscale. These include caregivers': (a) sensitivity to cues, (b) response to child distress, (c) social-emotional growth fostering, and (d) cognitive growth fostering. Also among the subscales are children's: (a) clarity of cues and (b) responsiveness to caregiver (Sumner & Spietz, 1994). Total parent-child scores were computed and compared with the nationally normed scores for African American, Caucasian, and Hispanic populations. Dyads with scores below the 10th percentile for their raise are considered to have "Worrisome" interactions. Internal consistency reliabilities have been reported to range from .76 to .87 for the total scales (Sumner & Spietz, 1994).

Child cognitive development. Trained examiners administered BSID-III (Bayley, 2006) when the children were 24-months-old to measure the children's cognitive and language. For this assessment, which typically lasts for 50-90 minutes, examiners presented a series of test materials to the children and observed their responses and behaviors. The BSID-III is appropriate for children aged sixteen days to 42 months and has been regarded as the best instrument for assessing infant and toddler cognitive development (Sattler, 2008). It contains multiple indices, including: nonverbal cognitive, receptive language, and expressive language. Raw scores are converted to standard scores (M = 10, SD = 3) based on children's age (Bayley, 2006).

The BSID-III nonverbal Cognitive scale contains items that measure the children's processing speed, visual attention and memory, ability to discriminate pictures,

developmental level of play, and numeracy skills in addition to their capacity to recognize colors and match items. Receptive language items include identifying common objects or action pictures as well as responding to commands and simple quotes. Expressive language items range from assessing children's ability to exert early sounds and sound combinations to their use of word combinations, naming objects and actions, and communicating their wants and needs for older children (Bayley, 2006).

The BSID-III shown strong reliability for the norming sample, with internal consistency (Cognitive = .91, Language = .93) and test-retest reliability (Cognitive = .81, Language = .87). Additionally, a .79 correlation has been found between Cognitive scale and the Wechsler Preschool and Primary Scales of Intelligence-III (Wechsler, 1991) Verbal IQ and Full Scale IQ, while it correlates at .72 with the nonverbal, Performance IQ of the WPPSI-III (Bayley, 2006). Finally, the nonverbal Cognitive score and the full Language scale of the BSID-III correlate at .60 and .71 with the Bayley II (Bayley, 1993) Mental Index, respectively (Bayley, 2006).

Child social-emotional development. Mothers completed the BITSEA (Briggs-Gowan & Carter, 2006; Briggs-Gowan, Carter, Irwin, Wachtel, & Cicchetti, 2004) as a measure of children's social-emotional development at 24 months. This 42-item assessment is appropriate for children ages 12 months to 35 months 30 days, and measures Internalizing, Externalizing, Dysregulation, and Social Competence. The Internalizing, Externalizing, and Dysregulation subscales are totaled into the Problem scale. For the Social Competence scale, low scores suggest possible deficits in children's social skills. In contrast, higher scores on the Problem Behavior scale indicate that children may have more behavior problems. The at-risk cut-score for the Social

Competence scale is set at the 15th percentile and the behavior Problem Total is set at the 75th percentile (Briggs-Gowan & Carter, 2006).

Briggs-Gowan et al. (2004) reported acceptable internal consistency both the BITSEA Problem Behaviors and Social Competency scales (.79 and .65, respectively), with the norming sample. Additionally, they reported that the test-retest reliability was .87 for the problem scale and .85 for the competency scale. Similarly, the Problem and Competence scales had inter-rater reliability coefficients .74 and .67, respectively (Carter & Briggs-Gowan, 2006). The BITSEA scales have moderate to strong correlation with the Infant-Toddler Social and Emotional Assessment (ITSEA; Carter & Briggs-Gowan, 2006), with the Problem Behaviors subscales' correlations range from .57 (internalizing for girls) to .77 (externalizing for boys). Furthermore, the Social Competence scales correlations between the BITSEA and the ITSEA $r = .79$ for girls and $r = .77$ for boys. Finally, the BITSEA has been shown to have predictive validity when compared to Child Behavioral Checklist for ages 1.5-5 years (Briggs-Gowan et al., 2004). For the present study, the internal consistency of responses on each of the scales was somewhat low, but determined to be adequate. The Chronbach's alphas were .65 for the Social Competence scale, .68 for the Externalizing subscale, .59 for the Internalizing subscales, and .61 for the Dysregulation subscale.

Analysis

Descriptive analyses were run on each of the demographic variables as well as on the variables of interest for the study to attain greater understanding of the participants in this sample (see Table 1). Additionally, Cronbach Alpha internal consistency scores were computed for the self-report measures used in this study to help determine whether the

scales and subscales are reliable for the participants in this study. Because study personnel take care to assure that the examiners are well-trained and have high interrater reliability, internal consistency was not tested for the observation measures.

Finally, this study's hypotheses were tested using structural equation modeling (SEM), which is a group of procedures that blend exploratory and confirmatory analyses (Kline, 2011). It is important to note, that mothers' anxiety and depressive symptoms were considered as continuous variables. Computer programs used for SEM test three basic scenarios, but the most common is to generate and test a model based on theory and previous research for goodness of fit to the data. As often occurs, when an initial model does not fit the data, it is modified and then tested again (Kline, 2011). SAS statistical software and maximum likelihood estimation were used for SEM in this study. Maximum likelihood estimation refers to a statistical principal that assumes that the estimates made by the computer software are the ones that maximize the likelihood that the data were drawn from the population (Kline, 2011).

CHAPTER 4: Results

Introduction

This study's hypotheses were examined using structural equation modeling (SEM) and SAS statistical software, with maximum likelihood estimation. The benefits of SEM analyses over other analyses include being able to assess multiple relationship between variables at once and the use of latent variables (described later), which reduces measurement errors (Nachtigall, Kroehne, Funke, & Steyer, 2003). The core characteristic of SEM is to develop conceptual, hypothesized model and compare them to the observed data. Models that propose relationships supported by the data are considered to have good or adequate fits (Nachtigall et al., 2003).

The hypothesized models (Models A, B, and C) were tested by following the five general steps of SEM (Kline, 2011). First, a model was specified; in other words, study hypotheses were expressed in a series of equations in addition to conceptual drawings. The next step in testing the conceptual model was to check for model identification, or whether the software program will be able derive unique estimates for the specified model parameters. Step three involved data preparation and screening. The fourth step, model estimation, entailed using the computer software to conduct the analysis. This step has many parts: evaluation of model fit, interpretation of parameter estimates, and consideration of equivalent models. Finally, modifications were made to improve model fit and parsimony (Kline, 2011).

Specification & Identification of the Hypothesized Models

First, the models were specified, based on the three overarching hypotheses. These conceptual models (Figures 1, 2, and 3) represent the hypothesized relationships

between the variables of postnatal maternal anxiety (PMA), postnatal maternal depression (PMD), mother-child interactions, child cognitive development, and child social-emotional development. These models include both manifest (i.e., observed) and latent variables. Latent variables are hypothetical factors derived from manifest variables in the model (Kline, 2011).

Next, model identification was determined for each hypothesized model. Models need to be just-identified (i.e., zero degrees of freedom left) or over-identified (i.e., at least one degree of freedom left) in order produce a solution of model fit. The software programs cannot generate a solution for an under-identified model, a model in which there are more model parameters estimated than data points available. Furthermore, when constructing models with latent variables, they need to be both locally and globally identified. Local identification refers to the number of manifest variables expected to compose the latent variables and their parameters; a minimum of three manifest variables are needed to be just-identified locally. Global identification refers to the number of parameters estimated across the entire model. Ideally, models estimate fewer parameters than data points in the model in order to be over-identified.

To mathematically determine identification, first, the number of manifest variables (p) is multiplied by one plus the number of manifest variables and divided by two (i.e., [p (p +1)]/2). Then, this calculated number subtracts the number of estimated parameters (Byrne, 2010). In the case of this study, the conceptual Models A and B have 22 manifest variables and proposed to estimate 56 parameters. Thus, there are 197 degrees of freedom and the models are over-identified. Model C includes 16 manifest

variables and proposed to estimate 37 parameters; thus, it is over-identified and has 99 degrees of freedom.

Data Screening and Preparation

The data were then screened and prepared for the analyses. Following the recommendations of Tabachnick and Fidell (2001) for screening data, the ranges, means, variances, and standard deviations for each variable were explored using the SPSS computer software. Because an interaction was intended to be tested (PMA at 24 months by PMD at 24 months), an interaction variable was created. Recommendations to center the measured variables at their means to reduce multicollinearity were followed in creating this variable (Kline, 2011). Additionally, assumptions of structural equation modeling were tested, including univariate and multivariate normality and homoscedasticity. Finally, data were checked for multicollinearity among the variables and for outliers (Kline, 2011).

No problems were found with the assumptions of SEM. Two multivariate outlying cases were found and removed from the dataset. Also, multicollinearity was determined to be a problem for the interaction variable and both PMA and PMD at 24 months (i.e., variance inflation factors or VIFs >10). No other variables showed problems of multicollinearity (VIFs ranged from 1.32 to 3.10). Lastly, the variances of each of the anxiety, depression, and mother-child relationship variables were about 10 times greater than those of the other variables and variances. Extreme variances can cause estimates to fail to converge (Kline, 2011); thus, these variables were rescaled to reduce potential problems. The anxiety and depression variables were multiplied by three while the mother-child relationship variables were divided by three.

Subsequently, bivariate correlations were calculated between each of the variables in the study (see Table 3). As expected, each of the anxiety and depression variables was moderately to highly positively correlated with each other. Additionally, the three manifest variables intended to measure child cognitive development at 24 months (i.e., non-verbal cognitive development, expressive language, and receptive language) were highly positively correlated. Similarly, the manifest variables for child social-emotion development at 24 months were moderately correlated. Externalizing behaviors, internalizing behaviors, and dysregulation had positive correlations with each other. Predictably, social competence was negatively correlated with the other three social-emotional development variables. Surprisingly, however, social competence was more highly correlated with the cognitive development variables than the other social-emotional development variables. No significant correlations were found between the maternal mental health variables and mother-child relationship at either 12 or 24 months. Furthermore, the only significant correlation between the maternal mental health variables and the child cognitive development variables was that PMA at 24 months was negatively correlated with child non-verbal cognitive development. On the other hand, several significant correlations were found between the mother mental health variables and the child social-emotional development variables. Finally, both of the mother-child relationship variables had significant correlations with each of the child development variables. Means and standard deviations for each of the variables in the models are also reported in Table 3.

Table 3

Bivariate Correlations and Descriptive Statistics for Study Variables (N=395)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Prenatal maternal anxiety	-	.53**	.45**	.62**	.42**	.32**	.05	.09	.09	.03	.04	.01	.13**	.03	.14**
2 PMA – 12 months		-	.47**	.46**	.65**	.38**	-.02	.07	-.05	-.04	-.03	-.11*	.12*	.12*	.26**
3 PMA – 24 months			-	.39**	.38**	.65*	-.02	-.04	.02	-.01	.01	-.11*	.20**	.21**	.26**
4 Prenatal maternal depression				-	.52**	.42**	-.07	-.01	-.06	-.01	-.04	-.02	.10*	.08	.18**
5 PMD – 12 mo.					-	.48**	-.05	-.02	-.08	-.06	-.04	-.12*	.12*	.09	.17**
6 PMD – 24 mo.						-	-.02	-.01	-.03	.02	.02	-.14**	.21**	.24**	.27**
7 Mother-child relationship - 12 months[a]							-	.25**	.25**	.22**	.25**	.18**	-.14**	-.14**	-.16**
8 Mother-child relationship - 24 months[a]								-	.33**	.33**	.34**	.14**	-.06	-.17**	-.17**
9 Non-verbal cognitive development									-	.55**	.64**	.35**	-.15**	-.20**	-.20**
10 Expressive Language										-	.75**	.34**	-.21**	-.15*	-.17**
11 Receptive Language											-	.35**	-.18**	-.15**	-.20**
12 Social Competence												-	-.30**	-.21**	-.25**
13 Externalizing Behavior													-	.38**	.43**
14 Internalizing Behavior														-	.57**
15 Dysregulation															-
M	45.18	43.64	43.47	47.88	47.25	47.61	55.39	56.16	9.48	9.65	9.12	17.84	2.62	2.40	3.53
SD	8.68	8.41	8.12	7.73	7.83	7.88	6.96	7.04	2.68	2.59	2.77	2.69	2.27	1.92	2.46

Note. $*p < .05$. $**p < .01$. Means and standard deviations provided based on original values, prior to rescaling for structural equation modeling. [a] A total mother-child relationship manifest variable was used rather than latent variable.

Model Estimation and Modification

In the final steps, the models were estimated and modifications were made. Because the models in this study contain latent variables, "measurement" models were initially estimated to ensure that the latent variables reflect the hypothesized latent constructs with reasonable accuracy (Kline, 2011). Being able to test the constructs of interest with a measurement model is one of the benefits of using latent variables (Hatcher, 1994; Kline, 2011). When evaluating the measurement model estimation, the factor loadings of the manifest variables onto the latent variables were considered, in addition to the overall fit of the model. The conceptual or hypothesized models were then estimated and three types of effects (i.e., direct, indirect, and total) were considered (Hoyle & Panter, 1995). All effects are reported as standardized regression weights. Although the models for Hypotheses A and B were generally considered good fits of the observed data, there was evidence that they could improve. Therefore, they were modified (i.e., adding or removing estimated parameters that define relationships between variables) based on the variable loadings on factors, normalized residuals, and considerations of parsimony (Hatcher, 1994). The procedures of estimating and modifying each hypothesized model are detailed below.

Hypothesis A: The Anxiety Model. Hypothesis A for this study was that postnatal maternal anxiety (PMA) symptoms would negatively influence children's cognitive development and socio-emotional development. The relationship was expected to be partially mediated through the mother-child relationships (Figure 1). The measurement model for Hypothesis A or the Anxiety Model was specified, over-identified, and run through the SAS program. However, the software program was not

able to converge because the data matrix was nonpositively defined. There are many reasons such an error can occur, including extreme multicollinearity, the incidences of outliers, pairwise deletion of missing data, extreme differences between variable variances, and not having large enough sample size (Kline, 2011). Because each of the other issues was addressed, and a minimum 10:1 ratio for participants per parameter was not met, it was concluded that reducing the number of parameters would likely solve the problem. Using total-scores (i.e., a combination of five subscales recorded as part of the Parent-Child Interaction measure) manifest variables for the mother-child relationships, rather than creating a latent variable, reduced the number of parameters without affecting the hypotheses or outcome measures. This simplified model (Figure 4) has 34 estimated parameters; therefore, this study has an adequate sample size to test this model. Additionally, it was verified to be over-identified, with 44 degrees of freedom.

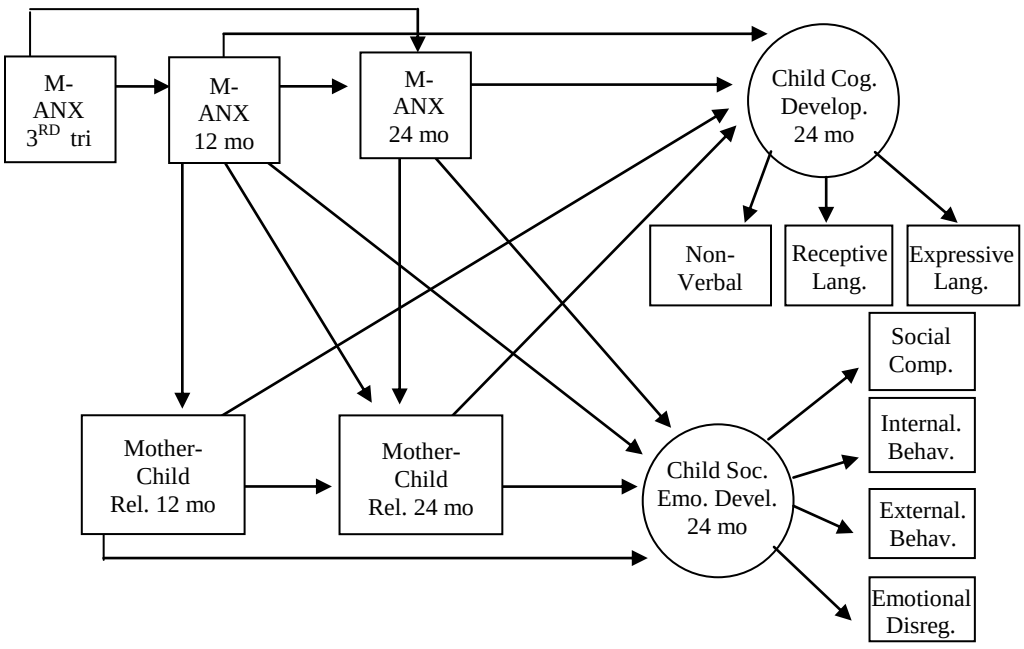

Figure 4. Conceptual Model A-Revised illustrating that the mother-child relationship variables are now manifest variables.

The measurement model for this revised Anxiety Model was estimated (see Figure 5). The Chi-Square statistic was significant ($\chi 2$ (38) = 101.744, $p < .0001$), indicating significant differences between the model and the data. However, Chi-Square tests are highly sensitive to sample size, and sample sizes over 200 can result in non-significant Chi-Squares, even when the model fits the data reasonably well (Kline, 2011). Therefore, since this study includes 395 participants, Chi-Squares are reported but were not exclusively used to examine how well the model fits the observed data. Instead, the Comparative Fit Index (CFI), Nonnormed Fit Index (NFI), and Root Mean Square Error of Approximation (RMSEA) were used to indicate model fit because they are most sensitive to misspecified factor loading (Hu & Bentler, 1998). Models were considered to fit the data well with indices of greater than .95 and .90, and less than .06, for CFI, NFI, and RMSEA, respectively (Hu & Bentler, 1999). These fit indices minimally indicated adequate fit: (NFI = .926; CFI = .952; RMSEA = .065, 90%CI = .050 to .081).

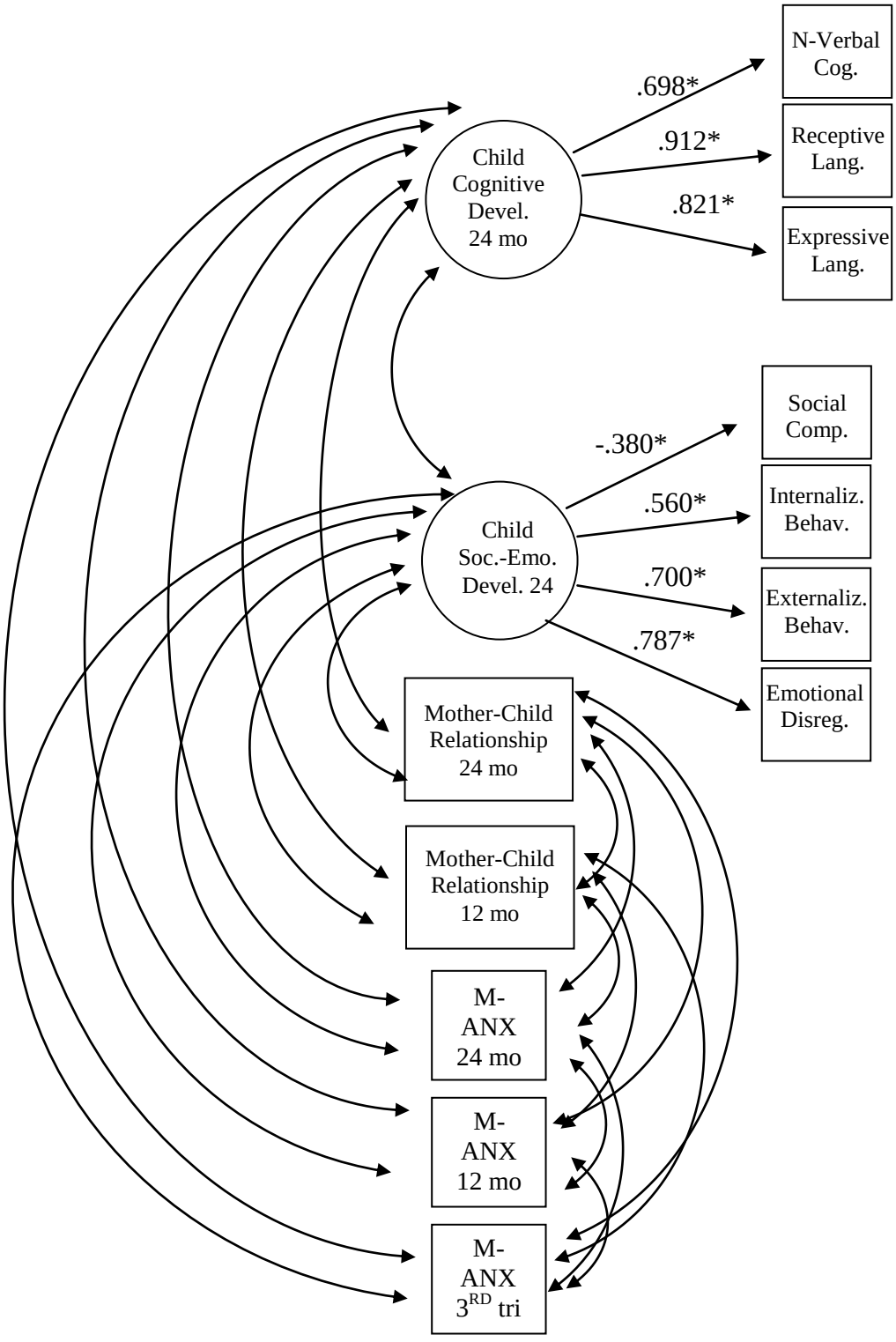

Figure 5. Initial Measurement Model for Anxiety, illustrating the hypothesized loadings of manifest variables onto the latent variables, and their standardized estimates. *p<.001.

Next, factor loadings or standardized regression weights (i.e., correlation coefficients), and normalized residuals were examined more closely to verify construct validity of the latent factors. Non-significant factor loadings, and loadings less than .40 on latent variables, indicate that a manifest variable inadequately measures the underlying factor (Hatcher, 1994). Additionally, the SAS program creates standard or normalized residuals for each pair of manifest variables in the model to identify how well relations between just two variables are being represented by the model. Good model fits have residuals close to zero, indicating that the theoretical model is nearly identical to the observed data. Normalized residuals greater than 2.00 suggest that relations between variables may not be adequately represented by the theoretical model (Hatcher, 1994).

For the initial measurement model of the Anxiety Model, all of the factor loadings were statistically significant; however, the standardized regression weight for social competence onto the social-emotional development latent factor was only -.380. Additionally, this variable had normalized residuals of 5.10, 4.63, and 4.72, with non-verbal cognitive development, receptive language, and expressive language, respectively. These findings were consistent with the Pearson correlations reported earlier. Although often considered separately, children's social-emotional and cognitive development are highly linked in the first several years of life (Bayley, 2006; Briggs-Gowan & Carter, 2006; Lamb & Lewis, 2011). Thus, following this conceptual framework, as well as the evidence from the factor loading and normalized residuals, a new measurement model (Figure 6) was tested with social competence estimated on the latent factor with the cognitive variables. The new latent factors are conceptualized as child social and cognitive competence (SCC) and child emotional and behavioral problems (EBP).

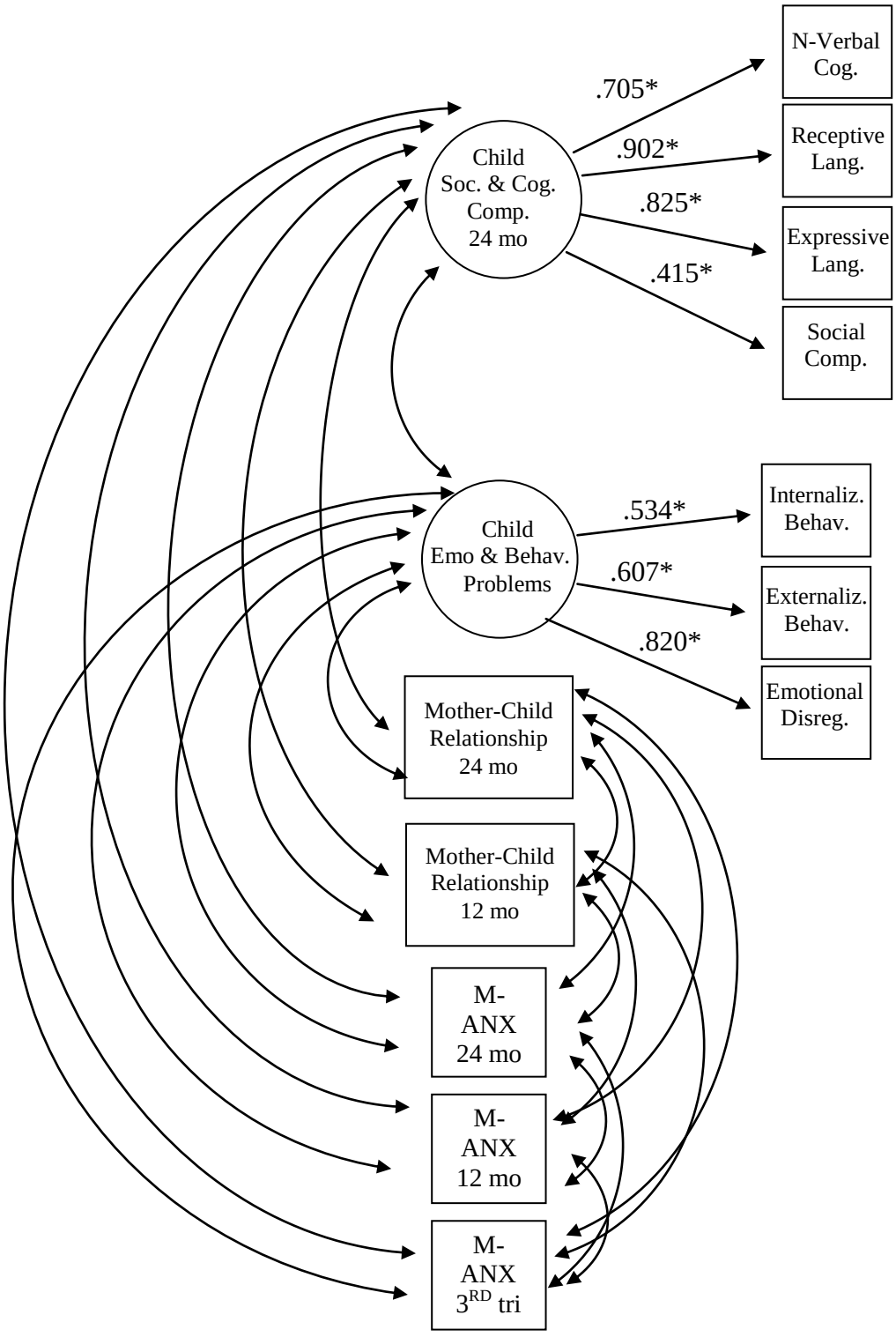

Figure 6. Revised Measurement Model for Anxiety, illustrating the factor loadings of the manifest variables when social competence is moved to the latent variable with the three cognitive development manifest variables. *p<.001.

The fit indices for the revised measurement model improved ($\chi 2$ (38) = 81.37, p < .001; NFI = .941; CFI = .967; RMSEA = .054, 90%CI = .038 to .070), indicating that the modifications produced a model more closely fitting to the observed data. (See Table 4 for a comparison of the models' fit indices).

Table 4

Hypothesis A Measurement Models with Fit Indices

	$\chi 2$	*df*	NFI	CFI	RMSEA
Initial Model, Hypothesis A	101.74	38	.926	.952	.065
Revised Model, Hypothesis A (moved social competence)	81.37	38	.94	.97	.054

The factor loadings onto the latent variables all remained statistically significant, and the standardized regression weight for social competence onto the social and cognitive competence latent factor was .415. Moreover, the normalized residuals between this manifest variable and all of the cognitive variables reduced below 2.00; however, this variable now had normalized residuals of -4.68, -2.86, and -2.44 with each of the respective emotional and behavioral problem variables (i.e., externalization, dysregulation, and internalization). Even still, these residuals are closer to zero than those in the previous model, and the revised model is considered an adequate fit.

Thus, this measurement model was accepted and the structural model was estimated with the new latent variables. Additionally, a path was added from the SCC factor to child EBP factor to mitigate the large normalized residuals. When children have better social and cognitive skills, they are better able to communicate their needs and desires without acting inappropriately (Thompson et al., 2011). The fit indices for this

initial structural model (Model A1) indicated that the model is a good fit ($\chi 2$ (43) = 86.83, $p < .001$; NFI = .937; CFI = .967; RMSEA = .051, 90%CI = .035 to .066).

Although the model fit the data adequately, the standardized factor loadings revealed that five of the estimated paths were not significant and a more parsimonious model may be appropriate. Kline (2011) suggests that researchers only modify one path at a time. Accordingly, one nonsignificant path extended from PMA at 24 months to the child SCC latent factor. The normalized residual for this anxiety variable and social competence was also greater than 2.00. Thus, this path was removed and Model A2 was estimated. A Chi-Square difference test was conducted to examine whether the two models differed from each other; this test was found to be nonsignificant. Furthermore, the other fit indices, factor loadings, R^2 for each endogenous variable, and normalized residuals were examined. These indicators of fit either remained the same or improved; therefore, it was concluded that Model A2 was a better model for the observed data than Model A1. There was also evidence that Model A2 could be modified to be more parsimonious. These procedures were followed four more times, removing the paths that had the smallest t-value and considering the fit indices, factor loadings, R^2 for each endogenous variable, and normalized residuals to determine whether removing the path improved or worsened the model.

Next, the path from PMA at 12 months to mother-child relationships (MCR) at 12 months was removed. (Note: Due to requirements of SEM analyses, a correlation had to be made between the maternal anxiety during pregnancy and MCR at 12 months because they were both exogenous variables.) This modification improved the model. Then, the path from PMA at 12 months to SCC was removed from the model. Although Chi-Square

test difference for this modification was nonsignificant, the normalized residuals for several of the pairs of variables increased substantially. Therefore, it was added back to the model. The path from the MCR at 24 months to the child EBP latent factor was removed, and this model (A5) was considered an improvement. Finally, the path between PMA at 24 months and mother-child relationship at 24 months was removed. Again, this change appeared to worsen the model. Therefore, it was concluded that Model A5 (Figure 7) was a better model and more changes would reduce the model fit. (See Table 5 for a comparison of the structural models' fit indices).

Table 5

Hypothesis A: Anxiety Model Structural Models' Fit Indices

	$\chi 2$	*Df*	$\chi 2$ dif*	NFI	CFI	RMSEA
Initial Structural Model A1	86.83	43	-	.937	.967	.051
Revised Model A2 (removed PMA24 -> SCC)	88.83	44	2.00	.949	.967	.051
Revised Model A3 (removed PMA12 -> MCR12)	87.47	44	1.36	.936	.967	.050
Revised Model A4 (removed PMA12 -> SCC)-reject	89.30	45	1.83	.935	.966	.050
Revised Model A5* (removed MCR24 -> EBP)	89.88	45	2.41	.935	.966	.050
Revised Model A6 (removed PMA24 -> MCR24)-reject	92.85	46	2.97	.933	.962	.051

Note. $\chi 2$ dif = Chi-Square difference test, which is significant at 3.84 for 1 degree of freedom. *Determined to be the best model for Hypothesis A

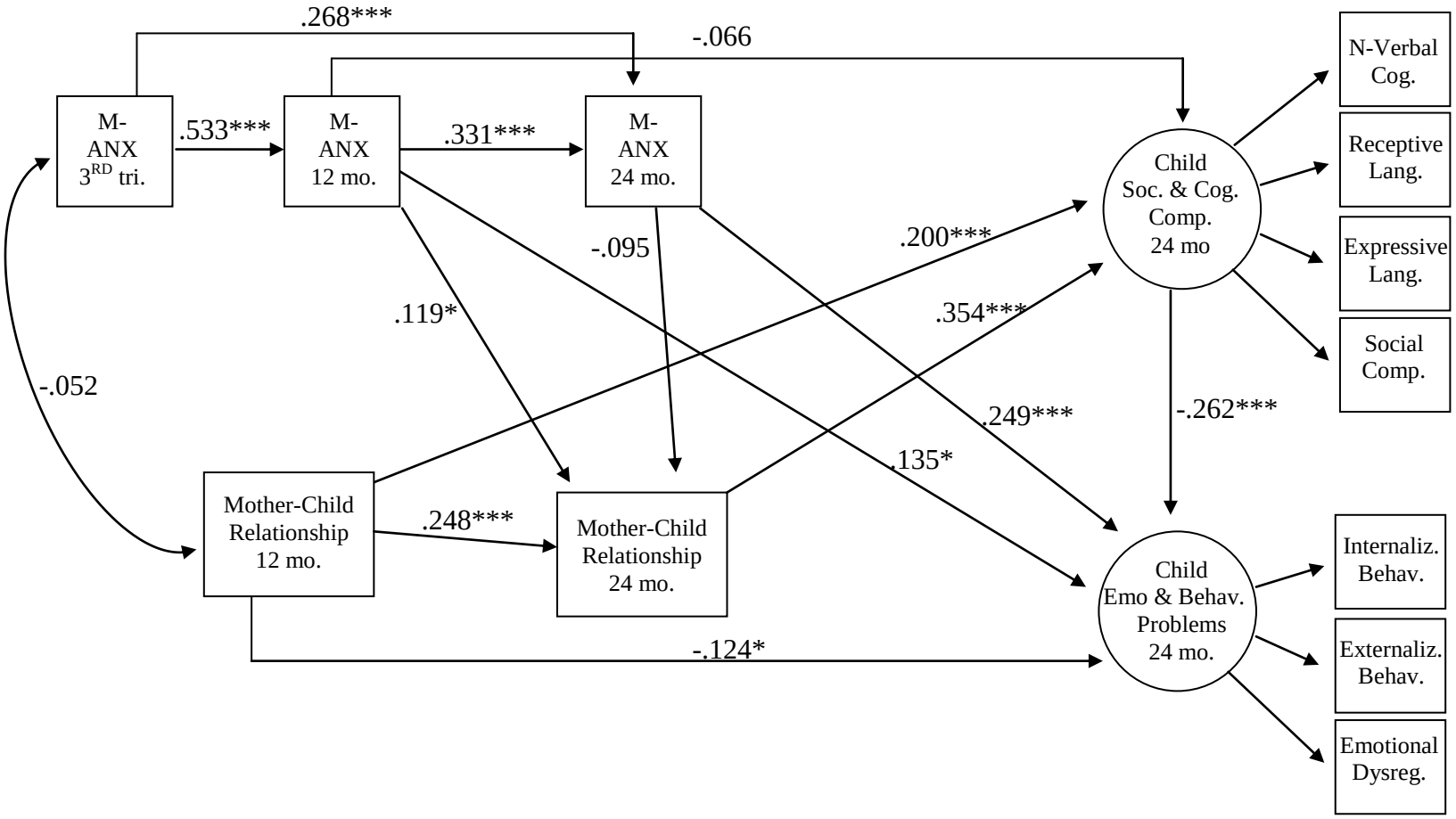

Figure 7. Model A5, Final Structural Model for Hypothesis A, illustrating the final relations between variables and standardized regression weights. *$p < .05$. **$p < .01$. ***$p < .001$.

In order to answer Hypothesis A, regarding the relations between PMA, mother-child relationships, and children's development, the effects yielded by the model on the variables of interest were examined. Specifically, the effects of interest for the Anxiety Model are: (1) the direct effects that predict the proportion of the variance in quality of mother-child relationships explained based on the level of maternal anxiety at 12 and 24 months; (2) the direct effects that predict child social-emotional and cognitive development based on quality of mother-child interactions at 12 and 24 months; (3) the direct effects that predict social-emotional and cognitive development based on the levels of PMA at 12 and 24 months; and (4) the indirect effects of the levels of maternal anxiety symptoms on the children's social-emotional and cognitive development, mediated through quality of mother-child attachment. Direct effects are represented by the standardized regression weights (i.e., betas or regression coefficients). Indirect effects or mediating effects were calculated by multiplying the direct paths between each indirect relation. Finally, total effects were also calculated by tallying the direct and indirect effects. Criteria for determining effect sizes for direct and indirect effects were based on Shrout and Bolger's (2002) recommendations.

As shown is Table 6, PMA has no effect on MCR at 12 months and a very small effect on MCR at 24 months. PMA at 12 months has a small, significant, positive direct effect on MCR at 24 months, while PMA at 24 months shows a nonsignificant negative direct effect. For SCC, the MCR at 12 months had both small direct and indirect effects, and MCR at 24 months had a moderate direct effect. The reverse was found for MCRs' effects on EBP. At 12 months, MCR had significant, small, negative direct and indirect effects, while at 24 months it had no direct effect on EBP and a medium indirect effect.

PMA at 12 and 24 months both had small positive effects on EBP (meaning higher anxiety was associated with more behavior problems, with the symptoms at 24 months appearing to a have larger direct effect. The indirect effects of PMA at 12 months was considered moderate, however. Finally, PMA did not have any significant effects on SCC.

Table 6

Standardized Effects for the Final Anxiety Model (Model A3)

Causal Variables	Endogenous Variables			
	MCR12	MCR24	SCC	EBP
PMA – 12 months				
Direct effects	-	.119	-.066	.135
Indirect effects	-	-.031	.031	.091
Total effects	-	.088	-.035	.226
PMA – 24 months				
Direct effects	-	-.095	-	.249
Indirect effects	-	-	-.034	.009
Total effects	-	-.095	-.034	.258
MCR – 12 months				
Direct effects	-	.248	.200	-.124
Indirect effects	-	-	.088	-.075
Total effects	-	.248	.288	-.199
MCR – 24 months				
Direct effects	-	-	.354	-
Indirect effects	-	-	-	-.093
Total effects	-	-	.354	-.093
SCC				
Direct effects	-	-	-	-.262
Indirect effects	-	-	-	-
Total effects	-	-	-	-.262

Note. MCR12 = mother-child relationship at 12 months, MCR24 = mother-child relationship at 24 months, SCC = social and cognitive competence, and EBP = emotional, and behavioral problems.

The software program also generated squared multiple correlations (R^2) for each of the endogenous variables. The R^2 for SCC suggests that 20.03% of the variance of 24-month-olds' social and cognitive competence was explained in this model, while the R^2 for EBP suggests the 21.89% of the variance of these children's emotional and behavioral problems were explained in this model. In addition, only 7.45% of the variance of the MCR at 24 months was explained, while 28.44% and 27.61% of the variances were explained for PMA at 12 and 24 months, respectively. Overall, there is evidence that supports this model as a good fit for understanding the relations between PMA, mother-child relationships, and child social-emotion and cognitive development. Moreover, Hypothesis A is partially supported; PMA at both 12 and 24 months have direct effects on EBP, but not CSS. In addition, the evidence does not suggest an indirect relationship with mother-child relationships as a mediator.

Hypothesis B: The Depression Model. Similar to the previous model, the Depression Model is examining the relations between maternal symptoms and children's development. Specifically, this model is testing the hypothesis that PMD symptoms negatively influence children's cognitive development and children's socio-emotional development, which is partially mediated through the mother-child interactions (Figure 2). This model uses the same mediating and outcome variables as the previous Anxiety Model. As such, modifications were made to this model based on findings from the anxiety model. For the initial measurement model of the Depression Model (Figure 8), the two latent factors were child CSS and EBP.

The fit indices for this measurement model were similar to that of the anxiety model and considered to be a good fit ($\chi 2$ (38) = 74.72, $p < .001$; NFI = .950; CFI = .971;

RMSEA = .050, 90%CI = .033 to .066). The factor loadings onto the latent variables were also similar to the previous model. They were all statistically significant and ranged from .414 to .903. Finally, the normalized residuals between the social competence manifest variable and the other social-emotional variables remained greater than two (-4.65, -2.11, and -2.40 for externalization, dysregulation, and internalization, respectively). Yet, the model fit indices indicated that this measurement model was sufficient, and the factor loadings of the manifest variables were all significant. Hence, this measurement model was accepted.

As with the measurement model, the initial structural Depression Model was the same as the previous initial structural Anxiety Model, only replacing the anxiety symptoms with depressive symptoms. The fit indices for this initial structural model (Model B1) indicated that the model is a good fit ($\chi 2$ (43) = 76.30, p = .001; NFI = .960; CFI = .974; RMSEA = .044, 90% Confidence Interval = .028 to .060). Like before, there was evidence that this model could be more parsimonious, and the nonsignificant paths were removed one by one. The fit indices, factor loadings, and normalized residuals were examined for each revised model. The fit indices and absolute values of the Chi-Square differences are reported in Table 7. Most of the alterations produced only small changes in the overall model as well as the individual relations; though, removing the path from PMD at 12 months to SCC substantially worsened the normalized residuals between several variables. Thus, this modification was rejected even though the overall model fit was essentially equivalent. The final Depression Model, Model B8 was more parsimonious than the initial model by 5 degrees of freedom and produced a Chi-Square that was not significantly different from the initial model. The fit statistics for Model B8

were considered good ($\chi 2$ (43) = 78.21, p = .004; NFI = .972; CFI = .977; RMSEA = .040, 90%CI = .023 to .056).

Table 7

Hypothesis B: Depression Model Structural Models' Fit Indices

	$\chi 2$	*Df*	$\chi 2$ dif	NFI	CFI	RMSEA
Initial Structural Model B1	76.30	43	-	.944	.974	.044
Revised Model B2 (removed PMD24 -> SCC)	76.97	44	0.67	.943	.974	.044
Revised Model B3 (removed PMD12 -> MCR12)	75.96	44	-	.944	.975	.043
Revised Model B4 (removed PMD12 -> EBP)	75.96	45	0.00	.944	.976	.042
Revised Model B5 (removed PMD24 -> MCR24)	75.98	46	0.00	.944	.977	.041
Revised Model B6 (removed PMD12 -> MCR24)	76.04	47	0.06	.944	.977	.040
Revised Model B7 (removed PMD12 -> SCC)-reject	77.10	48	1.06	.943	.977	.039
Revised Model B8* (removed MCR24 -> EBP)	78.21	48	2.17	.972	.977	.040

Note. $\chi 2$ dif = Chi-Square difference test, which is significant at 3.84 for 1 degree of freedom. *Determined to be the best model for Hypothesis B.

The effects yielded by the model (Figure 8) on the variables of interest were also explored to verify whether Hypothesis B, concerning the relations between PMD, MCR, and children's development, was supported. Analogous to the Anxiety Model, the effects of interest for the Depression Model were: (1) the direct effects of depressive symptoms at 12 and 24 months on MCRs; (2) the direct effects that predict SCC and EBP based on quality of MCR at 12 and 24 months; (3) the direct effects PMD at 12 and 24 months on SCC and EBP; and 4) the indirect effects of the levels of PMD on the children's social-emotional and cognitive development, mediated through quality of MCR.

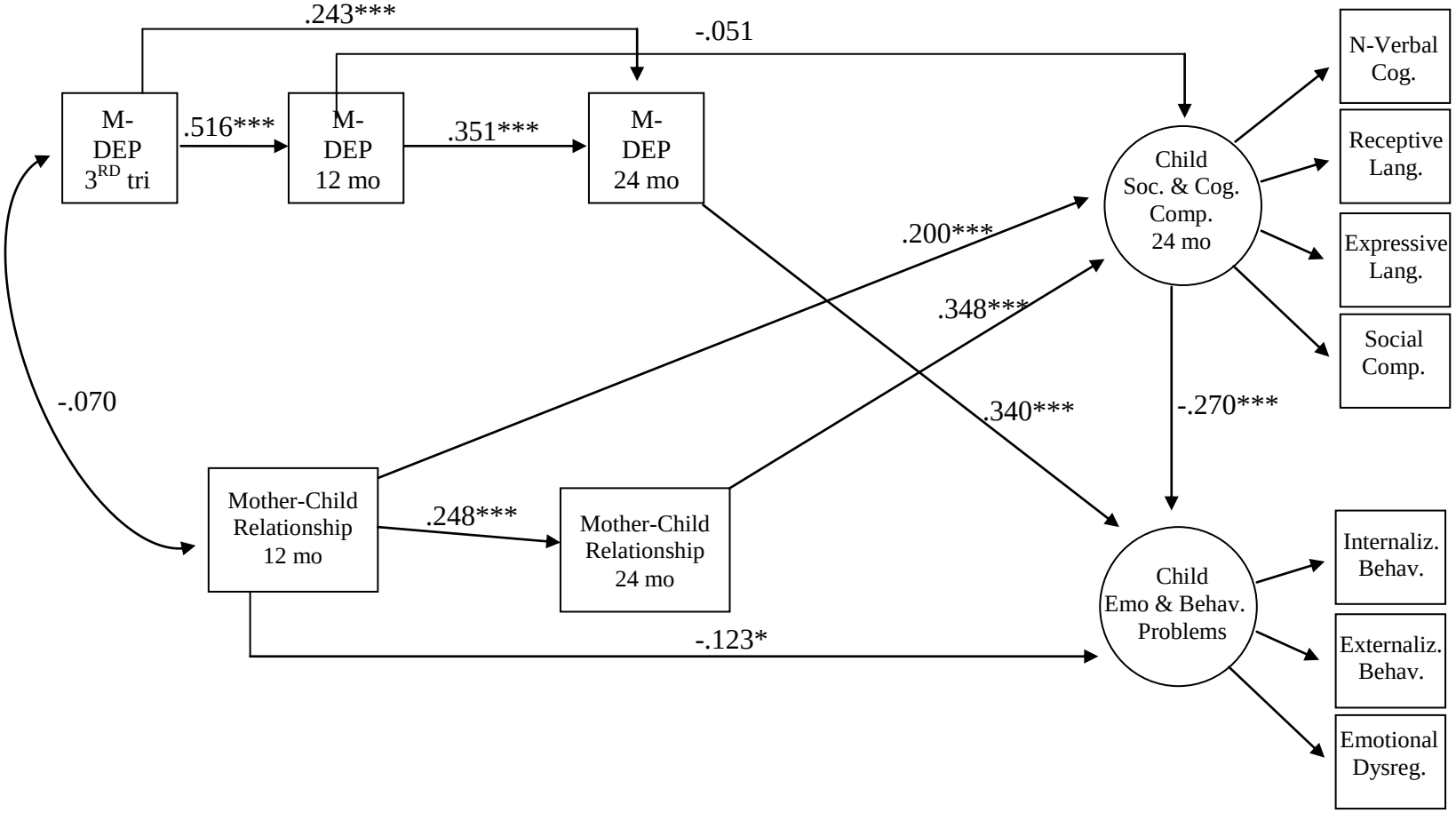

Figure 8. Model B8, Final Structural Depression Model illustrating the final relations between variables and standardized regression weights. *p < .05. **p < .01. ***p <.001.

Table 8 displays the direct, indirect, and total effects on each of the variables of interest. In this model, neither PMD at 12 months nor PMD at 24 months had effects on MCR at either time point. Similar to the previous model, MCR at 12 months had a small, direct and indirect effects on SCC and EBP. MCR at 24 months had no direct effect on EBP, but a moderate, negative indirect effect. Additionally, MCR at 24 months had a moderate direct effect on SCC. The only direct effect from PMD to either child development variable was PMD at 24 months on EBP, which was moderate and positive. The indirect effect on EBP by PMD at 12 months was also moderate and positive. Finally, PMD at 12 months had a nonsignificant direct effect on SCC, while PMD at 24 months had no effect on SCC.

In addition, there is evidence that the relations in this Depression Model account for 19.90% of the variance of SCC and 23.09% of the variance of EBP. Only 6.13% of the variance of MCR at 24 months is explained and 26.61% and 27.02% of the variances are explained for PMD at 12 and 24 months, respectively. Taken all together, the model was demonstrated to be a good fit for understanding the relations between PMD, mother-child relationships, and child social-emotion and cognitive development. Furthermore, Hypothesis B is partially supported; PMD at 24 months had direct effects on EBP, but not CSS. However, the indirect relationship between PMD and children's social-emotional and cognitive development was not supported.

Table 8

Standardized Effects for the Final Depression Model (Model B8)

Causal Variables	Endogenous Variables			
	MCR12	MCR24	SCC	EBP
PMD – 12 months				
Direct effects	-	-	-.051	-
Indirect effects	-	-	-	.119
Total effects	-	-	-.051	.119
PMD – 24 months				
Direct effects	-	-	-	.340
Indirect effects	-	-	-	-
Total effects	-	-	-	.340
MCR – 12 months				
Direct effects	-	.248	.200	-.123
Indirect effects	-	-	.086	-.077
Total effects	-	.248	.286	-.200
MCR – 24 months				
Direct effects	-	-	.348	-
Indirect effects	-	-	-	-.094
Total effects	-	-	.348	-.094
SCC				
Direct effects	-	-	-	-.270
Indirect effects	-	-	-	-
Total effects	-	-	-	-.270

Note. MCR12 = mother-child relationship at 12 months, MCR24 = mother-child relationship at 24 months, SCC = social and cognitive competence, and EBP = emotional, and behavioral problems.

Hypothesis C: The Interaction Model. An interaction between PMA and PMD was intended to be tested by estimating a model that included PMA at 24 months, PMD at 24 months, and an interaction term that was the product of the two former variables. The relationships were hypothesized based on the results of Model A and Model B (see Figure 9). As discussed earlier, multicollinearity was found to be a problem for the

interaction variable and both PMA and PMD at 24 months. This problem resulted in nonpositive definiteness; therefore, the software program could not estimate the model. An alternative method for testing an interaction was also considered; this method entails running an SEM model with two groups, and comparing the results.

Accordingly, Model C (Figure 9) was reduced to having only the anxiety variable and would have been estimated for participants with elevated (i.e., sub-clinical or clinical) levels of depressive symptoms and for participants with normal levels. It includes 9 manifest variables and proposed to estimate 20 parameters; thus, it is over-identified by 25 degrees of freedom. However, only 46 participants had elevated levels of depressive symptoms at 24 months (and only 25 participants experienced sub-clinical or clinical levels of anxiety at 24 months). It is recommended that SEM analyses have a minimum participant-parameter ratio of 10:1 (Kline, 2011). Thus, the analysis would require that each group have 200 participants. Therefore, the software program could not converge for the elevated level group and Hypothesis C was not able to be tested.

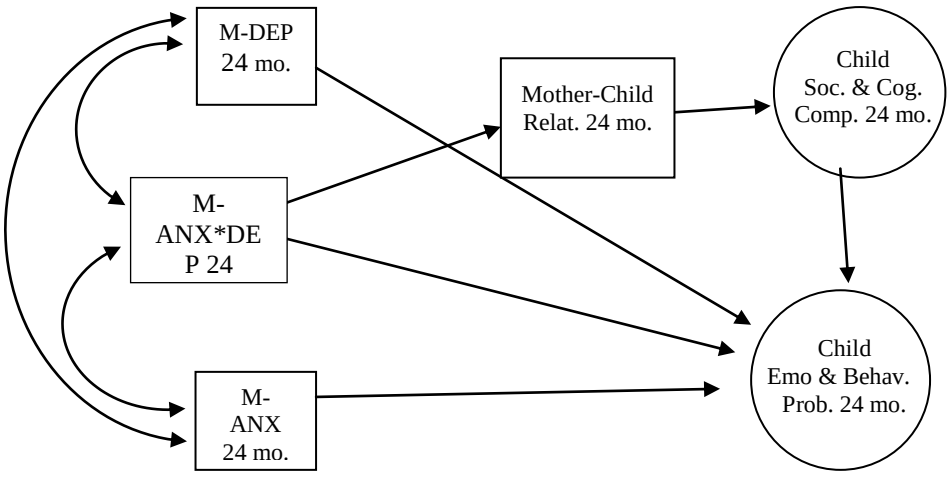

Figure 9. Revised Model C for the Interaction Model, illustrating the relationships hypothesized based on the results of Model A5 and Model B8.

CHAPTER 5: Discussion

Purpose of the Study

It is valuable to more fully comprehend processes that influence early childhood development because young children have incredible capacity for change that diminishes with age (CDCHU, 2007; Child Care Aware, 2010; Shonkoff & Phillips, 2000). As a result, early childhood experiences have a lasting impact on later development, achievement, and well-being (Dawson et al., 2000; NSCDC, 2004; NSCDC, 2005; Rolnick & Grunewald, 2007; Shonkoff & Phillips, 2000). Because mothers are most often the main caretakers, providing many of the experiences that help children grow, mother-child relationships are often especially influential for young children's development (Gottman, Katz, & Hooven; 1997; Laible & Thompson, 2007; Osofsky & Liebernman, 2011). Moreover, mothers' mental health has been shown to affect their relationships with their children (e.g., Nicol-Harber et al., 2007; Stein et al., 2008) as well as the children's development (e.g., Grace et al., 2003; Skylerman et al., 2005). The focus of the present study was to more fully understand the influence of postnatal maternal anxiety (PMA) and postnatal maternal depression (PMD) on children's social-emotional and cognitive development at 24 months of age. As part of this exploration, the potential mediating role of mother-child relationships' (MCR) was also examined.

Characteristics of the Sample

This study analyzed data on 395 healthy mother-child dyads that resembled the population of Shelby County, Tennessee. These dyads were followed until the children were 24 months. As expected, most of the mothers in this study experienced normal amounts of anxiety and depressive symptoms throughout the study. In spite of this, 27%

of the mothers experienced clinical or sub-clinical amounts of either anxiety or depressive of symptoms at least once during the study. This means that the symptoms were causing them some amount of distress and they may have had difficulty functioning in some areas of their lives. For depressive symptoms, the percent of mothers with at least sub-clinical symptoms remained stable at about 11% throughout the two years. Conversely, the percent of mothers with anxiety symptoms decreased with time (10% during the third trimester, 8% at 12 months post deliver, and 6% at 24 months).

Even though this study considered sub-clinical levels of symptoms, whereas other studies considered clinical symptoms only, many studies reported higher rates of PMD or PMA (Augusto et al., 1996; Ballard et al., 1994; Grazioli & Terry, 2000; Matthey et al., 2003; McMahon et al., 2001; Robertson et al., 2004). There are many potential reasons for these differences. For example, it could be that these mothers actually do experience fewer symptoms or that the times when symptoms were measured varied considerably across studies. The relatively low reports of symptoms may also be due to using the Brief Symptom Inventory (BSI, Derogatis, 1993) to measure anxiety and depressive symptoms. This measure may not have accurately assessed the mothers' symptoms because, like many assessments, it was not developed with a large portion of low-income, Black participants. Rather, the adult non-patient sample used to develop the BSI was mostly White, married, and middle-income (Derogatis, 1993). Yet, similar to one study that described the percent of mothers experiencing both depression and anxiety (Matthey et al., 2003), 4% to 6% of mothers in this study experienced symptoms concurrently. Also, many of the studies that examine postnatal depression utilize the Edinburgh Postnatal Depression Scale (Murray & Carothers, 1990), which has been criticized for actually

measuring both depressive and anxiety symptoms, rather than exploring depression as a unique construct (Phillips et al., 2009; Tuohy & McVey, 2008). Thus, the previous studies could be accounting for mothers who have elevated levels of depression, anxiety, or both. For the present study, 14%, 13%, and 15% of mothers reach sub-clinical levels for at least one of the symptom areas at the third trimester, 12 months post-delivery, and 24 months post-delivery, respectively.

The children in this study were all full-term (37 weeks gestation age or greater) and born relatively healthy. Additionally, most of them were born between 5-and-a-half and 9 pounds. The children in the study were also mostly skilled socially with just under 9% of the mothers reporting potential delays in their children's social competence. These children likely have trouble paying attention and complying with adults' demands. They may also have difficulties relating with their peers and conveying empathy. The cutoff score for potential delays on the measure of social competence is 15%; thus, compared to other mothers across the country, fewer mothers in this study reported that their children had difficulties with social skills. On the other hand, mothers' reports of their children's behavioral problems more closely matched the national sample, with 22% of mothers indicating a potential problem. These children may experience behavior problems that are part of normal development at greater intensity or frequency than the average child. Some of these behaviors might include aggression and impulsivity (externalizing behaviors), fearfulness and worry (internalizing behaviors), or emotional reactivity and sleep problems (dysregulation; Briggs-Gowan & Carter, 2006). Of particular concern, compared to 24-month-old children across the nation, children in this study were more likely to be behind in their non-verbal cognitive development, such as problem-solving

and memory, and language acquisition. Likewise, the trained-observers found more problems with these mother-child interactions than compared to the national population; and, as children grew older, the percent of relationships with potential problems increased to almost double the expected amount.

Main Study Findings

Structural equation modeling analyses were used to test the hypotheses of this study. These analyses allow researchers to consider multiple relations between variables and reduce error in design through a series of exploratory and confirmatory analyses (Kline, 2011; Nachtigall et al., 2003). In this study, three models were created to examine hypothesized relations between postnatal maternal anxiety, postnatal maternal depression, mother-child relationships, and children's social-emotional and cognitive development. The first two hypotheses concerned whether higher amounts of maternal anxiety and depressive symptoms at 12 months and 24 months decreased the quality of mother-child relationships, and, in turn, increased risk of being delayed social-emotionally or cognitively. The Anxiety Model (Figure 1) and the Depression Model (Figure 2) were developed to represent the conceptual relations.

It was anticipated that changes would be made to the hypothesized model, but the first modification came as a surprise. As noted above, one of the benefits of using SEM is that constructs can be tested using latent variables. This process occurred as part of the measurement model for the Anxiety Model (Kline, 2011; Nachtigall et al., 2003). When testing the hypothesized model, evidence emerged suggesting that children's social competence more closely aligned with their non-verbal cognitive skills and language skills than with the amount of emotional and behavioral problems they exhibited. As

such, the outcome constructs shifted from assessing social-emotional and cognitive development separately, to considering social and cognitive competencies (SCC) together. Additionally, these skills were then expected to influence the amount of emotional and behavioral problems (EBP) the young children displayed.

Although unexpected, theory and empirical findings support this connection. In fact, the creators of the Bayley Scales of Infant Development found similar correlations as were found in this study, such that their social-emotional scale positively correlated with their receptive language, expressive language, and nonverbal cognitive scales to a moderate degree (Bayley, 2006). In some sense, the importance of developing strong attachments with caregivers helps explain the connection between social competence and cognitive development found in these young children. Humans are incredibly social beings that learn through their relationships with their caregivers from birth. Caregivers talk with their children, helping them learn language, teach them numeracy skills, and foster problem-solving. They also teach children about how to play with others and what behaviors are appropriate (Lamb & Lewis, 2011; Thompson et al., 2011).

Additionally, there is a natural progression in which as children begin to move around (walk or crawl) and learn to communicate during the second year of life, they are more able to both explore their immediate world and interact with peers and adults in more meaningful ways (Lamb & Lewis, 2011). These two basic skills become the launching point for many other skills to develop both cognitively and social-emotionally. Early milestones for two-year-olds are being able to understand not only their own but others' emotional experiences, which requires some capacity to take others' perspectives. Moreover, being able to communicate one's wishes, intentions, and needs becomes both

a cognitive and a social task (Bayley, 2006; Briggs-Gowan & Carter, 2006). Similarly, children's cognitive development is highly dependent on attending skills (Bayley, 2006). The other major medium through which young children learn is play. Among other things, children learn problem-solving, begin to develop understanding of symbolic meaning or ideas, and learn to negotiate with peers through play (Bayley, 2006; Lamb & Lewis, 2011).

This literature also supports the finding that SCC, which was formed from the non-verbal cognitive, expressive language, responsive language, and social competence scales, had a small negative effect on EBP or emotional and behavioral problems (in both models). In other words, higher social and cognitive competence predicts lower emotional and behavioral problems. The behavior problems measured in this study are found in every young child to some degree, but do not become problems unless they occur in excessive frequency or intensity. Children's emotional development is made up of understanding themselves and others, being able to recognize appropriate social behaviors within contexts, and being able to regulate their emotions (Thompson et al., 2011). When children lack a means of communicating their desires and needs they also have difficulty understanding others and being understood. Additionally, when children do not understand social rules surrounding emotions, and thus act inappropriately, they may be perceived as defiant, they may be more fearful, and they may display more negative emotions.

Other alterations were made to the conceptual models of both the Anxiety Model and Depression Model. Specifically, three hypothesized relations were dropped from the Anxiety Model (see Figure 7 for the final structural model) and six relations were

removed from the Depression Model (see Figure 9 for the final structural model) because there was evidence that they did not exist in this sample when compared to the data. Both models were considered to be an adequate fit for the empirical data. Notably, the strongest direct effect in these models came from mother-child relationships at 24 months to children's social and cognitive competencies, such that stronger relationships were associated with more competence. Their relationships at 12 months had a similar association with children's competencies, though to a lesser extent. Strong mother-child relationships can be characterized by mothers who are sensitive or responsive to their children's cues and signs of distress. In addition, these mothers engage with their children in ways that promote better cognitive and social-emotional growth. Children in positive relationships are able to clearly indicate their needs to their mother and respond to their caregivers in meaningful ways (Sumner & Spietz, 1994).

Although there was a moderate relation between mother-child relationships and the children's competencies, the relationships were only weakly related to their emotional and behavioral problems. At 12 months, having strong mother-child relationships decreased the chances of having emotional and behavior problems at 24 months, while their relationships at 24 months did not appear to have any effect. Mother-child relationships at both time points, did have small, but significant correlations with the individual EBP scales (i.e., internalizing, externalizing, and dysregulation), but these associations are reduced in the context of the other variables in the models. These results are surprising because extensive literature finds that positive mother-child relationships influence their children's cognitive and social-emotional development (e.g., Carter et al., 2001; Dawson et al., 2000; Landry et al., 2006; Page et al., 2010).

It is possible that the findings in the present study occurred because the mother-child relationship was observed during a standardized teaching incident, in front of observers. Mother-child interactions are influenced by the contexts they are in. Because these mothers' goals during the interaction were likely to be perceived as capable of completing the task at hand – teaching their child – it seems reasonable that the mother-child relationship measure would have moderate effects on the children's competencies, but not necessarily on their emotional and behavioral problems. In addition to the type of interaction that is observed, it is also possible that the NCAST Parent-Child Interaction Scale (Sumner & Spietz, 1994) may not measure aspects of parenting behaviors that become more important as children get older; hence, this could explain why the relationship impact dropped off at 24 months. Baumrind's parenting styles model has been one of the most influential theories of parenting for understanding older children's development. The research using this model finds that having both responsive behaviors (like the ones measured in the current study) and demanding behaviors (including limit-setting and behavioral control) are associated with positive social and emotional development in children as young as four (Baumrind, 1971; Mattanah, 2005). Moreover, parental demandingness has been shown to be particularly important for low-income African American mothers (Brody & Flor, 1998; Middlemiss, 2003). Therefore, mothers' amount of demandingness may be influencing children's emotional and behavioral problems at 24 months more so than parents' responsiveness.

Development of emotional and behavioral problems may also be impacted by other circumstances. Bates, Maslin, and Frankel (1985) similarly found mother-child attachment did not predict the behavior problems of 3-year-old children. According to

these authors, mothers' perceptions of their children and the children's temperament best predicted behavior problems. Another study looked at a high-risk sample of mothers and children. The findings indicated that witnessing domestic violence predicted children's behavior problems, yet mother-child relationships did not. Like the present study, mother-child relationships were positively associated with children's social competence (Weatherill, 2008).

In the two separate models, both postnatal maternal anxiety and depressive symptoms were positively associated with the children's emotional and behavioral problems, meaning that as mothers' symptoms increased so did children's behaviors, such as aggression and emotional dysregulation. At 12 months, mothers' depressive symptoms or feelings of hopelessness and worthlessness had no direct effect on children's emotional and behavioral problems. They did however, influence children's behavior problems indirectly, by increasing the risk of experiencing these symptoms at 24 months. PMD at 24 months had a moderate direct effect on these problems in the children. This effect was the largest effect any of the postnatal maternal mental health variables had on either of the child development factors, and these results support the previous literature findings. In two meta-analyses conducted internationally, with 36 total studies, one study found that mothers' PMD had moderate effects on children's behavior problems regardless of the age of the children in the studies (Beck, 1999; Grace et al., 2003). Additionally, Beck (1998) found that depression symptoms at the time that children's development was measured were stronger than previous levels of symptoms.

Mothers' anxiety symptoms include feeling restless, nervous, and tense. They also include intense fear or panic. In the current study, higher levels of these symptoms at

both 12 and 24 months had small direct effects on children's emotional and behavioral problems. This result supports the finding by Barnett et al. (1991), that children whose mothers had high levels of anxiety soon after birth were described as more delinquent by both their mothers and fathers at five years old (Barnett et al., 1991). No other studies have specifically looked at PMA's influences of behavior problems.

Taken together, it appears as though PMD at 24 months has a stronger negative impact on children's emotional and behavioral problems than PMA, which is supported by previous literature. However, PMA seems to have a longer lasting impact in that PMA at 12 months continues to directly impact children's emotional and behavioral problem, whereas PMD at 12 months only influences the children's problems by increasing the risk of have PMD at 24 months. The total effects of mothers' anxiety symptoms at 12 months were also greater than for mothers' depressive symptoms. Further analyses are needed to examine these hypotheses. PMD and PMA were tested in different models, and although the two models accounted for the same factors (e.g, mother-child relationship), these two types of symptoms would be better understood taken together. Anxiety and depressive symptoms are often found to co-occur (Andrews et al., 2000; Carter et al., 2001; Matthey et al., 2003; Miller et al., 2006). In fact, the current study had large correlations between anxiety and depressive symptoms at each time point. These symptoms may have a moderating effect such that experiencing both anxiety and depressive symptoms may increase the influence of either type of symptoms alone. The intent of the third hypothesis was to test this potential interaction between the PMA and PMD; unfortunately, because this sample was drawn from a community population of

healthy, pregnant women rather than a clinical population, not enough of the participants experienced sub-clinical or clinical levels of symptoms to be able to analyze the data.

In regards to the mother-child relationships, contrary to the hypotheses, postnatal maternal depressive symptoms did not affect the relationships between the mothers and their children at either time point. Previous studies have had mixed results about PMD's influence on the mother-child relationship depending on how relationships were measured. Studies that examined whether PMD influences mothers' negative (i.e., hostility and negative affect) and disengaged (i.e., not interacting with child) behaviors more consistently found that PMD had a negative influence on mother-child relationships. Many studies that considered the positive behaviors of mothers, like sensitivity to cues, did not find any relation, but studies with disadvantaged participants did find that PMD seemed to decrease positive interactions between mothers and their children (Lovejoy et al., 2000). Likewise, Stein et al. (2008), who examined mother-child behaviors more similar to those observed in this study, found that PMD (measured multiple times) negatively influenced the participants' relationships when the children were three years old. Hence, these results that mothers' depressive symptoms had no effect on the relationships were surprising and do not support previous research.

Another surprising result was that having higher levels of postnatal maternal anxiety at 12 months actually increased the likelihood of having a good mother-child relationship at 24 months. This effect was small, however, and was suppressed by a link with PMA at 24 months that decreased the likelihood having a good mother-child relationship. It is possible that having slight elevations in anxiousness and worry at 12 months could lead to being more responsive to children's needs. The relation is small

though, and no previous studies found a positive relationship between PMA and mother-child relationships. Nicol-Harper and colleagues and Felman and colleagues, the only two studies found that looked at PMA's effects on mother-child relationships, reported significant relations, such that mothers with clinical anxiety symptoms were less sensitive or responsive with their children (Felman et al., 2009; Nicol-Harper et al., 2007), had lower emotional tone (Nicol-Harper et al., 2007), and were more intrusive (Felman et al., 2009) than mothers with low or moderate symptoms. Therefore, this study's results contradict much of the previous research, and more research is needed to determine if this finding can be replicated.

Mothers' depressive symptoms were also found to have no effect on the children's social and cognitive competencies, while anxiety symptoms at both 12 and 24 months only had small, indirect negative effects. This means that higher maternal anxiety decreases the likelihood of children being competent, but only because this relation was mediated through the mother-child relationships at 24 months. These findings generally do not support the previous studies for the effects of PMD. Postnatal maternal depression has consistently been found to lead to children's cognitive and emotional delays regardless of the children's ages (e.g., Beck, 1998; Stein et al., 2008). Fewer studies have explored PMA's influence on children's development, but the current study's findings support two studies' findings that postnatal maternal anxiety did not influence young children's cognitive development (Bergman et al., 2007; Slykerman et al., 2007). On the other hand, previous studies found significant negative effects of maternal anxiety symptoms on children's social-emotional development within the first year (Galler et al., 2000), in addition to social competence and maturity at five years old (Coplan et al.,

2005). It is important to consider that most of the previous research tends to look at PMA and PMD as dichotomous variables, in which mothers with clinical symptoms were compared to mothers without. The models in this study examined the range of reported anxiety and depressive symptoms, such that higher levels may not necessarily need to reach clinically significant levels to produce an impact on children's development. PMD and PMA may not have been found to have substantial influences on either the relationships or the children's social and cognitive competencies because, while mothers were experiencing distress from their symptoms, the levels of most of the mothers did not elevate to clinical levels that would limit their functioning.

Even still, mothers' postnatal symptoms of both anxiety and depression had meaningful negative effects on children's emotional and behavioral problems. One explanation for these effects was tested in the models; however, mother-child relationships did not serve to mediate the impact of these symptoms on the young children. Other explanations include mothers' modeling behavior that the children acquire. Both anxiety and depressive symptoms include internalizing behaviors, such as intense fear and worry. Similarly, emotional development has a neurobiological foundation (Thompson et al., 2011) such that mothers and children might be biologically more at risk for experiencing emotional difficulties. Finally, it could be that these mothers and young children live in environments that are highly stressful. Coming from low-income backgrounds, they are at greater risk for environmental and familial stressors. For example, mothers in poverty, and those who have less education, often have fewer resources to provide for their children and more chaotic lives (Shonkoff, 2010; Shonkoff et al., 2009). Moreover, family circumstances, such as being a single

parent or having an abusive partner, can have negative impacts on both mothers and their children (Shonkoff, 2010; Shonkoff et al., 2009).

Implications for Counseling Psychology

Preventing avoidable problems and intervening when problems arise are both highly valued in the field counseling psychology (American Psychological Association & Lichtenberg, 1999; Hage et al., 2007; Packard, 2009). There are ample opportunities for prevention and intervention with the population that was studied, in part, because medical professionals see pregnant women and families with young children frequently. When depression or anxiety symptoms are detected, medical professionals are in a good position to consult with or refer women and families to mental health professionals who can help reduce or eliminate any problems. The current study supported previous research that maternal anxiety and depressive symptoms increase children's risk for emotional and behavioral problems at 24 months, and earlier symptoms predicted later symptom. In fact, 27.0% and 27.6% of the variance in 24-month depressive and anxiety symptoms were explained by third trimester and 12-month symptoms combined. Such findings are consistent with previous research (Banti et al. 2009; Beck, 2001; Howell et al., 2009). The findings for the current study showed that mothers do not need to experience clinical levels of symptoms to have a negative impact on their children's development. Furthermore, because both the Depression Scale and the Anxiety Scale of Brief Symptom Inventory (Derogatis, 1993) are only six questions long, these self-reported measures of anxiety and depression could easily be incorporated as screening tools during routine medical visits. If such screening policies were implemented, mothers could be referred to mental health professionals before the symptoms manifested into

diagnosable problems for the mothers and before they could negatively influence children's development.

Not only could screening procedures be implemented, but these findings also suggest that intervening with mothers and children when symptoms appear is important. Although fewer mothers experienced anxiety symptoms as time passed, the depressive symptoms remained relatively stable over the two-year period. Thus, mothers have considerable chances of having depressive symptoms at 24 months after delivery if they experience them during pregnancy. Yet, these women often remain untreated, in part, because a main treatment option recommended is medication (Dietz et al., 2007). Women tend to decline the use of medication for mental illness during pregnancy and while breast-feeding because they have valid concerns about potential negative effects on their children's development as a result of the medication (Dietz et al., 2007; Misri & Kendrick, 2007). Moreover, although few women experienced symptoms as time passed, postnatal anxiety early on directly increased children's risk of problems; therefore, waiting for them to subside may be detrimental. Efforts to aid these women must increase, (Carter et al., 2001; Ramos-Marcuse et al., 2010), and psychotherapy, like Cognitive-Behavioral Therapy and Emotion-Focus Therapy, have been found to be effect at reducing anxiety and depressive symptoms (e.g., Butler et al., 2006; Greenberg, 2004; Misri & Kendrick, 2007). Moreover, making therapeutic lifestyle changes (e.g., improved nutrition and exercise, positive relationships, and relaxation and stress management) have also been found to lessen individuals' symptoms (Walsh, 2011) and would be appropriate recommendations for women during this time of life.

Limitations

Although the findings of the current study have implications for working with mothers and their children, there are limitations in the design of the study that may reduce the generalizability of its findings. First, the data were collected using a naturalistic design rather than experimental, meaning that no causal relationships between variables can be inferred and only correlational relationships will be established. However, given the nature of the constructs being examined, there is no ethical or practical way to examine these variables – children cannot be randomly assigned to different parents.

Secondly, mothers report their levels of their anxiety and depressive symptoms. This self-report can be a problem because individuals sometimes have poor insight into their own experience, or sometimes wish to appear to have more or less severe distress than they may actually be experiencing. Additionally, while the Brief Symptom Inventory is widely accepted as a strong measure for general psychopathology and overall psychological distress (e.g., Benishek, Hayes, Bieschke, & Stoffelmayr, 1998; Boulet & Boss, 1991; Heinrich & Tate, 1996; Piersma, Boes, & Reaume, 1994), it has received criticism for its psychometric properties on the subscales (Benishek et al., 1998). The criticism calls further attention to the validity of the maternal anxiety and depressive symptoms. However, the studies that have generally criticized the use of the BSI subscales have consistently reported depression and anxiety scales among the appropriate subscales of the BSI because they tend to have adequate reliability and validity (Gavazzi, Julian, & McKenry, 1996; Hayes, 1997). This study also found that the scales had internal consistency throughout the study.

A third limitation is that mothers also report their children's social-emotional development in this study. The parent-report can produce bias results because mothers who are experiencing high levels of symptoms may not be able to accurately report their children's development. However, the BITSEA was developed to be sensitive to the emotional state of the caregiver who may not otherwise be able to identify problems with their children's social-emotional development (Briggs-Gowan & Carter, 2006).

Finally, there are limits to SEM analyses. First, fit index values only specify the overall fit of models and do not focus on individual paths or relations within models. Thus, as was seen in this model, connections between some variables do not fit the data as well as others which lead to nonsignificant relations between variables remaining in models (Kline, 2005). In addition, SEM requires quite large sample sizes to test hypotheses (Nachtigall et al., 2003). Even with 395 participants Hypothesis C was not able to be tested due, in part, to not having enough participants with sub-clinical and clinical levels of depression.

Future Research Directions

Because Hypothesis C or the Interaction Model was not able to be tested as part of this study, the question of whether PMA and PMD symptoms interact to influence young children's development remains. Anxiety and depressive symptoms often co-occur, even in this study, and the presence of both symptoms has be found to indicate more severity (Andrews et al., 2000; Glasheen et al., 2010; Matthey et al., 2003; Miller et al., 2006). Further, the presence of comorbidity is a marker of severity (Andrews et al., 2000; Glasheen et al., 2010; Matthey et al., 2003; Miller et al., 2006). Future research

should explore this potential interaction between maternal anxiety and depressive symptoms and how such an interaction might influence young children's development.

In addition, exploring the link between social competence and cognitive development more fully would advance this area of study. This connection is important because social-emotional development and cognitive development are often studied separately, whereas this study suggests that researchers may gain a more meaningful understanding of children's development by considering both together. Other research in this area is also needed.

Several studies on PMD have considered some contextual factors, such as income, domestic violence, and social support on mothers' symptoms as well as children's development. These factors need to also be studied with PMA. This study is intended to examine only three variables related to child development. As discussed, other factors such as fathers' influences, family income, maternal education, and life stressors contribute to predicting child development that were not included in the model (Sroufe et al., 1999). Nevertheless, their relationships with their primary caregivers, mothers for this study, provide the most important experiences affecting their development in the first few years (e.g., CDCHU, 2007; Osofsky & Liebernman, 2011).

Finally, other aspects of parenting behaviors could also shed insight into how the mother-child relationship influences children's development at such a young age. No researchers have examined Baumrind's parenting styles, which include both aspects of responsiveness and demandingness, in children this young, but they have been found to be important for children as young as four (Baumrind, 1971; Mattanah, 2005). New research should consider whether mothers' amount of behavioral control and limit-setting

influence children's emotional and behavioral problems when children are toddlers and begin to display amounts of behavioral defiance and emotional dysregulation as part normal development.

Conclusions

Many of the findings from this study do not support previous research. Specifically, this study did not find significant relations between postnatal depressive symptoms and mother-child relationships. This study also found a small, positive effect of postnatal anxiety on mother-child relationships that has never been published before. Finally, unlike many other studies, mother-child relationships did not predict children's emotional and behavioral problems at 24 months.

The results did provide continued support for the connection between postnatal anxiety and depressive symptoms and children's emotional and behavioral problems. While social competence was associated with emotional and behavioral problems at 24 months, it was more closely associated with children's cognitive and language development. Additionally, this study suggests implications for practice and future research. This study examined a wide range of anxiety and depressive symptoms, rather than comparing mothers who experienced clinical levels of symptoms to those who did not, and symptoms did not necessarily reach clinical levels to negatively impact the children. Moreover, symptom levels from the prenatal period through the 12-month and 24-month follow-ups were closely related to each other. Thus, early detection of mothers' anxiety and depressive symptoms and intervention are important. The study also uncovered an interesting connection between social and cognitive development that needs to be further explored. Lastly, the findings suggest that early child development is

complex, and thus, further research needs to consider factors beyond the mother-child relationship to better understand how anxiety and depressive symptoms influence children's development.

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Appendix A: Demographic Information

Maternal age: *Date of Birth _ _/_ _/_ _ _ _*

Marital status

1=Married,
2=Widowed,
3=Divorced,
4=Separated,
5=Never Married,
6=Living with Partner,
99=Unknown

Income: *estimated total household income per year—*

1=$0-4999,
2=$5000-9999,
3=$10000-14999,
4=$15,000-19999,
5= $20000-24999,
6=$25000-34999,
7=$35000-44999,
8=$45000-55999,
9=$55000-64999,
10=$65000-74999,
11= $75000 and over,
99= Unknown

Educational attainment: h*ighest grade of level of school completed or degree received*

1=less than high school,
2=GED or high school diploma,
3=technical school,
4=College degree,
5=Graduate or professional degree,
99=unknown

Number of children previously delivered

Number of pregnancies delivered full-term (>or= 37 weeks) ___
Number of pregnancies delivered pre-term (< 37 weeks) ___

Child's gender: 1=male, 2=female

Gestation age at birth *(weeks)-limit to 20-45* ___

Birth weight *(kg)*

Appendix B: Brief Symptom Inventory

The Brief Symptom Inventory contains protected information and was not included for proprietary reasons.

Appendix C: Brief Infant Toddler Social Emotional Assessment

The Brief Infant Toddler Social Emotional Assessment contains protected information and was not included for proprietary reasons.

Appendix D: Bayley Scales of Infant and Toddler Development, 3rd Edition Screening

The Bayley Scales of Infant and Toddler Development, 3rd Edition Screening contains protected information and was not included for proprietary reasons.

Appendix E: NCAST, Parent-Child Interaction – Teaching Scale

The NCAST, Parent-Child Interaction – Teaching Scale contains protected information and was not included for proprietary reasons.