

**MATERNAL DEPRESSION AND CHILD-DIRECTED SPEECH:
INFLUENCES ON TODDLERS' COMMUNICATION ABILITIES AND
SOCIOEMOTIONAL COMPETENCE**

by

Juana Gaviria-Loaiza

A dissertation submitted to the Faculty of the University of Delaware in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Human Development and Family Studies

Summer 2018

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ACKNOWLEDGMENTS

I would like to thank my advisor, Myae Han. Dr. Han, I have no words to thank you for all your guidance during the past years. Your insight was invaluable in helping me to accomplish my goals throughout this process. You have always been there for me when I needed you and you will never know how valuable that was to me. To my committee members Jason and Rena, thank you for all your feedback and support. Your help guided me in the right direction.

I would also like to thank Laura Finan. My friend and colleague, I would have not been able to do this without you. I am so lucky to have you in my life. Cara, Amanda, Sophie, Ana, Danielle, Caro and Luras, thank you for your contributions to this work. To my fellow grad students and staff at HDFS, thanks for being a community of support. Lastly, I would like to thank my family. My parents and brother Nicolas, you have always been my rock and the most important thing in my life. Camilo, my lovely husband, thank you for always having my back and in believing in me. Your encouragement kept me going. Last but not least, to Benjamin, you are my dream come true. We worked side by side on this and you were so patient and understanding while Mommy worked. I love you more than you can imagine, my dissertation baby.

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ABSTRACT

The purpose of the current study was to examine the influence of maternal depressive symptoms in maternal child-directed speech during play, as well as in toddlers' language and socioemotional abilities. Specifically, the moderating role of depressive symptoms on the relation between maternal child-directed speech components (quantity and quality) and child outcomes was explored. The sample consisted of 108 mother-child dyads participating in an Early Head Start program in the Mid-Atlantic United States. Mothers completed a depression scale and a demographic questionnaire, and dyads were observed during a puzzle play task. Multiple regression analysis suggested that mothers' depressive symptoms were associated with toddlers' socioemotional abilities (internalizing and externalizing behaviors). Depression was not related to quantity or quality of maternal child-directed speech in the context of puzzle play, nor was it directly related to children's language (communication abilities). Depression moderated the relation between maternal communicative diversity and children's expressive communication. The findings highlight the importance of considering the unique features of the context of interaction as well as other non-verbal factors that may influence these relations. Implications and future directions are discussed.

Chapter 1

INTRODUCTION

Depression is considered an important mental health disorder in the United States (U.S.). The Substance Abuse and Mental Health Services Administration [SAMHSA] (2014) suggests that 6.7% of adults 18 or older have had at least one major depressive episode during the previous year. Estimates are even higher for women, with one in ten women between 18-44 years of age experiencing symptoms of major depression in the past year (Centers for Diseases Control and prevention, 2016). Many of those women are mothers of young children. According to Ertel, Rich-Edwards, and Koenen (2011) one in ten children experience a mother with depression in any given year. This could be problematic given the possible impact that depression could have on mothers' abilities to adequately care for their children.

A strong body of literature on depressed mothers has focused on postpartum depression and its consequences for infants (Herrera, Reissland, & Sheperd. 2004; Murray, Kempton, Woolgar, & Hooper, 1993). However, other developmental periods, such as toddlerhood, have often been understudied even though mothers of toddlers have reported experiencing elevated depressive symptoms (i.e., 32% of U.S. mothers) (McLennan, Kotelchuck, & Cho, 2001). Given the prevalence of this disorder among mothers of young children it is essential to expand the research on this important topic.

The toddler years (i.e., 12 to 36 months) are a period of rapid development for children. This stage is characterized by a fast growth in the cognitive and emotional domains (Brownell & Kopp, 2007). Further, in this period of life children are more vulnerable to environmental influences and depend mainly on the interactions with their caregivers. Maternal depressive symptomatology commonly leads to withdrawal and disengaged behaviors among mothers when interacting with their children. This could affect mothers' parenting skills and the quality of their interactions (Kaminer, Beebe, Jaffe, Kelly, & Marquette, 2007). The risk is especially high among low-income populations where the likelihood of experiencing depression (Lorant, et al., 2003) and the possibility of potentially providing inadequate parenting for their children increases (Lovejoy, Graczyk, O'Hare, & Newman, 2000).

Based on the high prevalence of depressive symptomatology among mothers of young children and the important role that caregivers play in the first years of children's lives, the toddlerhood years can be seen as an important period to study the effects of maternal depression in different domains of children's development. One domain that has been extensively studied is children's language development. Research has explored the impacts that maternal depression may have on children's language by examining, among other variables, the way mothers talk to their children. For example, depressed mothers seem to talk less, have longer periods of silence and vocalize less when interacting with their young children compared to older children (Rowe, Pan & Aroub, 2005). Studying maternal speech in the toddler years is particularly important, given that the first three years of age are considered a sensitive

period for children's language development. In this stage children acquire most of their communication abilities and establish the bases for self-regulation as part of their healthy socioemotional development (Brophy-Herb, et al., 2015). Maternal depressive symptoms also seem to impact children's socioemotional development in the early years. For instance, findings have suggested that maternal depression could have higher and longer impacts on children's internalizing problems when exposure occurs in the early years (Goodman et al., 2011). Understanding the associations between depressive symptomatology, maternal child-directed speech, and children's outcomes in the toddlerhood years within a low-income sample is, therefore, an important area of research.

Despite the robust body of literature examining depression, gaps exist in research pertaining to the mechanisms of maternal depression and Maternal Child-Directed Speech (MCDS), and how these interact to influence children's communication abilities and socioemotional competence. Moderator analyses have been used when studying maternal depression and children's outcomes as reported in a meta-analysis by Goodman et al. (2011). However, most studies have often used variables such as child gender, parental marital status, and ethnicity among other variables to moderate the relation between depression and children's outcomes. The role of depression as a moderator for maternal child-directed speech and children's socioemotional competence and communication abilities needs to be explored further.

Mothers often interact with their children during ludic activities such as book reading or play. Although research has examined these contexts to draw conclusions

about mother-child interactions, the unique features of the context and its influences on the interactions have frequently been overlooked (Yont, Snow & Vernon-Feagans, 2003).

Considering the gaps in the existing research and using multiple regression and moderator analysis to explore interactions of low-income mother-toddler dyads during play, the present study aims to expand the current literature in three ways. First, by providing a detailed description of the variation of maternal child-directed speech among a sample of low-income families. Second, by exploring the role of maternal depression on the different components of MCDS. Third, by examining the interactions between maternal depression and maternal-child directed speech to influence toddlers' communication abilities and socioemotional competence.

Chapter 2

LITERATURE REVIEW

Theoretical Framework

The current study is grounded in the Bioecological theory, the ecological perspective of parenting, and the concept of cumulative risk. This framework contributes the understanding of how maternal characteristics influence parenting practices and children's outcomes in low-income families.

Bioecological theory. The Bioecological theory (Bronfenbrenner & Morris, 1998) explains the interaction between the environment and the individual and its impact on development. Initially, Bronfenbrenner's ecological systems theory (Bronfenbrenner, 1979) identified different levels that influenced the developing person (i.e., microsystem, mesosystem, exosystem, macrosystem, and chronosystem). First, the microsystem includes complex relations, in an immediate setting, between the person and the environment. Second, the mesosystem embraces interrelations among non-immediate settings that contain the person at a particular time. The mesosystem is conceived as a collection of interacting microsystems. Third, the exosystem is considered an extension of a mesosystem, comprising formal and informal social structures that may not contain the developing person but that affect him or her in less direct ways. Fourth, the macrosystem includes patterns of the culture such as social, educational and economic systems. Lastly, the chronosystem captures

experiences of the developing person with the environment as well as transitions that take place throughout the lifespan (Bronfenbrenner & Morris, 1998).

Bronfenbrenner later expanded his work by also incorporating other aspects of the individual and its immediate settings, such as personal characteristics and immediate relationships, with the Bioecological or PPCT model. This model includes four main components (i.e., process, person, context, and time, PPCT; Lerner, 2002), and dynamic, interactive relationships among them (Bronfenbrenner & Morris, 1998). This model is particularly useful for understanding the associations between maternal characteristics and children's development. The first component, *process*, includes reciprocal interactions between the developing organism and objects, persons, and symbols in the immediate environment (e.g., playing with a child or reading). These interactions, known as *proximal processes*, constitute the primary mechanism that influences and produces development, and need to happen with regular frequency over a period of time in order to be effective (Bronfenbrenner & Morris, 1998; Tudge, Mokrova, Hatfield, Karnik, 2009). In the current study, the interactions between a mother and her child during play would represent the *process* component. These interactions take place in the immediate setting that contains the developing child, are likely to happen multiple times during the child's early life and influence his or her development.

The second component, *person*, states that each individual has specific characteristics that influence his/her interactions or processes. Studies on parenting and mother-child interactions could serve to illustrate the person component, as

findings suggest that mother-child relationships are influenced by contributions from both the mother and the child (Azak & Raeder, 2013; Hummel & Kiel, 2015).

Bronfenbrenner, conceptualized the person's characteristics in three categories:

demand that includes aspects that act as direct stimulus to another person (e.g., age, gender, skin color), *resource*, which relates emotional and mental resources, and *force* that includes characteristics such as temperament and motivation (Tudge, Mokrova, Hatfield, Karnik, 2009). In the present study, demand characteristics (i.e., ethnicity/race, age and gender of the child) and resource characteristics (i.e., maternal depression) are considered. These characteristics may influence the mother's disposition to interact with her child and in particular, the quality and frequency of her verbal interactions.

The third component, *context*, involves interactions of the developing person with objects and symbols as well as different interactions among four systems (i.e., microsystem, mesosystem, exosystem, and macrosystem) from Bronfenbrenner's ecological theory (1977; 1979). In the case of the present study, the microsystem in which interactions take place is the home. However, influences from the meso, exo and macrosystems could play a role in the presence of mother's depression symptomatology, as well as shape the child's communication abilities and socioemotional competence. Particularly, this study is conducted with low-income families that are enrolled in Early Head Start, a federally funded program, which may serve as a reference on the influence that the macrosystem could have in child's development.

The last component of the PPCT model is *time* that encompasses microtime, mesotime, and macrotime. “Microtime refers to continuity versus discontinuity within ongoing episodes of proximal process”, “mesotime is the periodicity of these episodes across broader time intervals, such as days and weeks”, and macrotime (i.e., chronosystem from the ecological theory) “focuses on the changing expectations and events in the larger society” (Bronfenbrenner & Morris, 1998, p.995). In this particular study mother-child interactions are observed in microtime, but are expected to be consistent in mesotime.

Ecological perspective of parenting. Within the ecological framework, the current study draws on the ecological perspective of parenting (MacPheLuster & Okagaki, 1993) to understand the different factors that may shape parenting behaviors to influence children’s outcomes. This perspective draws on Bronfenbrenner’s ecological framework and on Belsky’s (1984) determinants of parenting. Three main aspects are considered by Belsky (1984) to determine parental behavior: the context where the parent-child interactions take place, the characteristics of the child, and the characteristics of the parent. These characteristics are aligned with Bronfenbrenner’s *person* and *process* components, and help understand the mechanisms through which characteristics of the mother, such as depression symptoms, and characteristics of the child, such as gender, influence maternal child-directed speech within the mother-child interactions.

Cumulative risk. One important construct to consider when examining the experience of children from low-income families is cumulative risk. This construct has

been applied in different contexts such as children with schizophrenia (Sameroff, Seifer, Zax, & Barocas, 1987) or maltreatment (Masten & Wright, 1998) and it helps illustrate the experiences of children facing adversity by accounting for multiple risk factors (Evans, Dongping, & Whipple, 2013). Children with higher amounts of cumulative risk are more likely to face adverse developmental outcomes, such as cognitive and socioemotional problems (Evans et al., 2013; Sameroff et al., 1987).

In the case of the present study, participants meet the criteria to be enrolled in Early Head Start and are thus more likely to experience economic hardship and other risks related to this situation. For instance, research suggests that depression is often more frequent among low-income mothers (Goodman et al. 2011; Hummel & Kiel, 2015; McDaniel & Lowenstein, 2013; NICHD, 1999; Rowe et al., 2005), and that children from economically disadvantaged backgrounds are more likely to experience inadequate parenting by their depressed mothers (Lovejoy, 2000). Further, children from low SES families are exposed to less language input from caregivers compared to their peers from other SES, putting them at greater risk for falling behind in language and literacy development (Hart & Risley, 1995; Hoff, 2002; 2003; Huttenlocher et al., 2002; Lawrence & Shipley, 1996; Rowe et al., 2005; Schwab et al., 2006).

Depression

Depression is a common psychological disorder that affects individuals across their lifetime. According to the DSM-V a major depression disorder is defined by the presence of one or more major depressive episodes (MDE) throughout the lifespan,

without mania or hypomania. Criteria for a MDE require that five out of nine different symptoms be concurrent during a two-week period and result in an alteration of daily functioning. Some of these nine symptoms include fatigue, hypersomnia or insomnia, thoughts of death, depressed mood and loss of interest, with one of the two latter symptoms needing to be present (Uher, Payne, Pavlova, & Perlis, 2014). Different aspects may predict the presence of major depressive disorders in early adulthood, including recurrent MDE and age of onset, among others (Pettit, Lewinsohn, Roberts, Seeley, & Monteith, 2009).

Based on clinical criteria, different methods have been employed to measure depressive symptomatology. Clinical interviews and diagnosis, as well as self-reported measures, are the most common. Self reported measures, such as the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977), permit researchers to examine different levels of depressive symptoms without the need to conduct a clinical interview. This is particularly useful given that often the presence of depressive symptoms does not necessarily meet clinical levels (Wesselhoeft et al., 2013). In some cases, even mild depression symptoms have effects on children's outcomes. Regardless of the method used to identify depressive symptomatology maternal depression represents a risk factor for children's development (NICHD, 1999).

Epidemiologic studies have identified gender differences in depression, reporting a greater prevalence in women than in men (SAMHSA, 2014), with women being about two times as likely to experience depression (Nolen-Hoeksema, 2001).

Not surprisingly, this disorder is also more common in mothers than in fathers (Petersen & Nazareth, 2010). Most of the data available on maternal depression has focused primarily on the prevalence of postpartum depression, which according to the CDC (2016) is estimated to be 12%. Yet, information about maternal depression after children's first year of life is scarcer. McLennan, Ktelchuck, and Cho (2001) contributed to this area of research by examining the prevalence and persistence of depressive symptoms among mothers of toddlers. Using a nationally representative sample, these authors found that depressive symptoms were common in mothers of toddlers with at least 32% of U.S. mothers of young children experiencing depressive symptoms at some point. Twenty-four percent of the sample reported elevated depressive symptoms when their children were 17-months, and 17 % when their children were 35-months.

Depression and parenting. The presence of depression symptoms in mothers of young children seems to increase children's risk of negative developmental outcomes. For instance, studies have shown that children of depressed mothers are more likely to develop internalizing and externalizing problems, as well as to present behavioral problems, social difficulties, and lower academic achievement (Dawson et al., 2003; Goodman et al., 2011; NICHD, 1999; West & Newman, 2003).

Different mechanisms have been explored to understand the ways through which maternal depression influences children's outcomes. Some of these mechanisms include parenting, maternal behaviors, and mother-child interactions (Azak & Raeder, 2013; Humme & Kiel, 2015; Kaminer, Beebe, Jaffe, Kelly, & Marquette, 2007;

Lovejoy et al., 2000; NICHD, 1999). Findings suggest that depressed mothers face challenges when interacting with their children, which may lead to non-optimal parenting behaviors. For instance depressive symptoms have been linked to high hostility and low warmth and responsivity rates (Goodman & Gotlib, 2002). In a study by the NICHD (1999) on mothers of infants and toddlers, women without reported symptoms of depression were compared to women who reported occasional or chronic symptoms. Mothers with chronic depression symptoms displayed lower quality of parenting, by being the least sensitive to their children during play. Similarly, during mother-child interactions, depressed women seem to be more negative and coercive than non-depressed women (Lovejoy et al., 2000).

In a meta-analysis study of maternal depression and parenting behavior Lovejoy et al. (2000) identified three domains of parenting behavior among the studies reviewed in their analysis. These included disengagement, negative/coercive behaviors, and positive behaviors. Disengagement was reported when mothers did not get involved with their child or show neutral affect; negative/coercive behaviors were characterized by mothers showing hostile behavior and negative affect; while positive behaviors included enthusiastic interactions with positive affect. Depressed mothers appeared to show more hostility and irritability towards the child, followed by disengagement behaviors, and did not seem to engage in play and other enthusiastic interactions with their children as much as non-depressed mothers. Particularly, depressed mothers of younger children showed difficulties in the three previously described domains of parenting behavior (Lovejoy et al., 2000). Another important

behavior that has been documented in mother-child interactions of depressed mothers is maternal intrusiveness (Hummel & Kiel, 2015; Kaminer et al., 2007). When interacting with their children, depressed mothers may become overinvolved by controlling children's actions and play, providing high levels of stimulation and using predominantly directive language (Cox, Puckering, Pound, & Mills, 1987; Gaertner, Spinrad, & Eisenberg, 2008).

Child gender and depression. Gender differences seem to also exist when considering the influence of maternal depression on child's outcomes. A meta-analysis by Goodman et al. (2011) on maternal depression and child psychopathology found that the association between maternal depression and children's internalizing problems was higher in girls than in boys. However, the authors did not find differences in externalizing behaviors. Furthermore, studies looking at the mechanisms through which this relationship occurs have found boys to be more vulnerable to genetic influences of depression and girls to be more susceptible to environmental processes (Lewis, Rice, Harold, Collisaw, & Thapar, 2011). Similarly, regarding parenting behaviors' influencing the relationship between maternal depression and child's outcomes, Hummel and Kiel (2015) found gender differences in the path to toddlers' internalizing behaviors, with girls being more susceptible to parenting associated with maternal depression, specifically to maternal intrusive behavior. Despite these findings, more research is needed to clarify the role of gender in the relationship between maternal depression and children's outcomes.

Socioeconomic status (SES) and depression. The relationship between

economic hardship and depressive symptomology is a common finding in the literature (Goodman et al., 2011; Hummel & Kiel, 2015; Lovejoy et al., 2000; NICHD, 1999; Rowe et al., 2005). Generally, research findings suggest a negative correlation between SES and depressive symptoms, with low-SES mothers experiencing more depressive symptoms (Hummel & Kiel, 2015). Attempts to understand the co-occurrence of these variables have emphasized different aspects such as the perception of economic pressure, lack of family resources, and access to quality child care as aspects that increase the likelihood of low-income mothers experiencing more depression symptoms (Yeung, Linver, & Brooks-Gunn, 2002). Poverty also seems to increase the risks of depression, negatively impacting children's development regardless of the outcome assessed (Goodman et al., 2011). Further, low-income mothers are also less likely to receive treatment for their depression (McDaniel, & Lowenstein, 2013). Despite these facts, most of the literature available on depression and mother-child interactions has focused on middle-class families (e.g., Azak & Raeder, 2013).

One important component of SES is education. Maternal educational levels have been associated with the likelihood of mothers experiencing depressive symptoms. For example, using a national sample to study the prevalence of depression in mothers of toddlers, McLennan, Kotelchuck, and Cho (2001) found that lower educational levels constituted one of the main predictors of depressive symptoms. On the contrary, Azak and Raeder (2013) did not find any significant correlations of education with maternal depression, nor did they find differences in maternal styles

due to educational levels in their study about parenting behaviors and maternal depression. That study however, had a low variation in educational levels with most mothers reporting higher levels of education.

There is also a documented relationship between family income, parenting practices, and maternal depression (Lovejoy, 2000; NICHD, 1999; Yeung et al., 2002). For instance, depression seems to be associated with lower levels of parenting behaviors only when mothers encounter and deal with economic stress (Lovejoy, 2000). Economic hardship may therefore be considered a risk factor for parenting problems in depressed women.

Cultural differences in depression. Differences in depressive symptoms have been documented among different racial/ethnic groups, however the extent to which group seems to have higher prevalence rates is not so clear. For example, Howell, Mora, Horowitz, and Leventhal (2005) found that Hispanic and African-American women were more likely to report depressive symptoms during the postpartum period than white women. These differences persisted above and beyond demographic, personal, and situational factors. On the contrary, in a study about maternal depression in the U.S., Ertel et al. (2011) found that compared to white mothers, Hispanic and African American mothers were less likely to experience depression during the past year. However, these minority groups of mothers were less likely to receive services for their depression in comparison with their white counterparts. These results are in line with findings by Ispa et al. (2004) who compared four groups of mothers of toddlers from Early Head Start: European American, African American, less

acculturated Mexican Americans, and more acculturated Mexican Americans. This study found that European American mothers had the highest depression scores while less acculturated Mexican Americans had the lowest depression scores among the compared groups.

Depression and maternal speech. The main symptoms of depression include fatigue, withdrawal, lack of interest, and other behaviors that suggest disengagement from the environment. These symptoms not only make mothers more likely to engage in less playful interactions with their children, show more negative and neutral affect, and be withdrawn (Keminer et al. 2007), but also have repercussions on maternal speech. For instance, depressed mothers tend to vocalize less (Lovejoy et al., 2000), produce fewer amounts of words, have more periods of silence, and slow speech when interacting with their children (Rowe et al., 2005).

Given the limited literature examining lexical aspects of depressed mothers' language during interactions with their young children, Rowe et al. (2005) sought to examine the differences in amount and lexical diversity of maternal talk to toddlers in low-income families. This study also aimed to explore patterns of change in maternal talk over time, and the different predictors of variation in maternal language input. Using a sample of 108 children from 14 to 36 months, enrolled in Early Head Start, and their mothers Rowe and colleagues (2005) examined two main aspects of maternal talk: total number of words (tokens) and vocabulary diversity (word types). Results suggest a negative association between maternal depression and the amount of maternal talk but not with vocabulary diversity. Variations in the maternal speech

content have also been studied, with findings suggesting an association between increased depressive symptoms and mothers focusing more on their own experience rather than on the child's experience (Kaminer et al., 2007; Murray et al 1993). However, these studies have focused on maternal postpartum depression with highly educated mothers and their infants (Kaminer et al., 2007).

Many of the studies looking at depression and maternal child-directed speech take place during the postnatal period, exploring associations between postpartum depression and maternal talk (Herrera, Reissland, & Sheperd, 2004; Murray et al., 1993) Depressive mood has been found to impact the affective quality of maternal speech. Depressed mothers tend to include less affection and information in their speech's content, by being less likely to share feelings and confirm cognitive information of their infants' experiences speech (Herrera et al., 2004). Other studies focus on infancy and the toddler years. For example, Murray et al. (1993) found that in the first 18 months child-directed speech mediated the relationship between depression and children's cognitive development in this stage. Similarly, a study by the NICHD (1999) found that children from depressed mothers perform more poorly in measures of linguistic functioning and display less cooperation and behavioral problems at 36 months, when compared to children of non-depressed mothers. The association between maternal depression and expressive language, and cooperation was moderated by maternal sensitivity, which seemed to compensate for some of the depressive symptoms, as sensitive mothers seem to talk more to their children (NICHD, 1999).

Child-Directed Speech and Children's Communication Abilities

Child-directed speech is perhaps one of the most important factors contributing to children's language development (Schwab et al., 2006). It has been frequently studied in two familiar contexts for young children: play (e.g., Salo, Rowe, Leech, & Cabrera, 2016) and book-sharing (e.g., Deckner, Adamson, & Bakeman, 2006; Malin, Cabrera, & Rowe, 2014). Most studies have focused primarily on mothers (Hoff, 2003; Rowe et al., 2005), although there has been a recent growth in the number of studies of paternal child-directed speech (e.g., Leech, Salo, Rowe, & Cabrera, 2013), while some studies have compared fathers' and mothers' talk (e.g., Tamis-LeMonda, Baumwell, & Cristofaro, 2012).

Child-directed speech is highly correlated with children's language development, particularly in regards to vocabulary (e.g., size and sophistication) and syntax (Farkas & Beron, 2004; Hoff, 2003; Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002). For example, child-directed speech at age two predicts child's vocabulary skills at age three (Rowe, 2008).

When studying child-directed speech, the quantity and the quality of the input have been considered. Quantity refers to the number of words produced by the parents (i.e., word tokens) while quality often has multiple components, including vocabulary diversity (i.e., word types), type of talk (e.g., decontextualized talk), grammatical or language complexity (i.e., Mean Length of Utterance [MLU]), vocabulary sophistication (i.e., sophisticated words), and communicative diversity (e.g., requests

and questions), among others (Huttenlocher et al., 2002; Rowe, 2012, 2008; Rowe et al., 2005; Salo et al., 2016; Tamis-LeMonda, Baumwell, & Cristofaro, 2012). Both quantity and quality play an important role in children's language development. For instance, the amount of maternal talk to their 30-month-old toddlers predicted children's vocabulary size a year later (Farkas & Beron, 2004). Further, language complexity in parental child-directed speech has been associated with more advanced language in children (e.g., language comprehension) (Huttenlocher et al., 2002; Tamis-LeMonda et al., 2012). Similarly, the more number of words parents produce, the more diverse vocabulary they use, and the fewer directive utterances they produce is associated with a larger vocabulary in their children (Hart & Risley, 1995; Rowe, 2008). The level of influence of specific components of child-directed speech on children's language development may differ by children's developmental stage. For example, using a sample of 50 parent-child dyads, Rowe (2012) examined the quantity and quality of caregiver input across children's early development, to explore the contribution of specific input aspects on children's vocabulary skills. Parent-child interactions were examined with children 18, 30, and 42 months of age in relation to children's vocabulary skills at 54 months. For quantity, tokens were considered, while for quality vocabulary diversity, vocabulary sophistication, and decontextualized utterances were examined. Rowe (2012) found a relation between different aspects of parental input and children's receptive vocabulary skills, after controlling for SES, children's vocabulary skills, and amount of input. Specifically, the use of diverse and sophisticated vocabulary, as well as the use of decontextualized talk contributed to

explaining additional variation in children's vocabulary at 54 months. Results suggest that quantity input tends to be most important during children's second year of life, while quality components are more important later on. Vocabulary diversity and sophistication seem to be more crucial during the third year of life, and the use of decontextualized utterances appear to be most beneficial in the fourth year of life (Rowe, 2012). Communicative diversity (i.e., utterances with different functions including directing attention, prompting play, labeling objects, among others) seems to benefit children as well (Tamis-LeMonda et al. 2012). Therefore, being exposed to different types of input across children's early development may represent significant benefits for children's language development.

Child-directed speech and SES. Children are exposed to different language environments based on their SES. An extended body of research has documented the different language experiences children from different economic backgrounds have when interacting with their caregivers (Hart & Risley, 1995; Hoff, 2002; 2003; Huttenlocher et al., 2002; Lawrence & Shipley, 1996; Rowe et al., 2005; Schwab et al., 2006). One of the most cited and replicated studies in this topic is the one conducted by Hart and Risley (1995). Authors documented significant differences in the amount of words children from three different SES groups (professional, working class, and welfare) were exposed to. Preschool children from families in the welfare group heard less than half of the amount of words their peers with professional parents heard per hour. There was a positive association between the amount of words heard and the amount of familiar words to children. As a result, children from low-income

families knew significantly less words than their peers from other SES groups, and were at a higher risk for deficits in vocabulary and low academic achievement (Hart & Risley, 1995). Other studies have provided more support for the notion that the child-directed speech children are exposed to in daily interactions with caregivers, influences the relationship between SES and child's vocabulary skills (Hoff, 2002; 2003; Huttenlocher et al., 2002). Similarly, Lawrence and Shipley (1996) found that preschool children from middle SES were exposed to more object labels and information when compared to their peers from low SES families.

Some studies have specifically explored some of the components of child-directed speech to better understand this association. For example, Hoff (2003) found that MLU mediated the relationship between SES and children's vocabulary skills. Mothers from high SES seem to use longer MLU and different types of words in their child-directed speech, which is reflected in children's larger vocabulary.

Other studies have gone further by adding other variables that can potentially explain the association between SES and child-directed speech. For example, Rowe (2008) found that parental knowledge of child development mediated the relationship between SES and child-directed speech. Variation in parental beliefs about child development exists across different SES, and these beliefs influence the way parents communicate with their children on a daily basis.

Most of the studies on SES previously described have also discussed the role of maternal educational levels. The results are often aligned with the outcomes for SES and child-directed speech. Specifically, more educated mothers seem to use more

words (Hart & Risley, 1995; Rowe et al., 2005) and use more diverse vocabulary with their children (Rowe, 2012). Therefore, it is important to consider maternal education as an important predictor of the way mothers talk to their children and to account for its influence on SES levels.

Child-Directed Speech and Children's Socioemotional Competence

A considerable body of literature focusing on the different components of child-directed speech and its relationship with children's socioemotional competence has taken place during the preschool years (e.g., Dunn, Brown, & Beardsall, 1991; Garner, Carlson Jones, Gaddy, & Rennie, 1997). These studies rather than focusing on the structure, or quantity of the language input have emphasized the content, particularly linked to emotions. For example, it is often the case that studies in this area examine mother-child conversations about feelings to later link them to children's outcomes, such as children's capacity to recognize emotions (Dunn, et al., 1991; Garner et al., 1997). Other studies have shown that when children engage in conversations about their own desires as well as others' desires it helps scaffold their social understanding (Taumoepeau & Ruffman, 2008). Additional socioemotional outcomes that have been studied include emotion regulation, executive function, and theory of mind, among others. Preschoolers' language abilities are far more developed than those of toddlers facilitating the development of conversations. Yet, some studies have examined the content of maternal talk related to emotions in younger children. A study by Brophy-Herb et al. (2015) explored the relationship between specific content of maternal talk (i.e., talk about emotions) and the risk of toddlers from low SES for

behavioral problems. Specific content of the talk about emotions included emotion bridging (i.e., labeling emotions, contextualizing emotions, recognizing behavioral cues of emotions, and linking making connections of emotions with toddlers' own experiences). Results suggested that mothers' emotion talk was particularly beneficial for toddlers at highest risk for behavioral problems. Other studies have primarily focused on other aspects of mother-child interactions such as synchrony, mutuality, and responsiveness that contribute to children's socioemotional development (e.g., social competence, peer orientation, communication competence, and self control) (Lindsey & Mize, 2000; Lindsey, et al., 2013; Lindsay, et al., 2009). Research examining quantity and quality of maternal input linked to toddlers' socioemotional competence is limited.

Play as a Context for Studying Maternal Child-Directed Speech

Play along with book reading, has been one of the main contexts chosen by researchers to study mother-child interaction in the early years (e.g., Ispa et al., 20013; Ispa et al., 2004; Malin et al., 2014; Tamis-LeMonda et al., 2012). Both contexts allow researchers to get a snapshot of what typical interactions of young children with their parents may look like on a daily basis. Most research contributing to the role of parents on children's language development has taken place during parent-child reading (e.g., Deckner, Adamson, & Bakeman, 2006; Malin et al., 2014) along with other contexts/tasks such as reminiscing, meal time, and play (e.g., Rowe et al., 2005; Salo et al., 2016). Conclusions about parents' talk have been drawn from interactions in these contexts, yet little emphasis has been made to the unique characteristics that

the specific contexts (e.g., play vs book reading) may bring to conversations and parental language use (Yont et al., 2003). Yont and colleagues tried to address this issue by comparing mothers' child directed speech across contexts. They found that mothers were more likely to engage in discussions of common attention with their children during book reading, and children were also more likely to label objects within this context. On the other hand, mothers were more likely to use directives and negotiate their children's attention during toy play. Authors suggest that it is important to consider that these differences may be context specific (i.e., an outcome of the particular context) instead of a conclusion of maternal speech in general. It is therefore essential to make an effort to better understand the context in which verbal interactions are taking place, and the factors that may be influencing these interactions within that particular context. In the case of the play context, considering the views that parents hold about play has shown to be imperative for different reasons, including the variations among groups in terms of beliefs and practices. The literature has reported differences among SES levels and ethnic/racial/cultural groups in parents' play beliefs. For instance, low-income parents and minorities often conceive play as an activity that may distract children from learning what is important for their school success (Johnson, Christie & Wardle, 2005). In a study about play beliefs among low-income families, Laforrett and Mendez (2017a) found that compared to African-American parents, Latino parents considered school readiness activities to be more important than play, but valued play as a technique to promote their children's social skills. In a cross cultural study (Chessa et al., 2012), Italian parents considered play as "a national

thing” rather than a path to promote social competence, as opposed to American parents who viewed play as a way to improve cognitive and social development crucial for later achievement. Likewise, culture and SES have shown to play a role in parental beliefs on play.

The differences in parents’ play beliefs should be carefully considered when it comes to parenting practices related to play in children’s lives. Beliefs and knowledge often influence practices. Rowe (2008) suggests based on her findings that parental beliefs and knowledge of child development may influence the way parents communicated with their children on a daily basis. Researchers have found similar outcomes in the early childhood teacher education literature. For example, studies have reported a connection between early childhood teachers’ beliefs on play and their practice in the classroom (Vu, Han, & Buell, 2015). Most studies report the teachers’ beliefs on play impact their practice in the classroom with some differences in training (Vu et al., 2015; Ashiabi, 2007, Bodrova & Leong, 2007) while other studies report the degree of impact on practice may vary despite their beliefs (Kemple, 1996). These studies on adults and children may lead to the assumption that the way parents conceive play can be linked to their practices and the type of activities and interaction their children are exposed to (Laforrett & Mendez (2017b). Parents may influence children’s play by their choice of activities and materials. For example, some parents may choose to expose their children to more structured types of play and materials rather than unstructured free play.

In addition, parental beliefs on play may also influence the extent to which they allow children to take control of play episodes depending on their goals. If parents emphasize educational goals, they may be more intrusive and try to direct toward their goals while playing with children. This could be reflected in their language choice and their child-directed speech during play (Johnson, et al., 2005). For example, in a study conducted by Tamis-LeMonda et al., (2012) about maternal teaching during block play, authors found differences by ethnicity/race with Chinese parents emphasizing advanced concepts in math while African American parents advanced literacy concepts. The language choice and the differences among groups during the task were aligned with parents' cultural values and their views of play.

Another important aspect to consider within the play context is the nature of the task. Johnson, et al. (2005) identified different types of play children engage with (e.g., motor play, object play, symbolic play). Different types of play are more salient in specific developmental periods and often follow a sequential order over a long period of time in a process known as *ontogenesis*. This process can be illustrated in children's transition during childhood years from functional play (i.e., manipulation of materials, playing without a specific goal) to constructive play (i.e., combination of materials to complete play construction) to dramatic play (i.e., fantasy or make believe play). In the infant and toddler years, object play constitutes the most often used type of play, followed by constructive play. Puzzle play is a type of object play and constructive play in which there is a specific goal that children should achieve. Children should put pieces in a specific place where they belong in order for the task

to be complete. Object play such as puzzle play is an ideal context to examine the parental beliefs and practice because it exposes parents' interaction style linked to their goals for their children. Unfortunately, the studies comparing parents' interaction styles, particularly their language use in different contexts such as puzzle play are limited (e.g., Levine, Ratliff, Huttenlocher, & Cannon, 2012). Most research studies have focused on preschoolers' conversations during fantasy or sociodramatic play and the effects on children's language and socioemotional outcomes with a clear positive relationship (Roskos & Christie, 2011). However, sociodramatic play and puzzle play are very different; one being unstructured play and the other being structured play with a clear outcome. Language use during puzzle play can also contribute to understanding parental influence on language development in general. In a study by Levine, et al. (2012) about puzzle play and its contribution to preschoolers' spatial transformation skills, authors found that the extent to which children engage in puzzle play along with quality of the play vary by different demographic characteristics, and that engaging in puzzle play was associated with high levels of parental language input. In sum, the play context has unique features that influence the types of talk parents use and these context specific factors along with the nature of the play task should be carefully considered when drawing conclusions about parental language use in interactions during play. Lastly, despite the lack of literature on this topic, depressive symptoms have also shown to be associated with parental perceptions of play, with parents experiencing depressive symptoms being less likely to support play as an important context for children's development (Laforrett & Mendez, 2017a).

Present Study

An extended body of literature has established an important relationship between maternal depression and children's socioemotional development and language ability during the early years (Dawson et al., 2003; Goodman et al., 2011; NICHD, 1999; West & Newman, 2003). Research also suggests that mothers who experience depressive symptomatology have more challenges in the interactions with their children, which is often linked to negative outcomes in maternal child-directed speech (Hummel & Kiel, 2015; Kaminer et al., 2007; Lovejoy et al., 2000; NICHD, 1999). Similarly, the way mothers talk to their children during the early years has an important impact on children's language abilities (Farkas & Beron, 2004; Hoff, 2003; Huttenlocher et al., 2010; Huttenlocher et al., 2002). However, the literature exploring the relationship between the content of maternal child-directed speech and children's socioemotional development in the toddler years is limited.

Current literature has focused on either MCDS as a predictor of children's language abilities, or as an outcome predicted by different aspects such as SES and depression. The present study expands the literature by examining MCDS as a predictor and an outcome in the same study. Furthermore, it contributes to the play literature by examining MCDS during puzzle play, an area that has been understudied and by specifically exploring the influence of maternal depression. Further, one novel aspect about the current study is the use of maternal communicative diversity as a measure of maternal language quality during puzzle play with toddlers. Being exposed to a wide range of communicative possibilities (e.g., refer to object, directives,

evaluations) seems to benefit children (Tamis-LeMonda et al., 2012), however, this component is not frequently used in the quality measures of language.

The current study draws on the Bioecological theory and the concept of *cumulative risk* to examine maternal child directed speech in mother-child interactions during play (i.e., *process*) that take place in the home microsystem (*context*) and that are influenced by specific characteristics (e.g., depressive symptoms, level of education, ethnicity/race) of the mother (i.e., *person*). Considering these maternal characteristics in addition to other family particularities in different ecological systems such as economic hardship, family structure, and immigration status, among others is important. Each of these characteristics on their own may represent a risk factor for negative outcomes for the mother and the child, but the odds of presenting a negative outcome increase with the co-occurrence of multiple risk factors. For example, the present study examines dyads of mothers and children from low-income families who may be experiencing economic hardship, lack of services, malnutrition, membership of a minority group, among others, that could increase the risk of mothers presenting depression, deficits in parenting behaviors or deficits in language exposure for children. Therefore, the notion of *cumulative risk* and considering these potential risk factors at different levels (i.e., systems) may contribute to understanding the variation in maternal child directed speech during mother-child interactions.

The purpose of the present study was threefold. First, this study intended to provide a detailed description of the possible variation of maternal child-directed speech during a puzzle play task among a sample of Early Head Start families.

Second, the present study sought to explore the role of maternal depression on the different components of maternal child-directed speech (i.e., quantity, vocabulary diversity, language complexity, and communication diversity). Third, this study aimed to expand the existing literature by exploring the interactions between maternal depression and maternal-child directed speech to influence children's communication abilities and socioemotional competence. The last goal in particular, hoped to contribute to the understanding of the mechanisms through which depression influences children's outcomes.

The present study asked the following research questions and specified the following hypotheses:

1) What types of variation in Maternal Child Directed Speech (MCDS) components during play exist by child gender, maternal level of education, and among different ethnical/racial groups within a sample of Early Head Start mothers?

Hypothesis 1.1: There will be no differences in the quantity, but there will be higher quality of speech with boys.

Hypothesis 1.2: White mothers are expected to talk more, have more diverse and complex language than African American and Hispanic mothers.

Hypothesis 1.3: Mothers with higher levels of education will produce more diverse and complex language than mothers with lower levels of education

2) Does maternal depression predict the different components of MCDS?

Hypothesis 2: Mothers with higher depressive symptoms are expected to talk less, use less diverse language and communication, and produce less complex language than mothers with lower or no depressive symptoms

3) Does maternal depression interact with MCDS components to predict children's communication abilities and socioemotional competence?

Hypothesis 3.1: maternal depression is expected to moderate the relation between MCDS components and children's communication abilities.

Hypothesis 3.2: maternal depression is expected to moderate the relation between maternal language quantity and quality and children's socioemotional competence.

Chapter 3

METHOD

The present study used a secondary analysis of data collected from a larger project. In the original study, authors identified all families enrolled in an Early Head Start program in the state of Delaware and invited them to participate in the project. The partnering Early Head Start program enrolls approximately 200 children (prenatal to age three) and their families in the state, including families from urban, suburban and rural regions receiving home-based and center-based services. About 90% families enrolled in this program are at or below the federal poverty guideline. In 2018, the Federal poverty guideline for a household of four was stated at \$25,100 per year (Office of the Assistant Secretary for Planning and Evaluation, 2018).

Participants

The sample of this study consisted of 108 toddlers and their mothers enrolled in the Early Head Start program. Children were between 12 months and 34 months, with an average age of 22.2 (SD=6.5) months at the time of data collection. Children younger than 12 months from the original study were excluded from the sample because the BITSEA (Brief Infant Toddler Socioemotional Assessment) scale does not apply for children younger than 12 months, and consistency in the measures for all participants was imperative for this study. Boys constituted 56.5% of the sample. Half

of the participants identified as Hispanic (51.8%), and 59% spoke English at home. A little over half of the sample (55.5%) graduated from high school.

Procedures

Families enrolled in the partnering Early Head Start program were invited to participate in the original study between 2011 and 2017. After the Institutional Review Board approved the human subject protocol, the research team contacted families and provided information about the study. Parents interested in participating signed a form indicating their consent. Individuals were also informed that their participation was voluntary and would not affect their status or services received within the Early Head Start program. The original study's design included a group that received a parenting intervention and a control group (i.e., no intervention). Overall, the current study selected participants from the first wave of data (i.e., pre-intervention) ($n = 99$). To maximize the sample size, participants from the control group that were not yet 12 months during pre-intervention visits but reached 12 months by the start of the second wave of data collection were included ($n = 9$).

Data collection took place during three visits at the participants' home. In the first visit a package with self-report questionnaires including information about family demographics, parental mental health, family stress, and child development was dropped at the participants' house. Information on how to complete each of the measures was provided by a research team member. In cases where parents required assistance filling out the questionnaires, a member of the research team provided appropriate support. Families were able to choose the language of the materials

between English and Spanish. In both cases the research staff member assigned to the family was fluent in the family's language of choice. During a second visit, survey questionnaires were collected and a new packet of questionnaires was delivered. This visit also included direct measures of the child including the communication section of the Batelle Developmental Inventory (BDI, Newborg, 2004), and the three bags task, to assess parent-child interactions. For the three bags task, parents were videotaped for 15 minutes during a semi-structured play activity with their children. The researcher provided three different bags with developmentally appropriate toys. The first bag included a book with words covered (e.g., No, David); the second bag had two puzzles about animals and transportation; and a third bag comprised an interactive toy (e.g., a barnyard with animals). Parents were asked to a) play with their child as they usually would, b) only use the toys in the bag, for consistency among families, c) distribute the time as they would like, and d) not interact with the researcher or the camera unless they had questions about the task. Finally, a third visit consisted of the collection of the second packet of questionnaires. Families were compensated with a \$25 gift card for completing these three visits. This study was approved by the University of Delaware's Institutional Review Board).

Measures

Maternal depressive symptoms. The Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977) was used to indicate parental depressive symptomology. Parents were asked to respond to 20-items rating the frequency in which they had experienced depressive symptoms during the previous week on a scale

ranging from 1 - “Rarely or None of the Time (less than one day)” to 4 - “Most or all the time (5 to 7 days)”. Sample items included: “I felt everything I did was an effort” and “I felt depressed”. Scores range between 0-60, with higher scores indicating greater levels of depressive symptoms. A score of 16 or greater is reported as a cutoff to denote the presence of “elevated” depressive symptoms, indicating “possible depression”. This scale has demonstrated high internal consistency ($\alpha = .84$) (Radloff, 1977). For the present study total scores were used to report maternal presence of depressive symptoms.

Child’s communication abilities. The communication domain of the Batelle Developmental Inventory (BDI-2) was selected to measure the child’s communication abilities. This instrument assesses child’s ability to express (expressive subscale; 45-items) and understand (receptive subscale; 40-items) verbal and nonverbal information (Newborg, 2004). The receptive subscale measures the child’s capacity to identify and understand information, words and sounds through non-verbal sources and conversations (e.g., associating words with pictures, responding to different tones of voice). The expressive subscale assesses the child’s ability to use different words, gestures, and sounds to communicate information to others, as well as to use simple rules of grammar (e.g., articulating certain number of words, producing sentences of a determined length). This instrument is directly administered to the child by a trained researcher, and it includes three options of administration, observation (i.e., observing the child in a natural setting), structure (i.e., asking the child to perform a task), or interview (i.e., asking questions to the primary caregiver) elements. In the original

study, only the structure and interview options were used. Newborg (2004) reports an adequate internal consistency of the communication domain of the BDI ($\alpha = .85$). The scaled scores of the expressive and receptive communication, as well as the sum for both subscales were used in the analysis.

Child's socioemotional competence. The Brief Infant Toddler Socioemotional Assessment (BITSEA) (Briggs-Gowan, Carter, Irwin, & Wachtel, 2004) was used to assess children's social and emotional behavior. This measure consists of 42-items administered to caregivers of children aged 12 to 36 months. It is considered a screener for behavioral and social-emotional problems, as well as for delays in children's social-emotional competence. Some examples of the items include "[the child] Is restless and can't sit still", and "[the child] Is affectionate with loved ones" (Briggs-Gowan et al., 2004). Ratings for each item are given on a 3-point scale with values of zero representing "not true/rarely", one "somewhat true/sometimes" and two "very true/often". Scores of the BITSEA are divided into the social problem total score and the competence total score. A higher social problem total score indicates the presence of a possible internalizing or externalizing problem whereas a lower competence total score refers to possible competence difficulties. These values would need to be analyzed with a specific cut-off score and percentile if drawing conclusions about children's possible socioemotional delays. Authors report an acceptable internal consistency for the problem total score ($\alpha = .79$), and a marginal for competence total score ($\alpha = .65$) (Briggs-Gowan et al., 2004). In the present study raw scores for competence and social problem were used.

Maternal Child-Directed Speech (MCDS). The three bags task videos were used to measure maternal child-directed speech, specifically the segment of the second bag containing puzzles. Once the parents opened the second bag the time started counting and up to seven minutes of video were selected. To account for time variation in the videos, the length in seconds was included in the analysis as a control variable. The average duration of the puzzle play video segment was 5:33 (5 minutes and 33 seconds, $SD = 1:30$ seconds, range=1:48 sec to 7:28 sec).

Transcribing process. All verbal interactions were transcribed verbatim by two trained research assistants using CHAT (Codes for the Analysis of Human Language) codes and rules (Child Language Data Exchange System – CHILDES, MacWhinney, 2000). This software has been widely used in studies of conversational interactions and linguistics. It accelerates the transcription process and allows for automatic computation of morphosyntactic components. A third transcriber verified all transcripts for accuracy purposes. The unit of the transcriptions was the utterance. Based on the work of Rowe et al. (2005) the utterance was defined as a sequence of words that was followed by a pause of 2 or more seconds, by a grammatical closure (punctuation), or by a speaker transition.

Coding process. The coding scheme for maternal child-directed speech was developed from the work of Tamis-LeMonda, Baumwell, and Cristofaro (2012), Tamis-LeMonda et al. (2013), and Salo et al. (2016). Four main components of maternal speech were coded from the mother-child interactions during puzzle play (See Figure 1.). These components were chosen based on the body of research that

links quantity and quality of maternal talk to children's language skills (Boyce, Gillam, Innocenti, Cook, & Ortiz, 2013; Rowe, 2008; Song, Spier, & Tamis-LeMonda, 2014), and included 1) input quantity, 2) vocabulary diversity 3) language complexity, and 4) communicative diversity.

1) Input quantity refers to the total number of words (known as tokens) used by the mother during the interaction. 2) Vocabulary diversity denotes the different types of words (i.e., different roots) in the transcripts used by the mother (e.g., book and books count as one type, but book and car count as two types). 3) Language complexity refers to the mean length of the utterance (MLU), a standard measure that assesses the average number of morphemes (i.e., the smallest unit of meaning. E.g., 'walk' has one morpheme, 'walked' has two morphemes, walk, and ed) or words in each utterance. This measure has often been used to identify grammatical or language complexity (Huttenlocher et al., 2002; Rowe, 2012). In the present study the number of words was selected for the analysis of the MLU. The MLU_w (words) has found to be correlated with the MLU_M (morphemes) at .97 for English (Malakoff, Mayes, Schottenfeld, & Howell, 1999) and .99 for Spanish (Aguado, 1988). An automated analysis of the transcripts by the Computerized Language Analysis (CLAN) program generated the tokens, word types, and MLU from the transcripts.

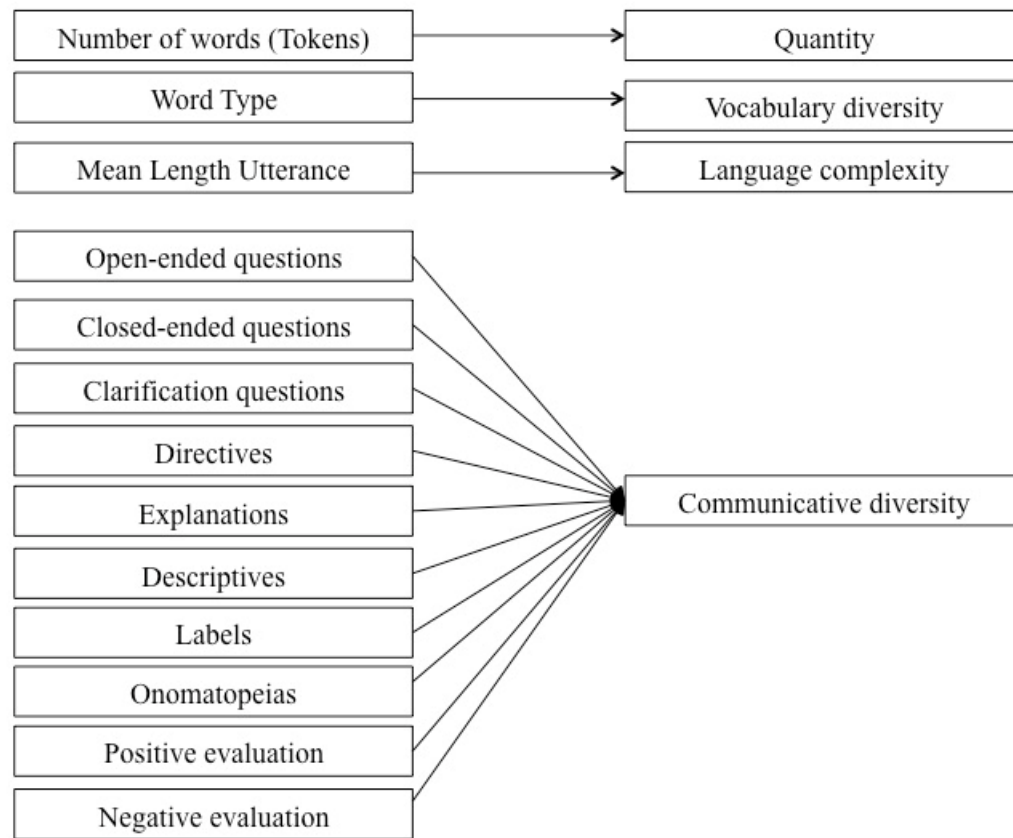


Figure 1 Coding categories: Components of maternal child-directed speech

4) Communicative diversity encompasses pragmatic measures of language, or specific language functions (Rowe et al., 2005; Salo et al., 2016; Tamis-LeMonda, et al., 2012). Ten mutually exclusive categories of language functions were developed and included in the analysis of communicative diversity (i.e., open ended questions or *wh* questions, closed-ended questions, clarification requests, explanations, directives, labels, descriptions, onomatopoeias, positive evaluation, and negative evaluation). See Table 1 for a description of these categories and examples. In line with the work of

Tamis-LeMonda et al. (2012) communicative diversity was calculated as a total score based on the average of the number of distinct categories used by each parent ranging from one to ten. Two coders independently coded 20% of the utterances for reliability purposes. Agreement ranged from 75% to 100% with Cohen's kappas above 0.7, indicating good agreement (i.e., .65 or higher) as suggested by Landis and Koch (1977). Disagreements were resolved through discussion until a consensus was reached about the utterance.

Table 1

Description of categories of the communicative diversity component

Coding category	Definition	Example
1. Open-ended Questions	Questions that are expected to elicit information from the child and have more than one possible answer	"Where is the truck?"
2. Closed-ended questions	Questions that have specific/limit options for an answer including yes/no	"Do you want to do it again?"
3. Clarification	Requests that explicitly ask the child to repeat or revise a specific utterance	"Huh?" "What did you say?"
4. Explanation	Utterances that clarify, justify or draw conclusions about events, objects or concepts	"This one is the mom because is bigger"

5. Directive	Utterances that attempt to direct child's attention or behavior	"Put that piece here" "Look"
6. Descriptive	Utterances that provide descriptive information of an object or an action	"The baby lion is with his mommy"
7. Labels	Utterances that emphasize in the name of an object	"That's a truck" "Giraffe"
8. Onomatopoeias/sounds	Utterances that imitate the sound of animals or vehicles	"moooo"
9. Positive evaluation	Utterances that provide approval, positive evaluation, or encouragement to child's action, idea or comment	"Good Job" "Yay"
10. Negative evaluation	Utterances that reject, refuse, or provide a negative evaluation to a child's action, idea or comment	"That's not right"

Control variables. Demographic information was obtained using a family background survey created for the original study. Caregivers were asked to complete this survey that contained basic information (e.g., ethnicity and race, parents' and children's birth date, sex, and languages spoken), parental education level, family information (e.g., family structure and family members living in the household), and family income information. Based on findings from previous research (e.g., Goodman et al., 2011; Leaper, Anderson, & Sanders, 1998; Rowe et al., 2005) five control

variables were included in the analyses: child age, child gender, maternal education, maternal race/ethnicity, and video length.

Child age was measured in months by the time of data collection and was treated as a continuous variable. Child gender was dummy coded with girl as the reference category (0 = girl; 1 = boy). Mothers were asked to report on their level of education (1 = less than 8th grade; 2 = 8th - 11th grade; 3 = General Equivalency Diploma; 4 = graduated high school/high school diploma; 5 = some college credits; 6 = Associate's degree/graduated 2-yr college; 7 = Bachelor's degree/graduated 4-yr college; 8 = some graduate credits; 9 = Master's degree or higher). For interpretation purposes and consistency with previous studies (e.g., Howel et al., 2005; Malin et al., 2013) this variable was recoded to (0 = less than high school diploma, 1 = high school diploma and 3 = more than high school diploma). Mothers were also asked about their Hispanic origin (1 = not Hispanic, Latino/a, or Spanish origin; 2 = Mexican, Mexican American, Chicano/a; 3 = Puerto Rican; 4 = Cuban; 5 = another Hispanic, Latino/a, or Spanish origin) and their race (1 = White; 2 = Black or African American; 3 = American Indian or Alaska Native; 4 = Asian Indian; 5 = Chinese; 6 = Filipino; 7 = Japanese; 8 = Korean; 9 = Vietnamese; 10 = Other Asian; 11 = Native Hawaiian; 12 = Guamanian or Chamorro; 13 = Samoan; 14 = Other Pacific Islander; 15 = Other). These categories were condensed by the original study into six categories (1 = White; 2 = Black or African American; 3 = American Indian or Alaska Native; 4 = Asian; 5 = Native Hawaiian/Pacific Islander; 6 = other). In the present study the race and ethnicity categories were combined into a new variable race/ethnicity that included three final

groups (0 = non-Hispanic Whites/Asian; 1 = non-Hispanic black/native; 3 = Hispanics) with White as the reference category. These groups were mutually exclusive. Lastly, video length was included as a control variable due to the variation of the length of video of the play task, and with the premise that more time spent in the task allowed the mothers more opportunity to produce speech. Video was measured in seconds (as reported on tables) but described in minutes in the interpretations.

Analytic Strategy

In order to test the aforementioned research questions a series of descriptive analyses, bivariate correlations, and multiple regressions were conducted using SPSS Statistics (version 21) and Stata (version 23).

Frequencies and descriptive statistics (i.e., mean, standard deviation, and range) were obtained for all the study variables, and correlations were tested among the main study variables and sociodemographic variables. Multiple regression was selected as the analysis technique to answer the main research questions. Multiple regression is a type of statistical analysis used to test the relationship among different independent variables and a quantitative dependent variable. It yields two main results: (1) the variance explained by a model (i.e., R^2) with multiple independent variables on a dependent variable, and (2) a regression coefficient (i.e., b : unstandardized, or β : standardized) that represents the individual contribution of a specific independent variable on a dependent variable after controlling for other variables in the model (Field, 2000).

Research question 1 (RQ1): Variation in MCDS components. To test the differences in the MCDS components among racial/ethnic groups, maternal level of education, and child gender, the following multiple regression equation was estimated:

$$\text{Model 1- 4: COMPONENT}_i = \beta_0 + \beta_1 * \text{cgender} + \beta_2 * \text{cage} + \beta_3 * \text{RE1} + \beta_4 * \text{RE2} + \beta_5 * \text{HS} + \beta_6 * \text{HS1} + \beta_7 * \text{length} + e$$

where COMPONENT_i = each of the four components of the MCDS (i.e., Tokens, MLU, Types, and Communicative diversity), cgender = child gender, cage = child age, RE1 = Black, RE2 = Hispanics, HS = high school diploma, HS1 = more than a high school diploma, and Length = length of the video.

Additionally, the possible differences by child gender, maternal level of education and race/ethnicity on the ten different categories of the communicative diversity component were tested in individual regression models with the following equation:

$$\text{Models 1-10: CATEGORY}_i = \beta_0 + \beta_1 * \text{cgender} + \beta_2 * \text{cage} + \beta_3 * \text{RE1} + \beta_4 * \text{RE2} + \beta_5 * \text{HS} + \beta_6 * \text{HS1} + \beta_7 * \text{length} + e$$

where CATEGORY_i = each of the ten categories of the communicative diversity component of the MCDS (i.e., open-ended questions, closed-ended questions, clarification, directives, descriptives, labels, onomatopoeia, explanations, and positive and negative evaluations), and the other variables = the same ones described in the previous equation.

Research question 2 (RQ2): Depression and MCDS components. To test the effects of depressive symptoms on the four components of MCDS the following multiple regression equation was estimated with depression added to the model:

$$\text{Models 1- 4 } \text{COMPONENT}_i = \beta_0 + \beta_1 * \text{cgender} + \beta_2 * \text{cage} + \beta_3 * \text{RE1} + \beta_4 * \text{RE2} + \beta_5 * \text{HS} + \beta_6 * \text{HS1} + \beta_7 * \text{length} + \beta_8 * \text{Dep} + e$$

where COMPONENT_i = each of the components of the MCDS (i.e., Tokens, MLU, Types and Communicative diversity), cgender = child gender, cage = child age, RE1 = Black, RE2 = Hispanics, HS = high school diploma, HS1 = more than a high school diploma, Length = length of the video, and Dep = depressive symptoms.

Additionally, to examine the relation between depressive symptoms and each of the categories of the communicative diversity component ten individual regression models with the following equation were estimated:

$$\text{Models 1-10: } \text{CATEGORY}_i = \beta_0 + \beta_1 * \text{cgender} + \beta_2 * \text{cage} + \beta_3 * \text{RE1} + \beta_4 * \text{RE2} + \beta_5 * \text{HS} + \beta_6 * \text{HS1} + \beta_7 * \text{length} + \beta_8 * \text{Dep} + e$$

where CATEGORY_i = each of the ten categories of the communicative diversity component of the MCDS (i.e., open-ended questions, closed-ended questions, clarification, directives, descriptives, labels, onomatopoeia, explanations, and positive and negative evaluations), cgender = child gender, cage = child age, RE1 = Black, RE2 = Hispanics, HS = high school diploma, HS1 = more than a high school diploma, Length = length of the video, and Dep = depressive symptoms.

Research Question 3 (RQ3): Interaction of MCDS and depression.

First, to test the main effects of depression on children's communication abilities and socioemotional competence five independent models (i.e., one for each outcome) with the following multiple regression equation were estimated:

$$\text{Model 1-5: CHILDOUTCOME} = \beta_0 + \beta_1 * \text{cgender} + \beta_2 * \text{cage} + \beta_3 * \text{RE1} + \beta_4 * \text{RE2} + \beta_5 * \text{HS} + \beta_6 * \text{HS1} + \beta_7 * \text{Dep} + e$$

where CHILDOUTCOME = expressive communication, receptive communication, total communication, competence, or problem, cgender = child gender, cage = child age, RE1= Black, RE2 = Hispanics, HS = high school diploma, HS1= more than a high school diploma, and Dep = depressive symptoms.

Second, to examine the associations between each of the components of MCDS with children's communication abilities and socioemotional competence, the multiple regression equations below were estimated. To consider the issue of multicollinearity given that the components of MCDS were highly correlated, an individual model was run for each MCDS component (tokens, types, MLU, communicative diversity).

$$\begin{aligned} \text{(Models 1-4) Receptive} &= \beta_0 + \beta_1 * \text{cgender} + \beta_2 * \text{cage} + \beta_3 * \text{RE1} + \beta_4 * \text{RE2} + \\ &\beta_5 * \text{HS} + \beta_6 * \text{HS1} + \beta_7 * \text{length} + \beta_8 * \text{COMPONENT} + \\ &e \end{aligned}$$

$$\begin{aligned} \text{(Models 5-8) Expressive} &= \beta_0 + \beta_1 * \text{cgender} + \beta_2 * \text{cage} + \beta_3 * \text{RE1} + \beta_4 * \text{RE2} + \\ &\beta_5 * \text{HS} + \beta_6 * \text{HS1} + \beta_7 * \text{length} + \beta_8 * \text{COMPONENT} \\ &+ e \end{aligned}$$

$$\begin{aligned} \text{(Models 9-12) Total} = & \beta_0 + \beta_1 * cgender + \beta_2 * cage + \beta_3 * RE1 + \beta_4 * RE2 + \\ & \beta_5 * HS + \beta_6 * HS1 + \beta_7 * length + \beta_8 * \text{COMPONENT} + e \end{aligned}$$

$$\begin{aligned} \text{(Models 13-16) Competence} = & \beta_0 + \beta_1 * cgender + \beta_2 * cage + \beta_3 * RE1 + \\ & \beta_4 * RE2 + \beta_5 * HS + \beta_6 * HS1 + \beta_7 * length + \beta_8 * \\ & \text{COMPONENT} + e \end{aligned}$$

$$\begin{aligned} \text{(Models 17-20) Problem} = & \beta_0 + \beta_1 * cgender + \beta_2 * cage + \beta_3 * RE1 + \beta_4 * RE2 + \\ & \beta_5 * HS + \beta_6 * HS1 + \beta_7 * length + \beta_8 * \text{COMPONENT} \\ & + e \end{aligned}$$

where receptive = receptive communication, expressive = expressive communication, total = total communication, competence = competence, problem = problem, cgender = child gender, cage = child age, RE1= Black, RE2 = Hispanics, HS = high school diploma, HS1= more than a high school diploma, Length = length of the video, and COMPONENT = each of the components of the MCDS (i.e., tokens, MLU, types and communicative diversity)

Third and last, regression models with interaction terms between depression and the components of MCDS and children's language and socioemotional abilities were run as is shown in the following equations:

$$\begin{aligned} \text{(Models 1-4) Receptive} = & \beta_0 + \beta_1 * cgender + \beta_2 * cage + \beta_3 * RE1 + \beta_4 * RE2 + \\ & \beta_5 * educ + \beta_6 * length + \beta_7 * Dep + \\ & \beta_8 * \text{COMPONENT} + \beta_9 * Dep * \text{COMPONENT} + e \end{aligned}$$

$$\begin{aligned} \text{(Models 5-8) Expressive} = & \beta_0 + \beta_1 * cgender + \beta_2 * cage + \beta_3 * RE1 + \beta_4 * RE2 + \\ & \beta_5 * educ + \beta_6 * length + \beta_7 * Dep + \\ & \beta_8 * COMPONENT + \beta_9 * Dep * COMPONENT + e \end{aligned}$$

$$\begin{aligned} \text{(Models 9-12) Total} = & \beta_0 + \beta_1 * cgender + \beta_2 * cage + \beta_3 * RE1 + \beta_4 * RE2 + \\ & \beta_5 * educ + \beta_6 * length + \beta_7 * Dep + \beta_8 * COMPONENT + \\ & \beta_9 * Dep * COMPONENT + e \end{aligned}$$

$$\begin{aligned} \text{(Models 13-16) Competence} = & \beta_0 + \beta_1 * cgender + \beta_2 * cage + \beta_3 * RE1 + \\ & \beta_4 * RE2 + \beta_5 * educ + \beta_6 * length + \beta_7 * Dep + \\ & \beta_8 * COMPONENT + \beta_9 * Dep * COMPONENT + \\ & e \end{aligned}$$

$$\begin{aligned} \text{(Models 17-20) Problem} = & \beta_0 + \beta_1 * cgender + \beta_2 * cage + \beta_3 * RE1 + \beta_4 * RE2 + \\ & \beta_5 * educ + \beta_6 * length + \beta_7 * Dep + \\ & \beta_8 * COMPONENT + \beta_9 * Dep * COMPONENT + e \end{aligned}$$

where receptive = receptive communication, expressive = expressive communication, total = total communication, competence = competence, problem = problem, RE1= black, RE2 = Hispanics, educ = level of education, cgender = child gender, cage = child age, length = video length, Dep = depressive symptoms, COMPONENT = each of the components of the MCDS (i.e., tokens, MLU, types and communicative diversity), and Dep*COMPONENT = interaction between depression and each of the components of MCDS. Significant interactions were explored through estimation plots at low and high levels ($\pm 1 SD$) around the mean of the interaction variables (Aiken & West 1991).

Chapter 4

RESULTS

The present chapter discusses: (1) missing data and assumptions of the models (2) preliminary descriptive analyses, and (3) multiple regression analyses.

Missing Data

On average 4.94% of the data were missing for all study variables, with the following values for each variable: Depression (5.6%), receptive (1.9%), expressive (1.9%), total (1.9%), problem (7.4%), competence (9.3%), education (2.8%), Hispanic (5.6%), race (9.3%). To ensure that there were no potential patterns in the missing data three sets of analyses were conducted. First, the Little's MCAR test was performed using SPSS to check if the data were missing completely at random. This test identifies potential patterns in the missing data. Results from this test were non significant ($\chi^2 = 87.726$; $df = 70$; $p = 0.075$), indicating that no identified patterns were found in the missing data and it was likely missing completely at random. Second, logistic regression analyses were conducted to test possible demographic differences between participants with and without missing data. These analyses were conducted for children's social competence and problem, and maternal depressive symptoms. Children's communication abilities did not have enough participants with missing data for this analysis. None of the demographic variables significantly predicted missingness of the data on maternal depressive symptoms and children's

socioemotional competence. Third, an independent sample t-test was run to compare the outcome variables' means for those with and without missing values in the depression scale (main predictor of the study). There were no significant mean differences in the outcome variables. Based on the results from these analyses and given that less than 10% of data was missing listwise deletion (default option in Stata and SPSS) was used to handle missing data.

Assumptions

Multiple regression analyses assume that variables are normally distributed. Variables that are non-normally distributed may alter the relation and significance tests (Osborne & Waters, 2002). In order to test the normality of the study variables, histograms and P-P plots were examined. P-P plots and variables approximated to a normal curve in the histograms and to a continuous line in the P-P plots. Only one severe outlier was identified for the social competence variable, and after analyzing the case it was likely that an error occurred when filling out the questionnaire. This case was treated as missing data for that variable. To account for the possible issue of multicollinearity given the high correlation among MCDS components it was decided not to include them together as predictors in one model.

Preliminary Descriptive and Correlation Analyses

Descriptive statistics and correlations for all study variables are presented in Tables 2, 3, 4, and 5.

Children's outcomes and maternal depression. On average mothers reported low depressive symptoms, with mothers of older children reporting higher levels of

depressive symptoms. Regarding children's communication abilities, receptive and expressive communications scores were positively associated. On average girls scored higher than boys in expressive communication, and older children showed greater receptive communication abilities. Furthermore, most children were reported to have high levels of social competence and low possible problem score. The higher the children's competence levels were the lower the likelihood to present a possible internalizing or externalizing problem. Furthermore, having a mother with depressive symptoms was associated with lower levels of social competence and higher chances of children presenting a possible externalizing or internalizing problem. Children's higher levels of social competence were related to higher scores in their expressive communication abilities.

Table 2

Descriptive Statistics of Demographic and Child Outcome Variables

	<i>n</i>	<i>%</i>	<i>M (SD)</i>	<i>Min-max</i>
Child gender				
- <i>Male</i>	61	56.5		
- <i>Female</i>	47	43.5		
Child age (months)	108	100	22.2 (6.5)	12-34
Mother education				
- <i><HS degree</i>	45	41.7		
- <i>HS degree</i>	21	19.4		
- <i>>HS degree</i>	39	36.1		
- <i>Missing</i>	3	2.8		
Maternal race/ethnicity				
- <i>Non-Hispanic White/Asian</i>	20	18.5		
- <i>Black/Native</i>	26	24		
- <i>Hispanic</i>	56	51.8		
- <i>Missing</i>	6	5.6		
Maternal depression	102		10.6 (9.1)	0-41
Child receptive communication	106		6.3 (4.3)	1-19
Child expressive communication	106		9.5 (3.9)	1-18
Child communication	106		15.8 (7)	2-36
Child competence	98		16.7 (3.5)	1-22
Child possible problem	100		9.8 (6.9)	0-39

Table 3

Correlations among Study Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Gender	1														
2 Child age	-0.03	1													
3 Education	0.04	-0.06	1												
4 Depression	0.15	0.24*	-0.01	1											
5 Rcom	-0.16	0.26**	0.01	0.1	1										
6 Ecom	-0.26**	-0.08	0.13	0.03	0.47**	1									
7 BDI	-0.22*	0.11	0.09	0.08	0.86**	0.83**	1								
8 Comp	-0.02	0.01	0.11	-0.28**	0.04	0.26*	0.16	1							
9 Probl	0.12	0.15	0.04	0.48**	0.04	-0.03	0.00	-0.34**	1						
10 Video	-0.03	0.09	-0.18	-0.04	-0.11	-0.13	-0.14	0.03	-0.07	1					
11 Utterances	-0.06	0.19*	-0.07	-0.03	0.15	0.04	0.11	0.09	-0.02	0.57**	1				
12 Tokens	-0.06	0.32**	0.02	-0.03	0.18	0.06	0.14	0.06	0.00	0.53**	0.91**	1			
13 MLU	-0.05	0.3**	0.26**	0.05	0.17	0.08	0.16	-0.07	-0.01	-0.14	-0.02	0.35**	1		
14 Types	-0.03	0.35**	0.06	0.07	0.20*	0.07	0.17	0.05	0.02	0.44**	0.79**	0.89**	0.42**	1	
15 Comdiv	0.02	0.32**	0.04	0.26**	0.08	0.02	0.06	0.03	0.09	0.36**	0.55**	0.56**	0.22*	0.65**	1

** p<0.01, * p<0.05

Maternal Child Directed Speech. The average duration of the puzzle play video segment was 5:33 (5 minutes and 33 seconds, $SD = 1:30$ seconds, range=1:48 sec to 7:28 sec). Mothers with high school education had shorter videos compared to mothers with less than a high school degree. Longer segments of video were associated with more tokens, more types of words used, and more diversity in maternal communication. There were no significant differences in the video length by maternal race/ethnicity, maternal depressive symptoms, and child's age or child gender.

There was a wide variability on the number of words (tokens) and the different types of words mothers used during the puzzle play episode. Mothers who spoke more types of words to their children had children with higher receptive communication skills. Furthermore, mothers with more years of education produced on average more words per utterance. In general, mothers spoke more words, used more types of words, produced longer utterances, and used more diverse communication with older children.

Communicative diversity. Most mothers used on average seven out of the ten different categories coded. Mothers produced more directive commands than any other category, followed by positive evaluations, labels, open-ended questions, closed-ended questions, descriptive statements, and negative evaluations respectively. Onomatopoeias, clarifications, and explanations were categories used least by the mothers. Correlations among these variables can be found in Table 5.

Table 4

Descriptive Statistics of MCDS Variables

	M (SD)	Min-Max
Video length (seconds)	320.2(90.3)	107-448
# Utterances	91.7(45.3)	3-222
Tokens	273.8(141.7)	3-629
MLU	3(0.7)	1-5
Types	83.6(30.5)	2-153
Communicative diversity	7.4(1.4)	1-10
Open-ended	11.3(10.7)	0-61
Closed-ended	7.2(6)	0-31
Clarification	0.6(1)	0-5
Explanation	0.2(0.6)	0-3
Directives	27.7(17.8)	2-94
Labels	11.8(9.3)	0-50
Descriptives	6.7(6)	0-37
Onomatopoeia	0.8(1.8)	0-13
Positive evaluation	13(10.2)	0-52
Negative evaluation	5.9(6.5)	0-33

Table 5

Correlations among Communicative Diversity categories

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1 Utterances	1														
2 Tokens	0.91**	1													
3 MLU	-0.02	0.35**	1												
4 Types	0.79**	0.89**	0.42**	1											
5 Comdiv	0.55**	0.56**	0.22*	0.65**	1										
6 Open-ended	0.59**	0.65**	0.19*	0.58**	0.47**	1									
7 Closed-ended	0.37**	0.51**	0.33**	0.48**	0.30**	0.23*	1								
8 Clarification	0.28**	0.26**	-0.01	0.33**	0.36**	0.20*	0.38**	1							
9 Explanation	0.27**	0.33**	0.19	0.30**	0.33**	0.25*	-0.09	-0.01	1						
10 Directives	0.74**	0.54**	-0.30**	0.39**	0.24*	0.13	0.03	0.06	0.22*	1					
11 Descriptives	0.52**	0.55**	0.14	0.60**	0.34**	0.34**	0.31**	0.38**	0.06	0.24*	1				
12 Labels	0.50**	0.42**	-0.02	0.43**	0.33**	0.28**	0.11	0.03	0.07	0.26**	0.24*	1			
13 Onomatopoeia	0.22*	0.13	-0.13	0.10	0.28**	0.09	0.00	0.08	0.01	0.13	0.07	0.32**	1		
14 Positive	0.73**	0.72**	0.10	0.66**	0.49**	0.54**	0.31**	0.23*	0.21*	0.39**	0.29**	0.26**	0.09	1	
15 Negative	0.50**	0.46**	0.00	0.33**	0.29**	0.23*	0.01	0.03	0.37**	0.51**	0.14	0.01	0.00	0.24*	1

** p<0.01, * p<0.05

Variation in MCDS Components (RQ1)

The first research question aimed to examine differences in the MCDS components by maternal race/ethnicity and level of education, child's age and gender. Results from the regression models for each MCDS component can be found in Table 6.

Table 6

Variation in MCDS Components

Predictor	Tokens		Types		MLU		Comdiv	
	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β
HS diploma	92.71*** (33.75)	0.25	18.70** (7.48)	0.24	0.22 (0.18)	0.13	0.27 (0.39)	0.07
>HS diploma	63.90** (26.84)	0.22	16.57*** (5.94)	0.27	0.27* (0.14)	0.19	0.47 (0.31)	0.16
Black	-3.12 (35.09)	-0.01	-9.38 (7.77)	-0.14	-0.12 (0.19)	-0.08	-0.05 (0.40)	-0.01
Hispanic	22.85 (30.38)	0.08	-1.09 (6.73)	-0.02	-0.49*** (0.16)	-0.36	-0.15 (0.35)	-0.05
Child age	6.22*** (1.78)	0.28	1.46*** (0.39)	0.31	0.03*** (0.01)	0.30	0.07*** (0.02)	0.30
Boy	-6.77 (23.17)	-0.02	2.18 (5.13)	0.04	-0.09 (0.12)	-0.07	0.15 (0.27)	0.05
Video Length	0.81*** (0.13)	0.50	0.14*** (0.03)	0.41	-0.00 (0.00)	-0.06	0.01*** (0.00)	0.35
Constant	-173.30*** (62.59)	.	-1.56 (13.86)	.	2.64*** (0.33)	.	3.79*** (0.72)	.
Observations	101		101		101		101	
R-squared	0.40		0.34	0.34	0.25		0.24	
F-stat	8.91		6.80		4.54		4.12	
prob > F	0.00		0.00		0.00		0.00	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Word tokens. The regression model explained 40% of the variance of the total number of words used by the mothers ($R^2 = .40$, $F(7,93) = 8.91$, $p < 0.001$). Results suggest that the number of words used by the mothers had a positive relationship with their level of education (high school diploma, $b = 92.7$, $p < 0.01$; more than high school diploma, $b = 63.9$, $p < 0.01$), children's age ($b = 6.22$, $p < 0.001$), and video length ($b = .81$, $p < 0.01$). In other words, high school graduates produced 93 more words and mothers with more than a high school education produced 64 more words than those with less than a high school diploma. Likewise, for one extra month in children's age mothers produced on average six more words. Additionally, an increase in one minute of length of the video was associated with mothers producing 46 more words. This model did not find associations between maternal race/ethnicity and the number of words they produced.

Word types. The regression model explained 34% of the variance of the different types of words mothers use ($R^2 = .34$, $F(7,93) = 6.8$, $p < 0.001$). Results suggested that maternal education (high school diploma, $b = 18.70$, $p < 0.05$; more than high school diploma, $b = 16.57$, $p < 0.001$), child's age ($b = 1.46$, $p < 0.001$), and video length ($b = .14$, $p < 0.01$) were positively associated with the types of words mothers used during play. Compared to those mothers with less than a high school diploma, high school graduates produced 19 more types of words, and mothers with more than a high school education produced 16 more. Additionally, for one extra

month in child's age mothers produced on average 1.46 more types of words. Likewise, an increase in one minute of length of the video resulted in mothers producing 8.4 more types of words. Maternal race/ethnicity and child gender were not associated with the types of words mothers used during the puzzle play episode.

MLU. The regression model explained 25% of the variance in the MLU ($R^2 = .25$ $F(7,93) = 4.54, p < 0.001$). In this model (model 1), children's age and Hispanic ethnicity significantly predicted maternal MLU. This means that for every additional month in children's age, mothers' MLUs were .030 words longer ($b = .03, p < 0.01$). Similarly, Hispanic mothers had on average MLUs .49 words shorter than White/Asian mothers ($b = -.49, p < 0.01$). However, when language was added to the model (model 2) the effect of being Hispanic on the MLUs was no longer significant (See Table 7 for model comparison). Children's gender, maternal level of education, video length were not associated with the MLUs.

Table 7

MLU Variation with and without Controlling for Language

Predictor	Model 1		Model 2	
	<i>b</i>	β	<i>b</i>	β
HS diploma	0.22 (0.18)	0.13	0.14 (0.17)	0.08
>HS diploma	0.27* (0.14)	0.19	0.06 (0.15)	0.05
Black	-0.12 (0.19)	-0.08	-0.10 (0.18)	-0.06
Hispanic	-0.49*** (0.16)	-0.36	-0.08 (0.20)	-0.06
Child age	0.03*** (0.01)	0.30	0.03*** (0.01)	0.33
Boy	-0.09 (0.12)	-0.07	-0.09 (0.12)	-0.07
Video Length	-0.00 (0.00)	-0.06	-0.00 (0.00)	-0.01
Spanish			-0.65*** (0.19)	-0.47
Constant	2.64*** (0.33)	.	2.58*** (0.32)	.
Observations	101		101	
R-squared	0.25		0.34	
F-stat	4.54		5.86	
prob > F	0.00		0.00	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Communicative diversity. The regression model explained 24% of the variance in maternal communicative diversity ($R^2 = .24$ $F(7,93) = 4.12, p < 0.001$). Children's age ($b = .07, p < 0.001$) and video length ($b = 0.01, p < 0.001$) were significant predictors of communicative diversity. For one extra month in children's age mothers produced on average .07 more categories. Likewise, an increase in one minute of length of the video resulted in mothers producing an average of 0.6 more categories. This model did not find any significant differences in maternal communicative diversity by maternal education, race/ethnicity, or child gender.

Communicative diversity categories. When analyzing the principal categories that comprise the communicative diversity score there were some variations by demographics, as shown in Table 8. Specifically, children's age ($b = .81, p < 0.001$) and maternal education ($b = 4.72, p < 0.1$) predicted the use of open-ended questions. In other words, for each one-month increase in children's age, mothers asked on average .81 more open-ended questions. Additionally, compared to those without a high school diploma, mothers who graduated high school asked on average 4.72 more open-ended questions. Further, maternal education (more than high school education, $b = 4.16, p < 0.001$) and race/ethnicity (black, $b = -4.67, p < 0.001$; Hispanic, $b = -4.84, p < 0.001$) significantly predicted the use of closed-ended questions. Mothers with more than a high school diploma asked 4.16 more closed-ended questions than mothers with less than a high school diploma. Compared to white mothers, black mothers asked 4.67 less closed-ended questions while Hispanic mothers asked 4.84 less. Maternal level of education also predicted the use of positive evaluations (high

school degree, $b = 6.23, p < 0.01$ more than high school, $b = 5.05, p < 0.01$). Mothers with more than a high school diploma produced 5.05 more positive evaluations than mothers with less than a high school diploma. Furthermore, Hispanic mothers used on average 13.41 more directive commands than white mothers ($b = 13.41, p < 0.001$). The length of the video was also significantly associated with the use of open-ended questions ($b = .05, p < 0.001$), closed-ended questions ($b = .02, p < 0.001$), and directive commands ($b = .05, p < 0.001$). For every additional minute of video length mothers asked 0.3 more open ended questions, 1.2 more closed-ended questions, and gave 30 more direct commands to the children. There were no significant differences by race/ethnicity, level of education, and child gender in the use of labels or in the use of negative evaluations by the mother.

Table 8

Variation in the main Communicative Diversity Categories

Predictor	Open-ended		Closed-ended		Directives		Labels		Positive		Negative	
	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β
HS diploma	4.72*	0.17	1.95	0.12	5.75	0.13	4.26	0.17	6.23**	0.23	0.23	0.01
	(2.40)		(1.61)		(4.64)		(2.65)		(2.55)		(1.73)	
>HS diploma	0.98	0.04	4.16***	0.34	0.06	0.00	2.06	0.11	5.05**	0.24	-1.43	-0.11
	(1.91)		(1.28)		(3.69)		(2.11)		(2.03)		(1.37)	
Black	-3.29	-0.13	-4.67***	-0.34	5.04	0.13	0.18	0.01	-1.16	-0.05	2.85	0.20
	(2.50)		(1.68)		(4.82)		(2.75)		(2.65)		(1.79)	
Hispanic	-0.72	-0.03	-4.84***	-0.40	13.41***	0.39	3.38	0.18	0.59	0.03	2.33	0.19
	(2.16)		(1.45)		(4.17)		(2.38)		(2.29)		(1.55)	
Child age	0.81***	0.48	0.05	0.05	-0.39	-0.15	0.29**	0.20	0.51***	0.32	-0.07	-0.08
	(0.13)		(0.09)		(0.24)		(0.14)		(0.13)		(0.09)	
Boy	1.88	0.09	0.28	0.02	1.50	0.04	-1.38	-0.07	0.28	0.01	-0.33	-0.03
	(1.65)		(1.11)		(3.18)		(1.82)		(1.75)		(1.18)	
Video Length	0.05***	0.43	0.02***	0.31	0.05***	0.27	0.03**	0.24	0.05***	0.44	0.03***	0.37
	(0.01)		(0.01)		(0.02)		(0.01)		(0.01)		(0.01)	
Constant	-24.73***	.	1.18	.	8.56	.	-5.40	.	-17.97***	.	-2.40	.
	(4.45)		(2.99)		(8.60)		(4.91)		(4.73)		(3.20)	
Observations	101		101		101		101		101		101	
R-squared	0.49		0.25		0.23		0.17		0.36		0.19	
F-stat	12.74		4.41		3.89		2.64		7.39		3.19	
prob > F	0.00		0.00		0.00		0.02		0.00		0.00	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Maternal Depression and Components of MCDS (RQ2)

The second research question for this study aimed to examine the associations between depression and the different components of MCDS. As shown in Table 9, all regression models for each of the MCDS components were statistically significant. Individual models explained 38% of the variance ($R^2 = .38$, $F(6,88) = 6.74$, $p < 0.001$) for tokens, 31% of the variance for types ($R^2 = .31$, $F(7,88) = 4.79$, $p < 0.001$), 29% for MLU ($R^2 = .29$, $F(7,88) = 4.39$, $p < 0.001$), and 28% for communicative diversity ($R^2 = .277$, $F(7,88) = 4.15$, $p < 0.001$). However, depressive symptoms were only marginally associated with communicative diversity ($b = .03$, $p < 0.06$). By an increase of one point in maternal depressive symptoms mothers used on average 0.3 more categories. Depressive symptoms were not significantly associated with types and tokens. Neither were they significantly associated with MLU after controlling for age, gender, race/ethnicity, level of education and language. Even though not significant, they were in negative direction with depressive symptoms.

Additional models were run for all the categories of maternal communicative diversity. All models were significant except for onomatopoeia, explanations and descriptives. In Table 10 the most frequent categories of maternal communicative diversity used by mothers are displayed. The model with depression and clarification questions ($R^2 = .24$, $F(8,87) = 3.35$, $p < 0.01$) explained 24% of the variance in clarification questions. Additionally, depressive symptoms were significantly associated with the use of clarification questions ($b = .03$, $p < 0.01$). For each additional point in depressive symptoms mothers seemed to produce .03 more

clarification questions. Depression did not make a significant contribution to the other components of communicative diversity.

Table 9

MCDS Components Predicted by Depression, Controlling for Education, Race/Ethnicity, Age, Gender, and Video Length

Predictor	Tokens		Types		MLU		Comdiv	
	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β
HS diploma	91.27** (37.49)	0.24	16.90** (8.23)	0.22	0.14 (0.20)	0.08	0.25 (0.41)	0.07
>HS diploma	66.51** (28.53)	0.23	15.87** (6.26)	0.27	0.22 (0.15)	0.16	0.43 (0.31)	0.15
Black	-10.21 (38.12)	-0.03	-10.40 (8.37)	-0.16	-0.12 (0.20)	-0.07	-0.13 (0.42)	-0.04
Hispanic	16.33 (32.75)	0.06	-3.58 (7.19)	-0.06	-0.57*** (0.17)	-0.41	-0.16 (0.36)	-0.06
Child age	6.63*** (1.95)	0.30	1.48*** (0.43)	0.32	0.03*** (0.01)	0.32	0.07*** (0.02)	0.31
Boy	-5.51 (24.84)	-0.02	0.59 (5.45)	0.01	-0.14 (0.13)	-0.10	0.04 (0.27)	0.01
Video Length	0.79*** (0.14)	0.48	0.13*** (0.03)	0.37	-0.00 (0.00)	-0.12	0.01*** (0.00)	0.32
Depression	-1.06 (1.38)	-0.07	0.00 (0.30)	0.00	-0.01 (0.01)	-0.07	0.03* (0.02)	0.18
Constant	-163.53** (68.85)	.	4.73 (15.11)	.	2.91*** (0.36)	.	3.70*** (0.76)	.
Observations	96		96		96		96	
R-squared	0.38		0.31		0.29		0.28	
F-stat	6.74		4.79		4.39		4.15	
prob > F	0.00		0.00		0.00		0.00	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Table 10

Communicative Diversity Categories Predicted by Depression, Controlling for Educ, Race/Ethn, Age, Gender, and video

Predictor	Open-ended		Closed-ended		Directives		Labels		Positive		Negative	
	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β
HS diploma	4.08 (2.58)	0.14	0.88 (1.73)	0.05	8.23 (5.08)	0.18	6.00** (2.91)	0.23	6.76** (2.82)	0.24	-0.32 (1.91)	-0.02
>HS diploma	0.92 (1.97)	0.04	4.11*** (1.32)	0.34	1.55 (3.87)	0.04	2.69 (2.22)	0.14	4.87** (2.14)	0.23	-1.71 (1.45)	-0.13
Black	-3.33 (2.63)	-0.14	-4.55** (1.76)	-0.33	4.02 (5.17)	0.10	-0.44 (2.96)	-0.02	-1.80 (2.86)	-0.08	3.21 (1.94)	0.22
Hispanic	-1.33 (2.26)	-0.06	-4.89*** (1.51)	-0.40	14.42*** (4.44)	0.41	3.93 (2.54)	0.20	0.42 (2.46)	0.02	2.43 (1.67)	0.19
Child age	0.85*** (0.13)	0.51	0.07 (0.09)	0.07	-0.39 (0.26)	-0.14	0.27* (0.15)	0.18	0.54*** (0.15)	0.34	-0.06 (0.10)	-0.06
Boy	1.31 (1.71)	0.06	-0.03 (1.15)	-0.00	3.21 (3.37)	0.09	-0.89 (1.93)	-0.05	0.62 (1.87)	0.03	-0.26 (1.26)	-0.02
Video Length	0.05*** (0.01)	0.40	0.02*** (0.01)	0.31	0.06*** (0.02)	0.30	0.03** (0.01)	0.25	0.05*** (0.01)	0.42	0.03*** (0.01)	0.36
Depression	-0.07 (0.10)	-0.06	0.02 (0.06)	0.03	-0.10 (0.19)	-0.05	0.05 (0.11)	0.05	-0.01 (0.10)	-0.01	-0.02 (0.07)	-0.03
Constant	-23.06*** (4.74)	.	0.57 (3.17)	.	4.68 (9.33)	.	-7.17 (5.35)	.	-17.94*** (5.17)	.	-2.56 (3.50)	.
Observations	96		96		96		96		96		96	
R-squared	0.48		0.27		0.25		0.19		0.35		0.19	
F-stat	10.09		4.06		3.68		2.48		5.88		2.58	
prob > F	0.00		0.00		0.00		0.02		0.00		0.01	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Interaction of MCDS Components and Depression (RQ3)

The third research question sought to examine possible interactions between depression and MCDS components to predict children's communication abilities and socioemotional competence. In this section the effects of depressive symptoms on children's communication and socioemotional outcomes are discussed first (see Table 11), followed by the effects of MCDS components on the same outcomes (see Table 12), and discussing interactions last (see Table 13).

Depressive symptoms. Results from the different regression models of depression on children's communication abilities and socioemotional outcomes are shown in Table 11. The model regressing children's possible social problems was significant ($R^2 = .29$, $F(5,85) = 4.79$, $p < 0.001$). Higher scores in maternal depressive symptoms explained 29% of the variance of children's problem scores. Further, depressive symptoms were significantly associated with children's possible externalizing and internalizing problems ($b = .37$, $p < 0.001$). For every one additional point increase in maternal depressive symptoms children's problem score increased by .37 points. Although, there was a negative association between maternal depression and children's competence scores ($b = -0.12$, $p < 0.001$) the model was not significant. Likewise, the regression models for children's receptive communication, expressive communication, and total communication scores were not significant.

Table 11

Children's Communication Abilities and Socioemotional Outcomes Predicted by Depression, Controlling for Education, Race/Ethnicity, Age, and Gender

Predictor	Receptive Communication		Expressive Communication		Total Communication		Problem		Competence	
	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β	<i>b</i>	β
HS diploma	-0.40 (1.37)	-0.03	-0.90 (1.21)	-0.09	-1.36 (2.27)	-0.07	3.33* (1.99)	0.18	-0.22 (1.08)	-0.02
>HS diploma	0.16 (1.04)	0.02	0.68 (0.91)	0.09	1.06 (1.72)	0.07	2.77* (1.51)	0.20	0.79 (0.84)	0.12
Black	0.16 (1.41)	0.02	-0.50 (1.24)	-0.06	-0.03 (2.34)	-0.00	-0.19 (2.06)	-0.01	-0.90 (1.12)	-0.12
Hispanic	0.76 (1.20)	0.09	-0.98 (1.06)	-0.13	-0.26 (1.99)	-0.02	2.34 (1.76)	0.17	-0.27 (0.97)	-0.04
Child age	0.16** (0.07)	0.23	-0.06 (0.06)	-0.09	0.10 (0.12)	0.09	-0.00 (0.10)	-0.00	0.05 (0.06)	0.10
Boy	-1.18 (0.92)	-0.14	-2.34*** (0.81)	-0.30	-3.32** (1.53)	-0.23	1.01 (1.33)	0.07	0.15 (0.73)	0.02
Depression	0.04 (0.05)	0.09	0.04 (0.04)	0.10	0.08 (0.08)	0.10	0.37*** (0.07)	0.50	-0.12*** (0.04)	-0.32
Constant	2.95 (1.94)	.	12.16*** (1.71)	.	15.03*** (3.20)	.	2.52 (2.86)	.	16.98*** (1.56)	.
Observations	95		95		95		91		89	
R-squared	0.10		0.13		0.08		0.29		0.11	
F-stat	1.32		1.83		1.10		4.79		1.46	
prob > F	0.25		0.09		0.37		0.00		0.19	

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

MCDS components. Results from the regression models of the different MCDS components as predictors of children's communication abilities and socioemotional outcomes are shown in Table 12. The model with tokens ($R^2 = .16$, $F(8, 90) = 2.66$, $p < 0.05$) and word types ($R^2 = .16$, $F(8, 90) = 2.46$, $p < 0.05$) as predictors were significant for receptive communication. The tokens model explained 16% and the types model explained 16% of the variance in receptive communication abilities. Further, types ($b = .04$, $p < 0.05$) and tokens ($b = .01$, $p < 0.05$) were significantly associated with children's receptive communication. Models for MLU and communication diversity were not significant.

The regression models with tokens ($R^2 = .15$, $F(8, 90) = 2.33$, $p < 0.05$) and types ($R^2 = .15$, $F(8, 90) = 2.25$, $p < 0.05$) were also significant for total communication. Each of these models explained 15% of the variance of total communication. However, neither tokens nor types had a significant association. Regression models of the MCDS predicting expressive communication, competence, and problems were not significant.

Table 12

Models and Regression Coefficients for Children's Communication Abilities and Socioemotional Outcomes Predicted by MCDS, Controlling for Education, Race/ Ethnicity, Age, Gender, and Video Length

		Receptive Communication		Expressive Communication		Communication		Problem		Competence	
		<i>Model #.</i> <i>variance</i> <i>explained</i>	<i>b(SE) B</i>	<i>Model #.</i> <i>variance</i> <i>explained</i>	<i>b(SE) B</i>	<i>Model #.</i> <i>variance</i> <i>explained</i>	<i>b(SE) B</i>	<i>Model #.</i> <i>variance</i> <i>explained</i>	<i>b(SE) B</i>	<i>Model #.</i> <i>variance</i> <i>explained</i>	<i>b(SE) B</i>
70	Tokens	1. 16%**	.01(.00)* .282	5. 13%	.01(.00) .21	9. 15%*	.01(.01) .29	13. 7%	-.00(.01) -.03	17. 3%	.00(.00) .08
	Types	2. 16%**	.04(.02)* .25	6. 13%	.27(.15) .21	10. 15%*	.07(.03) .28	14. 7%	-.01(.03) -.05	18. 3%	.01(.02) .09
	MLU	3. 13%	.76(.72) .12	7. 10%	.30(.65) .05	11. 10%	1.24(1.17) .12	15. 8%	-.91(1.20) -.09	19. 2%	-.32(.62) .05
	Comdiv	4. 13%	.28(.34) .09	8. 11%	.30(.31) .11	12. 10%	.58(.56) .12	16. 7%	.21(.56) .04	20. 2%	.13(.32) .05

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Interactions. Results from the regression models with the interactions of the different MCDS components and depression to predict children's communication abilities and socioemotional outcomes are reported in Table 13. The regression model for communication diversity, depression, and children's expressive communication was found significant. The overall model explained 19% of the variance in children's expressive communication ($R^2 = .19$, $F(9, 85) = 2.23$, $p < 0.05$). Further, results suggest that in addition to main effects there was a significant interaction between maternal depressive symptoms and communication diversity. Maternal depression symptoms moderated the relationship between maternal communicative diversity and children's expressive communication abilities ($b = -.08$, $p < 0.05$). As shown in Figure 2, estimation plots revealed that there is a positive relationship between maternal communicative diversity and children's communication abilities only when mothers have low depressive symptoms. Conversely when mothers have high depressive symptoms there is a negative relationship between maternal communication diversity and children's expressive communication abilities. Although models with other predictors were also significant, as seen in Table 13 the interaction terms between these predictors and depressive symptoms were not significant.

Table 13

*Models and Regression Coefficients for Children's Communication Abilities and Socioemotional Outcomes
Predicted by MCDS*Depression, Controlling for Education, Race/Ethnicity, Age, Gender, and Video Length*

	Receptive Communication		Expressive Communication		Communication		Problem		Competence	
	<i>Model #. variance explained</i>	<i>b(SE) B</i>	<i>Model #. variance explained</i>	<i>b(SE) B</i>	<i>Model #. variance explained</i>	<i>b(SE) B</i>	<i>Model #. variance explained</i>	<i>b(SE) B</i>	<i>Model #. variance explained</i>	<i>b(SE) B</i>
Tokens*cesd	1. 21%**	.00(.00) .10	5. 17%*	.00(.00) .12	9. 18%*	.00(.00) .12	13. 28%***	.00(.00) .12	17. 10%	-.00(.00) -.16
Types*cesd	2. 20%**	-.00(.00) -.07	6. 16%*	.00(.00) .14	10. 17%*	.00(.00) .02	14. 29%***	-.01(.03) -.05	18. 10%	.00(.00) .13
MLU*cesd	3. 15%*	.02(.08) .11	7. 14%	-.05 (.07) -.36	11. 13%	-.04(.13) -.18	15. 29%***	.01(.12) .02	19. 11%	.02(.07) .17
Comdiv*cesd	4. 17%*	-.07(.04) -1.27	8. 19%*	-.08(.04) -1.69*	12. 17%*	-.16 (.07) -1.73*	16. 29%***	-.00(.07) -.02	20. 11%	.03(.04) .73

** $p < 0.01$, *** $p < 0.001$

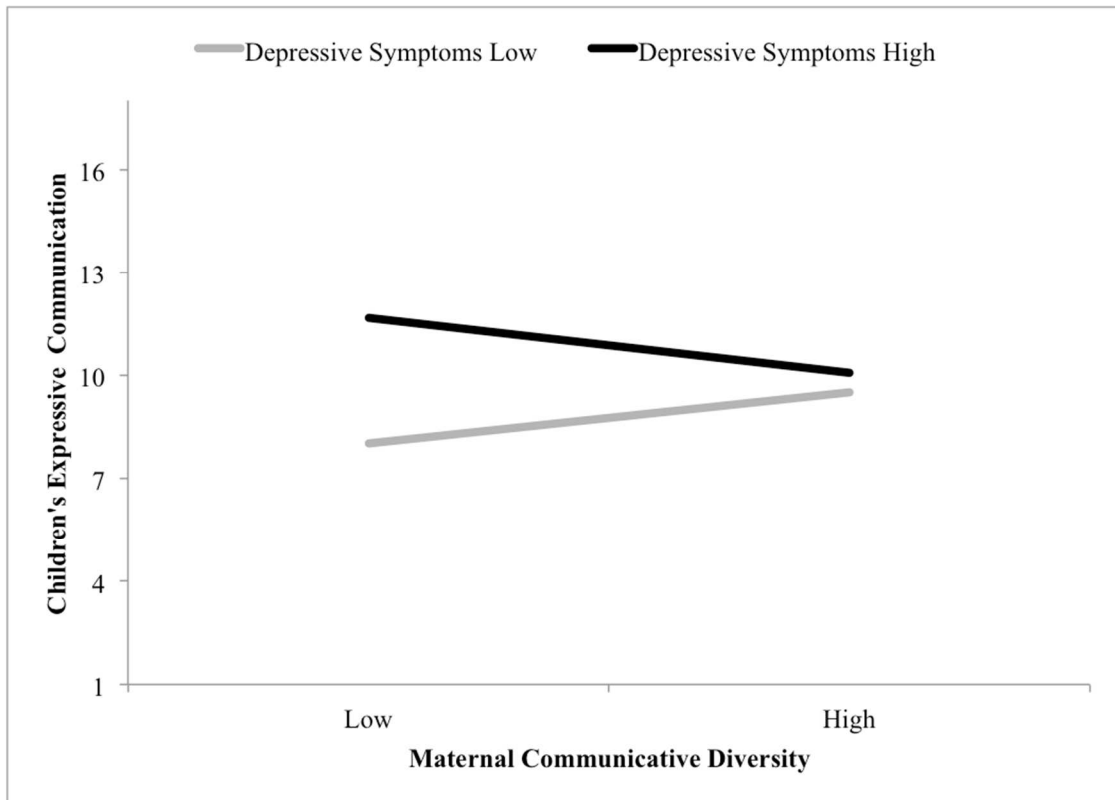


Figure 2 Interaction between communicative diversity and depression

Chapter 5

DISCUSSION

Depression is a prevalent disorder among mothers of toddlers (McLennan, et al., 2001). Yet there is limited information about maternal depression during this developmental period. Research has linked maternal depressive symptoms to children's negative developmental outcomes (e.g., language and socioemotional outcomes) as depressive symptoms may impact mothers' parenting behaviors, including the way they talk to their children (i.e., MCDS) (Ertel et al., 2011; Goodman et al., 2011; Kaminer et al., 2007). An extensive body of literature has focused on the different predictors that contribute to variation in MCDS, including maternal education and ethnicity, and child age and gender (Goodman et al., 2011; Hummel & Kiel, 2015; Lovejoy et al., 2000; NICHD, 1999; Rowe et al., 2005). Furthermore, associations between MCDS and children's socioemotional and language outcomes have been widely documented (Hoff, 2003; Farkas & Beron, 2004; Schwab & Lew-Williams, 2016). However, most of the evidence examining MCDS has focused on the quantity (i.e., tokens) and quality (e.g., types and MLU) of the maternal language input (Huttenlocher et al., 2002; Rowe, 2012, 2008; Rowe, Pan, & Ayoub, 2005; Salo, Rowe, Leech, & Cabrera, 2016). Fewer studies have considered the functions in language input by examining mothers' communicative diversity (e.g., Tamis-LeMonda et al., 2012) as part of the language quality. Further, there is limited research

that examines the interaction between depressive symptoms and MCDS to predict children's language and socioemotional outcomes. The specific features of the context in which MCDS is produced (e.g., object play), and the nature of the context also have often been overlooked. Therefore, the purpose of the current study was threefold. First, this study intended to describe the possible variation (i.e., as a function of demographics such as maternal education, child age and gender) in maternal child-directed speech during a puzzle play task among a sample of Early Head Start families. Second, the present study sought to explore the role of maternal depression on the different components of MCDS. Third, this study aimed to explore the interactions between maternal depressive symptoms and MCDS to influence children's communication abilities and socioemotional competence.

Maternal Characteristics

Before discussing the findings of the study it is important to consider unique characteristics of the sample in the current study. Most of the participants were from minority groups. Specifically, half of the mothers were from a Hispanic origin, and almost half of the sample did not finish high school. Based on the construct of cumulative risk (Evans et al., 2013), these two demographic characteristics are known to be associated with economic hardship, put these mothers at a greater risk of mental health issues, including depression, and their children at greater risks of falling behind their peers in their developmental outcomes (Evans, Dongping, & Whipple, 2013; Lovejoy, 2000, Sameroff et al., 1987).

Although, on average mothers in the sample reported low depressive symptoms, 25% of these mothers met the significance criteria for elevated depressive symptoms in the CES-D scale, indicating a possible depressive disorder. This is a substantial number of mothers considering that is more than twice as high the number of children (i.e., one in ten) experiencing a mother with depression in any given year reported by Ertel et al. (2011). Likewise, the number of mothers experiencing elevated depressive symptoms in the current study is almost as high as the 32% of toddler mothers reported by McLennan, et al. (2001). Further, current study findings indicated elevated depressive symptoms were more prevalent in White mothers (33.4%), followed by Blacks (32%) and Hispanics (20.4%), which is aligned with the findings of a study by Ispa et al. (2004).

Additionally, among the 26 mothers exhibiting elevated depressive symptoms, there were more mothers with higher education (46%), than mothers with below a high school education (38%). This highlights to the need for additional research to explore why mothers with more education among the low-income families may experience higher levels of depressive symptoms in larger samples. The gap between the expected life linked to receiving more education and mothers' current economic hardship might contribute to their possible depression. This might also explain the different findings of our study compared to previous studies. Perhaps, having higher educational levels might have helped mothers to become more resilient in parenting even when they experience depressive symptoms in general. This explanation is aligned with results from Azak and Raeder (2013) who did not find differences in

maternal styles of mothers with depressive symptoms compared to non-depressed mothers. These authors considered findings to be linked to the fact that the majority of their sample was relatively highly educated, which is in direct contrast the current study sample of Early Head Start mothers.

Another interesting aspect to consider in our sample is that the mothers of older children reported higher levels of depressive symptoms. Based on the findings from a longitudinal review of studies on postpartum depression by Vliegen, Casalin and Luyten (2014) it was expected that mothers of younger children would have higher levels of depression. Vliegen et al. (2014) report that between 30 to 50% of mothers affected by postpartum depression still present major depression into their children's first birthday and beyond. Perhaps some of the mothers in the current study sample may still have depressive symptoms linked to postpartum depression. On the other hand, the study by Ertel et al. (2011) did not find significant differences in maternal depression levels by the age of their children. These mixed findings could be associated with number of other factors, such as the number of children, social support, occupation status, which is worth considering in future research.

MCDS Variations

The first goal of this study was to examine the differences in the MCDS components by maternal level of education and race/ethnicity and child's age and gender. Results partially support the hypothesis that mothers with higher levels of education would produce more words and more types of words during a play task. When compared to mothers with less than a high school diploma, high school

graduates produced more words and more diverse words. Previous research has provided strong evidence that supports the association between education and language quantity and quality. More educated mothers seem to produce more words (Hart & Risley, 1995; Rowe et al., 2005) and more types of words (Rowe, 2012). However, it is also noteworthy that even though mothers with more than a high school degree produced more words and more types of words than non-high school graduates, this number was smaller than that for mothers with more than high school education. Thus, higher levels of education beyond high school did not necessarily reflect more and better language input for children in this sample.

Contrary to expectations, this study did not find any differences by maternal race/ethnicity and child gender on the four components of MCDS. Although language complexity appeared to vary by race/ethnicity with Hispanic women producing shorter utterances, this effect was no longer statistically significant when language (i.e., English vs. Spanish speaking) was introduced as a control. It was therefore likely that these results were due to differences between English and Spanish and not by the racial/ethnic group membership.

Regarding the categories of communicative diversity, differences by racial/ethnic groups were found in the use of closed-ended questions, with Hispanic and Black mothers asking fewer closed-ended questions compared to White mothers. Further, Hispanic mothers used more directive commands than White mothers. This last finding could be related to Hispanic parents' beliefs about play as they put more value into activities that prepare their children for school (Laforrett & Mendez,

2017b), which may lead to a tendency to direct the play episode toward learning. Cultures view maternal control and directedness as either positive or negative depending on their values and beliefs (e.g., macrosystem level influences; Bronfenbrenner, 1979), which is potentially reflected on their practices. Moreover, the use of directives has often been linked to higher levels of maternal intrusiveness and Hispanic mothers have shown to exhibit more often this type of behavior (Halgunseth et al., 2006; Ispa et al., 2013).

Finally, the current study found that children's age was associated with the four MCDS components. Older children were exposed to more and better language input, including being asked more open-ended questions. These results are in line with findings from Rowe et al. (2005) who found that in general mothers talk more and in more diverse ways, as children grow older. Importantly, this exposure to higher quality language interactions with mothers is important, as previous research has shown that these interactions are associated with better language outcomes for children (Rowe, Leech & Cabrera, 2017).

Depression as MCDS Predictor

The second aim of this study was to examine the association between depression and the different components of MCDS. Contrary to the study hypothesis, maternal depressive symptoms were not associated with any of the components of MCDS. Most of the research about depression and maternal talk has focused on the quantity not quality of the MCDS, especially including the communicative diversity component. To the best of my knowledge, there are no studies that have examined the

communicative diversity component of MCDS in relation to maternal depression. The association between maternal depression and the quantity of maternal speech seems to be consistent. However, there are mixed results in regards to the quality of MCDS among depressed mothers. For example, Rowe et al. (2005) found a connection between maternal depression and the amount of maternal talk but not with vocabulary diversity. Results from a meta-analysis indicated that depressed mothers tend to vocalize less, produce fewer amounts of words, have more periods of silence, and slow speech when interacting with their (Lovejoy et al., 2000).

The current study contributes to the body of evidence about the quantity and quality of MCDS during the unique context of puzzle play. In this particular context, maternal depressive symptoms do not seem to be associated with the quantity or quality of maternal input. When exploring the components of communicative diversity, depressive symptoms predicted the use of clarification requests. One characteristic of depression is the effects that it can have on individuals' attention span. People who experience major depression often present cognitive deficits including difficulty focusing on diverse tasks (Paelecke-Habermann, Pohl, & Leplow, 2005). This could be a reason why some of the mothers with depressive symptoms from the current sample needed to ask their children to clarify their utterances more often than mothers with less depressive symptoms.

Depression, MCDS, and Children's Outcomes

The third and final goal of this study was to examine possible interactions between depression and MCDS components to predict children's communication

abilities and socioemotional competence. First, relations between depression and children's outcomes were examined. Results indicated that greater depressive symptoms were significantly associated with higher scores for children's possible externalizing or internalizing problems. This relation has been previously reported in the literature, specifically, a positive association between maternal depression and children's internalizing behaviors (Goodman et al., 2011).

Second, the associations between the MCDS components and children's outcomes were tested. As expected, tokens and types of MCDS significantly predicted children's communication skills, specifically receptive but not expressive communication. Based on previous research, it had been hypothesized that both components of communications would have been associated with types and quantity of language input. Maternal use of diverse language has been associated with children's receptive language and expressive vocabulary (Rowe, 2012). One explanation could be that other studies have used a specific measure of language development (e.g., Peabody Picture Vocabulary Test) while the current study used a measure of communication abilities that involves broader aspects of communication.

Lastly, findings from the interactions among MCDS and depression, suggested a moderation effect of depression in the relation between communicative diversity and children's expressive communication. Maternal communicative diversity was to be positively associated with children's expressive communication abilities only when their mothers have low depressive symptoms. When mothers have higher depressive symptoms mothers may have high levels of communicative diversity but this does not

seems to translate into benefits for their children's expressive communications. This finding may be understood when considering other elements of parent-child interactions. For example, mothers with more depressive symptoms may lack enthusiasm during interactions with children (Lovejoy et al., 2000), or these mothers may fail to engage their children in the tasks that catch their interest. It is therefore important to consider other non-verbal factors such as maternal affect or child's interest as important factors in MCDS during puzzle play. This has been the case reported in other contexts, such as book reading, where researchers have found that children's interest in the book mediates the relation between parental language use and children's language outcomes (Malin, Cabrera & Rowe, 2014).

The Puzzle Play Context

Unwrapping the categories of communicative diversity the present study found that the categories mothers produced the most were directive utterances, positive evaluations, and labels, whereas explanations were the least type of utterances used. This is where the unique features of the interaction context, puzzle play, need to be considered. When putting a puzzle together children are expected to find the right place to fit a piece. Mothers often are tempted to direct the child's behavior toward achieving this goal and is therefore reflected in their language use (i.e., use of directives). When children do what is expected to complete the task, mothers tend to celebrate and praise their efforts and achievements (i.e., positive evaluation). Likewise, to help children find the right place for their pieces, for example, mothers emphasize the name of the piece by using labels. These examples could explain why

these three categories are the ones most used by the mothers during a puzzle task. Unlike interactions with books or reminiscing tasks, the need to explain and draw conclusions about objects and circumstances is minimal. These findings are therefore context specific and study findings regarding the interactions between mothers and their children should consider the context effect before generalizing the study results.

Limitations

The limitations of the current study should be noted. First, because the current study relied on secondary video data, we did not have control over the lengths of the video, specifically over the time for the puzzle task. The length of the interactions in videos were relatively short. As such, these videos may not have captured the range of interaction styles that could have emerged in more extended play episodes between mothers and their children. Second, the context of the interaction was a very specific task and therefore, findings may not apply to other interaction contexts. Future studies could benefit from comparing different play contexts, including both structured and unstructured play contexts. Further, future research should consider exploring the role of maternal affect and child engagement in the task since these factors may affect how responsive children are to mothers, which, in turn, may influence the dyad interaction style and the language used. Third, another important aspect to consider is the variability within the Hispanic sample. It is important to be aware that differences exist among Hispanics from different countries of origin and based on acculturation levels. These aspects could have an impact on mothers' play and child development beliefs and shape their interactions. Lastly, the current study was limited by a small

sample size. Future research should attempt to replicate and extend the current study with larger samples to increase power to detect the effects of depression on MCDS.

Conclusions

Despite the aforementioned limitations, the current study provides important contributions to the literature of depression and MCDS. General findings of the study differed from previous literature in that maternal depression was not related to quantity or quality of maternal child directed speech in the context of puzzle play. Further, maternal depression was related to children's internalizing and externalizing behaviors, but was not associated with children's communication outcomes. These results suggest that when considering the impact of mother's depression on children's communication and socioemotional competence, additional research is needed. The relation between maternal depression and child outcomes may not be a simple negative relation association as some previous literature has reported. There are a number of factors that may influence this link, such as mother's education, age of children, context of the interaction, and maternal communicative diversity. This study also extended the literature by expanding the components of the language quality during play, with the examination of maternal communicative diversity. The moderation effect of depression in the relationship between communicative diversity and children's expressive communication is an important finding that adds to the current literature. This finding suggests that other aspects beyond verbal input, including the way mothers deliver their speech to their children, are worth exploring.

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Appendix

IRB/HUMAN SUBJECTS APPROVAL



DATE: March 27, 2017

TO: Juana Gaviria-Loaiza
FROM: University of Delaware IRB

STUDY TITLE: [1037430-1] Maternal Depression and Child-Directed Speech: Influences on Toddlers' Communication Abilities and Socioemotional Competence

SUBMISSION TYPE: New Project

ACTION: DETERMINATION OF EXEMPT STATUS
DECISION DATE: March 27, 2017

REVIEW CATEGORY: Exemption category # (4)

Thank you for your submission of New Project materials for this research study. The University of Delaware IRB has determined this project is EXEMPT FROM IRB REVIEW according to federal regulations.

We will put a copy of this correspondence on file in our office. Please remember to notify us if you make any substantial changes to the project.

If you have any questions, please contact Nicole Farnese-McFarlane at (302) 831-1119 or nicolefm@udel.edu. Please include your study title and reference number in all correspondence with this office.