Longitudinal Relations between Parental Depression and Children's Language Development

by

Brandon Clifford

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Graduate Supervisory Committee:

Natalie Eggum, Chair
Vanessa Rainey
Kelsey Lucca
Robert Bradley

ARIZONA STATE UNIVERSITY

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ABSTRACT

Parental depression is a risk factor for children's healthy language development, however, the mechanisms of risk transmission are less understood. The present study aimed to examine aspects of parent-child interactions as mediators of the negative relations between mothers' and fathers' depression and children's expressive language. Using longitudinal data from families in a large city of the Western United States (N = 497; child Mage = 5.83 months; 47% female), I examined these relations using mothers' and fathers' reports of depression, observations of mothers' and fathers' parent-child interactions, and observational indices of children's expressive language in the home. Although results indicated no longitudinal relations between mothers' or fathers' depression and children's expressive language, mothers' depression was negatively related to mothers' and fathers' later parental supportiveness. Moreover, mothers' acceptance and fathers' supportiveness were positively related to children's later expressive language. These findings shed light on family dynamics when mothers' experience heightened levels of postpartum depression and how specific parent-child interactions support healthy language development.

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INTRODUCTION

Early language development is a key predictor of children's success and adjustment (Hoff, 2013; Pace et al., 2019; Vallotton & Ayoub, 2011). As children enter kindergarten, there is already significant variability in children's language abilities (Ginsborg, 2006). Part of this variability is explained by environmental factors. Parental depression is one factor that may negatively impact children's language, cognitive (Liu et al., 2017), and emotional development (Goodman et al., 2011), at least in part by altering children's environments. Depression is manifested by sad mood, reduced pleasure in daily activities, fatigue, and poorer cognitive functioning (American Psychiatric Association, 2013). Several studies (e.g., Clifford et al., 2021) and reviews (e.g., Slomian et al., 2019) have highlighted negative relations between parental depression and children's language development. These relations are moderated by child age; the timing, severity, and chronicity of depression; the time lag between depression and language assessments; and the aspect of language being examined (see Clifford et al., 2023). Despite previous work finding negative relations between parental depression and children's language development, researchers have only begun to examine specific mechanisms that may explain the relations between parental depression and children's language development (Ahun & Côté, 2019). Parent-child interaction is one potential mechanism as it has been found to be associated with both parental depression (see Lovejoy et al., 2000) and children's language development (e.g., Hirsh-Pasek et al., 2015). Parent-child interactions refer to the routine episodic exchanges between a parent or caregiver and their child (Bornstein & Tamis-LeMonda, 2001). Positive parent-child interactions tend to encourage and scaffold early language development (e.g., Hirsh-

Pasek et al., 2015; Vygotsky, 1978), whereas negative parent-child interactions tend to disrupt or hinder the language learning process (e.g., Pungello et al., 2009).

As will be described, there are a few studies in which the relation between mothers' depression and language development has been examined, and parent-child interactions have been explored as a mediator (e.g., Justice et al., 2019; Stein et al., 2008). Despite some work highlighting the role of fathers' depression (e.g., Paulson et al., 2009) in children's language development, to my knowledge, there has been no published work in which parent-child interaction has been explored as a mediator of these relations. Hence, the purpose of this study is to explore positive (i.e., supportive) and negative (i.e., intrusive) aspects of parent-child interaction as mediators of the relations between mothers' and fathers' depressive symptoms and children's early language development.

In what follows, broad theories of language development, and of depression as a developmental risk factor for children, are reviewed. Next, parent-child interactions are discussed as an intervening mechanism between these constructs. The methods and strategy for an empirical study are then proposed.

Theoretical Background of Language Development

Theories describing the development of language in children have surpassed the nature-nurture dichotomy and embraced integrated theories of development that involve both child-level cognitive maturational processes and environmental-level social processes. The Emergentist-Coalition Model (ECM) of language development is one such theory. The ECM incorporates ideas from both constraints, principles, associationist, and social-pragmatic theories to explain the process of word learning. Put simply, this model acknowledges the role of "internal" assumptions, predispositions, and biases that help guide word learning and the role of "external" factors such as interactions with

others and environmental variables that can help or hinder word learning (Hollich et al., 2000).

The authors of ECM present their theory in the form of three assumptions (Hollich et al., 2000). First, to learn words, children use attentional cues such as perceptual salience; social cues such as eye gaze, pointing, and intention; and linguistic cues such as markers of word segmentation (i.e., where words end and begin in a string of words) and prosody (i.e., the patterns of rhythm and sound of a language). Several studies highlight that children's ability to employ each of these cues aids them in their word learning (e.g., Hennon et al., 2000). In other words, children are better able to learn words by integrating information from a range of sources (Woodward & Markman, 1998).

Second, at different points of development, children learn to differentially weigh the importance of these attentional, social, and linguistic cues and use them accordingly. For example, 10-month-olds use attentional cues (i.e., perceptual salience) or the ability to notice new or interesting information in the environment to infer the meaning of a novel word (Pruden et al., 2006). At 12 months, in addition to these attentional cues, children also begin to use social cues (e.g., pointing) to learn new words. A few months later, 19- and 24-month-old children transition from using attentional cues to primarily using social cues to learn new words (Brand, 2000). Thus, as children develop, their capacity to use and utilize different types of cues improves at different points of development.

Third, children's processes and strategies for language learning shift from immature to mature and from domain-general to domain-specific. As children mature and their cognitive capacities improve, they are able to shift their perceptual point of view from themselves to the perspective of others. This enables children to learn from

others by following the pointing and gaze of others. Further, as children develop, they have a greater capacity to incorporate information from several cues simultaneously to extract the meaning of a novel word or concept. Children also move beyond the more domain-general rules of language (e.g., plural '-s' in "books") to account for specific exceptions to each rule (e.g., plural '-i' in "cacti"; Marcus, 1995).

These assumptions of the child's internal processes enable children to direct and maintain their attention to aspects of the environment that are important to the language learning process. When paired with a helpful caregiver, children are set up for healthy language development. Much of language development is facilitated during the "joint enterprise" of parent-child interactions (Bornstein & Tamis-LeMonda, 2001). These interactions are particularly important for language beginning around 9-months-old and later, as children begin to engage in triadic joint attention or secondary intersubjectivity, aligning their own attention with that of a caregiver towards a particular object in their environment (Baldwin & Baird, 1999; Carpenter et al., 1998; Striano & Stahl, 2005). However, in circumstances where children have fewer opportunities for rich, positive interactions with a caregiver, their language development may be hindered or interrupted.

Parental Depression: An Environmental Risk Factor for Children's Language Development

Despite children's remarkable capacity to acquire language, children's language development is largely dependent on social contexts. Variability in social contexts influences the rate and course of language development, as children have varying degrees of access to communicative opportunities and language models through interactions with others (Hoff, 2003). Children can only learn new words or acquire other aspects of language when they are present in their environments, and a richer,

more stimulating environment is optimal for developing language (Luo et al., 2021). Parents and caregivers play a large role in children's environments and there is reason to be concerned when depressed caregivers are less able to provide rich, stimulating contexts for their children (Goodman & Gotlib, 1999). Depression can be particularly problematic for language development during the first few years of life when children are learning to efficiently utilize the different cues in their environments such as the social cues described above.

Depression is associated with difficulties in the physical, psychological, and relational aspects of life. Affective symptoms of depression encompass feelings of sadness, emptiness, and/or irritability. Cognitive and somatic symptoms of depression include the inability to focus and concentrate and/or sleep problems. Combinations of symptoms result in behavioral manifestations of depressed mood, reduced pleasure in daily activities, fatigue, and poorer cognitive functioning (American Psychiatric Association, 2013). Clinical diagnoses of depressive disorders include major depressive disorder, disruptive mood dysregulation disorder, and persistent depressive disorder. Depression has been found to be more prevalent amongst females in the U.S. (Kessler et al., 2003). Further, several studies have estimated the prevalence of depression amongst parents of newborns. In a meta-analysis of postpartum depression, nearly 20% of women experienced depression within 3-months postpartum (Gavin et al., 2005). Other estimates indicate 15% of women experience depression either during pregnancy or during the early years of parenthood (Lanes et al., 2011). Other empirical studies (e.g., Paulson & Bazemore, 2010) and reviews (Goodman, 2004; Kim & Swain, 2007) suggest a prevalence rate of depression amongst fathers ranging from 4 to 25 percent. More recent estimates indicate the prevalence of fathers' depression to be 8% across the first trimester to 1-year postpartum (Cameron et al., 2016). Further, mothers' and fathers'

depression during the postpartum period appear to be comorbid (Paulson & Bazemore, 2010; Wee et al., 2011). Hence, not only is depression prominent amongst women and men, parents of newborns are at an increased risk for experiencing depressive symptoms relative to the general population.

When considering the cost of depression, economic estimates indicate that depression costs more than $80 billion annually in the U.S. including wages and health care needs (Greenberg et al., 2015). Yet, this estimate does not fully account for the effects of depression on others such as the children of depressed parents. Given the long-lasting consequences of early life experiences on later development (Heckman, 2006), young children may be especially at risk for experiencing the negative effects of their parent's depression. Parental depression has implications for children's emotional (Goodman et al., 2011) and cognitive development (Liu et al., 2017). In fact, the implications of parental depression may be experienced decades later as children of depressed parents report higher health-related stress and poorer social functioning (Raposa et al., 2014). Taken together, parental depression has the potential to negatively affect children's development, including language development.

Mothers' Depression and Children's Language Development

In studies examining the relation between parental depression and children's language development, children's language skills commonly are assessed using assessments of receptive or expressive language. *Receptive language* is defined as language comprehension or understanding of written or spoken symbols (Dunn & Dunn, 2007). *Expressive language,* which is the outcome examined in the present study*,* refers to children's ability to communicate their thoughts and feelings through words, gestures, signs, and/or symbols. During the second and third years of life, children make large

strides in their expressive language development in the forms of words and sentences (Woodward & Markman, 1998).

The majority of the research examining relations between parental depression and children's language development focuses exclusively on mothers' depression, because mothers are often viewed as the primary caregiver. Several studies indicate mothers' depression to be negatively associated with children's language development (e.g., Quevedo et al., 2012). These relations exist across several aspects of language including prelinguistic development (for instance, gestures, babbling; e.g., Kawai et al., 2017), receptive language (e.g., Ahun et al., 2017), and expressive language (e.g., Clifford et al., 2021; NICHD, 1999). These relations exist concurrently (e.g., Choe et al., 2020) and longitudinally across early childhood (e.g., Brookman et al., 2020). Further, despite its remittance, the effects of mothers' depression 5-months postpartum remain salient in children's later receptive and expressive language development (Bornstein et al., 2021). In sum, there is strong evidence that mothers' depression is associated with children's language development.

Fathers' Depression and Children's Language Development

Though scholars have highlighted the important role of fathers in children's development (e.g., Cabrera et al., 2007[a]; Cabrera et al., 2007[b]), there are relatively fewer studies of the associations between fathers' depression and children's language development. Moving past the stereotypical "aloof" father figure and a narrow focus on the financial and material resources provided (or not provided) by fathers, there is increasing support for the notion that fathers' engagement and parenting behaviors are associated with children's language and cognitive development (Anderson et al., 2013; Shannon et al., 2002; Tamis-LeMonda et al., 2004; Volling et al., 2019). In a study of parental supportiveness, father supportiveness during dyadic parent-child interactions

was found to be significantly related to children's cognitive and language development during early childhood. These associations were present when controlling for financial and material resources and mothers' supportiveness (Cabrera et al., 2007[b]).

Additional studies of fathers' depression and its relation to children's language development support this notion. Fredriksen and colleagues (2019) found fathers' postpartum depression to be negatively associated with children's later receptive and expressive language development. Similarly, Paulson and colleagues (2009) found a negative association between fathers' depression and children's expressive language 15-months later. Interestingly, for both of these studies no associations were found between mothers' depression and children's later language development when accounting for fathers' depression and other covariates. Both studies utilized large population samples and longitudinal approaches while accounting for mothers' depression. Hence, despite the relatively fewer studies concerning relations between fathers' depression and children's language development, it appears that fathers play a unique and important role in children's language development that is distinct from mothers' role.

Taken together, depression places a large burden on society that may affect not only those experiencing depression, but also their dependents. Parents of newborns tend to report a higher prevalence of depression compared to the general population which in turn, may place additional risk on young children. Specifically, several studies indicate that children of more depressed parents tend to lag behind their peers in language development.

Mechanisms of Risk Transmission

To increase understanding of the relations between parental depression and children's language development, researchers have begun to examine how depression and children's language development relate directly and indirectly. In other words,

researchers have begun to test conceptual models with hypothesized mediators (e.g., parenting, home environment) of the relations between parental depression and children's language development (Ahun & Côté, 2019). These models resemble theory (Goodman & Gotlib, 1999) outlining mechanisms of transmission between parental depression and children's development of depression. Despite, Goodman and Gotlib's focus on the transmission of risk from mothers' depression to their children's development of depression, aspects of this theory are conceptually relevant when examining the mechanisms of transmission between parental depression and children's language development.

Goodman and Gotlib's (1999) propose four mechanisms through which parental depression may be indirectly related to children's own development of depression (all may be applicable to mothers' depression, and three are applicable to fathers' depression). First, the genetic transmission of depression may place children at risk for a variety of difficulties. Specifically, children of depressed parents tend to inherit a vulnerability or predisposition to experiencing depression themselves (e.g., Kovacs, 1992). Children of depressed parents may inherit personality traits (e.g., neuroticism) and cognitive strategies (e.g., over-rumination) that increase the risk for the development of depression. Moreover, these and other heritable characteristics may also have an impact on children's language development. For example, heritable characteristics such as temperament have been found to be related children's development of depression (e.g., Compas et al., 2004; Lewis et al., 2020) and language development (e.g., Prior et al., 2011).

Second, and specific to mothers, dysfunctional neuroregulatory mechanisms in the intrauterine environment may place children at risk for poor development (Kinsella & Monk, 2009). Poor mental health during pregnancy has been found to be associated

with mothers' heightened hypothalamic-pituitary-adrenal (HPA) activity. This increased activity is associated with impaired fetal development as a result of reduced blood flow through the placenta (Glover, 1997) and alterations in the child's HPA axis functioning (Kaplan et al., 2008). Though speculative, these prenatal factors have the potential to negatively impact children's ability to regulate stress and emotions. This negative impact may in turn reduce children's ability to focus and maintain attention, two crucial tasks in language learning.

Third, and most important for the present study, children of depressed parents are more likely to be exposed to negative affect, cognitions, and behaviors in their environments. Given children's sensitivity to the emotional states of others (Weinberg & Tronick, 1998), this can be problematic for children's development. As is discussed with more detail in a later section, there is a large body of literature illuminating this potential mechanism when examining the relations between parental depression and children's language development. Several studies have examined relations between parental depression and parent-child interaction, parental depression and children's language development, and parent-child interaction in relation to children's language development. However, few studies have examined parent-child interaction as a mediating variable in relations between parental depression and children's language development (i.e., the entire process modeled together).

Affect, cognitions, and behaviors associated with depression can be problematic for children because language development occurs best in environments that are positive, interactive, and responsive (e.g., Baydar et al., 2014; Clay et al., 2007). Indeed, meta-analytic findings suggest that depressed mothers engage in more negative parenting, less positive parenting, and less engaged parenting (Lovejoy et al., 2000). Moreover, across studies, the timing of depression moderated the associations between

parental depression and negative parenting with measurements in closer proximity demonstrating the strongest associations. In addition, socio-economic status (SES) and child age moderated the associations between parental depression and less positive parenting behavior, with these associations being strongest for families of lower SES and when children were infants. Results were consistent across assessments of depression when comparing diagnostic interviews and self-reports (Lovejoy et al., 2000). Moreover, in a review of relations between postpartum depression and early parent-child interactions, parenting, and safety practices, Field (2010) summarized the studies declaring mothers' depression during the postpartum period to be associated with less sensitive and responsive parenting. These findings were consistent across SES and cultures indicating parental depression to be a salient predictor of the social environments parents create for their children. Others' studies have indicated parallel findings for fathers, as fathers' depression has also been found to be related to decreased positive, and increased negative, parenting behaviors (e.g., Wilson & Durbin, 2010).

One component of children's environments that is particularly important for healthy language development is the language environment parents and caregivers provide for the child (Rowe, 2018; Rowe et al., 2005). In addition to the quantity and quality of parental speech present in the home (Rowe, 2012), infant-directed speech (IDS) plays an important role in scaffolding children's language development. Infant-directed-speech includes using exaggerated prosody, higher pitch, and hyper-articulation (Golinkoff et al., 2015) to communicate affect, promote interaction, and sustain infant attention (e.g., Fernald & Simon, 1984; Spinelli et al., 2017). This speech is important, as infants who experience less IDS show poorer language development by the second year of life (Ramirez-Esparza et al., 2017[a]; Ramierz-Esparza et al., 2017[b]). This is problematic for children of depressed parents because depressed mothers have been found to engage

in less IDS (Herrera et al., 2004; Kaplan et al., 2015; Kaplan et al., 2001; Lam-Cassettari & Kohlhoff, 2020; Porritt et al., 2014; Scheiber et al., 2022). Altogether, children of depressed parents are more likely to struggle in their language development because depressed parents are less likely to provide the environment and interactions that are optimal for healthy language development.

As a fourth mechanism of the associations between parental depression and children's development, stressful environments or contexts may contribute to environments less conducive to language learning. This notion is supported by theories of family systems. Though mothers' depression may have an impact on the mother-child subsystem in a family, maternal depression is considered to be a "family affair" (Letourneau et al., 2012) that may impact other subsystems (e.g., mother-father). These "spillover" effects (Kouros et al., 2015) can impact other family dyads such as mother-father and father-child. Moreover, mothers' depression can impact the family processes and functioning as a whole (Feldman, 2007). For example, scholars have found relations between mothers' depression and family stress in several domains including marital relationships, finances, and work (Gelfand & Teti, 1990; Hammen et al., 1987). Marital discord is a particularly stressful environment that can be detrimental to children's development (Bruce & Kim, 1992; Conway et al., 2020). Moreover, when marital discord takes the form of intimate partner violence, children's language development tends to be delayed (Peterson et al., 2019). Additional work indicates that marital discord exacerbates the negative effects of mothers' depression on child functioning (Fendrich et al., 1990; Goodman et al., 1993).

Altogether, there are several prenatal and postnatal mechanisms through which depression may relate to children's language development. The present study aims to focus on the third mechanism, that is, children's exposure to negative affect, cognition,

and behaviors because of parents' depression may be detrimental to their language development. Theories of relations between parental depression and child development have often pointed to parent-child interactions as a tenable mechanism between these constructs (Downey & Coyne, 1990; Gelfand & Teti, 1990). While serving a variety of functions for children's development, parent-child interactions are a language playground that scaffold children's language development. It is through these frequent and increasingly dynamic exchanges that children experience many of their firsts with the help and support of a parent (Bornstein & Tamis-LeMonda, 2001).

In more global conceptualizations of parent-child interactions, scholars describe parenting behaviors in facilitator or interrupter domains (Barr et al., 2014; Hackworth et al., 2017). Parent facilitators or supportive parenting behaviors include warmth and acceptance of the child, descriptive language, maintenance of the child's interest, and following the child's lead. This conceptualization of supportiveness overlaps conceptually with other aspects of parent-child interactions such as mothers' sensitivity, being associated with scaffolding children's emotional and behavioral development (Thompson & Goodwin, 2007; Vygotsky, 1978). Parent interrupters or intrusive parenting behaviors include harsh or hostile demeanor towards the child and restrictive or intrusive behaviors (Barr et al., 2014). Other generalist conceptualizations of parent-child interactions simply categorize warm, sensitive, and responsive parenting behaviors as "positive" and categorize intrusive, hostile, and disengaged parenting behaviors as "negative" (Bornstein & Tamis-LeMonda, 2001). Alternatively, some scholars focus on specific parenting behaviors in relation to parental depression and children's language development. For example, scholar have specifically examined mothers' sensitivity (Leigh et al., 2011) and risky parenting behaviors (e.g., spanking, presence of home safety measures; Zajicek-Farber, 2010) in relation to children's language. Though

relations between parent-child interactions and children's language development will be discussed in more detail in later sections, specific and global aspects of parent-child interactions have been found to relate to children's language development (e.g., Hirsh-Pasek et al., 2015; Pungello et al., 2009).

Because depressed parents tend to experience more negative cognitions and behaviors (e.g., flat affect, negative mood, irritability), scholars theorize that depressed parents' interactions with their child tend to be less adaptive when it comes to their child's language development. For example, depressed parents may have more difficulty engaging in responsive, sensitive, and contingent parenting behaviors (e.g., Lovejoy et al., 2000). This is troubling because these and other parent-child interaction characteristics are important for children's language development (e.g., Madigan et al., 2019). In addition, depressed parents could be more prone to hostile and intrusive parenting behaviors (e.g., Vernon-Feagans et al., 2012) which tend to hinder or interrupt language learning processes.

Given the conceptual (Bornstein & Tamis-LeMonda, 2001; Hackworth et al., 2017) and empirical (e.g., Wang & Dix, 2013) work indicating that supportiveness and intrusiveness have implications for children's language development, the present study aims to examine these two aspects of parent-child interactions as mediators of the relations between mothers' and fathers' depressive symptoms and children's language development. *Supportiveness* is defined as warm, accepting behaviors towards the child, being responsive to the child's lead, helping maintain the child's interest, and using descriptive language (Barr et al., 2014). *Intrusiveness* is defined as harsh or hostile demeanor towards the child or restrictive or intrusive behaviors (Barr et al., 2014).

Parental Depression and Parental Supportiveness and Intrusiveness

Theoretical work of the implications of parental depression on children's development point to poorer parent-child interactions as a key mechanism (Bornstein & Tamis-LeMonda, 2001; Goodman & Gotlib, 1999). Resulting from depressed mood and negative affect, depressed parents may struggle to engage with their child in supportive and unintrusive ways to create a social context that facilitates language learning (Hoff, 2006; Sohr-Preston & Scaramella, 2006). Associations between parental depression and parent-child interactions have been summarized in meta-analytic and systematic reviews indicating mothers' (Field et al., 2010; Lovejoy et al., 2000) and fathers' depression (Cheung & Theule, 2019; Wilson & Durbin, 2010) to be related to generalist conceptualizations of parent-child interactions. These summations of studies indicate mothers' and fathers' depression to be related to less positive and more negative parent-child interactions. Many of the specific aspects of parent-child interactions reviewed in those studies are similar to those examined in the present study. For example, supportive, warm, and sensitive parenting behaviors are coded as positive parent-child interactions, while intrusive, controlling, and hostile parenting behaviors are coded as negative parent-child interactions (e.g., Wilson & Durbin, 2010). There are exceptions to this broad conceptualization of positive and negative parenting behaviors. Conceptual and empirical work suggests that parental intrusiveness carries a different meaning depending on culture. For example, compared to European American mothers, the associations between maternal intrusiveness and children's behavioral outcomes have been found to be small to non-significant for children of African American mothers (Ispa et al., 2004; Tamis-LeMonda et al., 2008). Further, amongst some cultures, higher intrusiveness coupled with higher supportiveness may encourage positive development in children (e.g., Dyer et al., 2014; Ispa et al., 2013; Tamis-LeMonda et al., 2009).

Altogether, parental depression may play a role in parent-child interactions and theoretical work commonly separates parenting behaviors into supportive and intrusive domains. Further, the meaning and implications of these parenting behaviors can be moderated by cultural differences.

More specific parenting behaviors have been examined in relation to parental depression. For instance, depressed mothers of young children (i.e., 3- and 6-months-old) were more likely to be observed engaging in intrusive behaviors such as lifting up their child to restrict their behavior (Herrera et al., 2004) and negative touch behaviors (e.g., pulling; Malphurs et al., 1996). Further, in a study of kindergarten children and their parents, mothers' and fathers' depression were found to be negatively associated with parental warmth and positively associated with intrusive and controlling parenting behaviors (Cummings et al., 2005). In a sample of mothers and their 14- to 27-month-old children, mothers' depression was positively associated with restrictive and less contingent parenting behaviors (Dix et al., 2004). Yet, in a study of fathers and their 3-month-olds, fathers' depression was negatively associated with intrusive parenting behaviors but positively associated with withdrawn parenting (Sethna et al., 2015).

Altogether, the literature investigating mothers' and fathers' depression and the nature of interactions between parents and their children is well developed and results are somewhat consistent. Parental depression tends to be negatively associated with positive parent-child interactions, including parental supportiveness. Further, parental depression tends to be positively associated with negative parent-child interactions; however, there are some studies indicating negative associations between fathers' depression and intrusive parenting behaviors (McElwain & Volling, 1999; Sethna et al., 2015). That said, a strength of this body of work is the examination of a wide range of parent-child interactions in relation to parental depression. Historically, previous work

has focused primarily on mothers. However, more recent work and reviews have expanded our understanding to relations between fathers' depression and father-child interactions and relations between one parent's depression on the other parent's parenting behaviors (e.g., Vakrat et al., 2018). Additional work should continue to clarify relations between these constructs both generally and specifically, especially as they relate to children's development.

Supportiveness and Intrusiveness and Children's Language Development

Theoretical models of language development suggest parent-child interactions to be a key "social context" that can encourage healthy language development (Hoff, 2006; Hollich et al., 2000; Pace et al., 2017). During these joint enterprises, the parent and child share and direct their attention towards objects or experiences in the environment. At a general level, positive parent-child interactions foster children's healthy language development, while negative parent-child interactions can hinder children's language development (e.g., Pace et al., 2017). However, scholars have also examined specific aspects of parent-child interactions in relation to children's language development, suggesting a more focused approach may be appropriate. For example, compared to the quantity of words spoken and more general parenting behaviors, the quality of parent-child interactions as characterized by contingent, fluent and connected, and elaboration appear to be more potent predictors of language ability (Hirsh-Pasek et al., 2015; Topping et al., 2013).

Other conceptual frameworks place supportive and intrusive parenting behaviors as either facilitating or interrupting children's language development (Barr et al., 2014; Hackworth et al., 2017). For example, supportive parents follow the lead of the child, enhance their attention to different aspects of the environment, and are responsive to the bids and behaviors of the child. Supportive parenting behaviors can reinforce, facilitate,

and enhance the child's exploration of their environment while encouraging the child in a warm, affectionate manner. In contrast, intrusive parents tend to display an annoyed or hostile demeanor toward the child and engage in disruptive or directive actions (e.g., taking away an object without explanation; saying "stop" or "don't do that") which can thwart children's language learning. Thus, with the help of a supportive and unintrusive partner, children can be appropriately scaffolded as they develop language (Bornstein & Tamis-LeMonda, 2001; Thompson & Goodwin, 2007; Vygotsky, 1978).

Several empirical studies support the above assertions. In general, positive parenting behaviors tend to be positively related to children's language development (e.g., Barnett et al., 2012; Madigan et al., 2019; Tamis-LeMonda et al., 2009). Moreover, negative parenting behaviors tend to be inversely related to children's language development (e.g., Pungello et al., 2009). More relevant to the present study, scholars have examined supportiveness and intrusiveness as characteristics of parent-child interactions that have implications for children's language development. For example, in a large sample of children and their mothers participating in an Early Head Start program (Brophy-Herb et al., 2013), observed mothers' supportiveness across 14- to 36-months postpartum was positively related to children's later letter-word identification at 60-months of age. Using a similar conceptualization of supportiveness, Vernon-Feagans and colleagues examined relations between positive (i.e., sensitive, engaged, stimulating) and negative (i.e., intrusive, hostile) aspects of parenting across 6- to 36-months postpartum (2012). Observed positive parenting behaviors were positively related to children's receptive and expressive language assessed at 36-months, whereas negative parenting behaviors were negatively related to these same outcomes. Focusing on the responsive aspect of parent-child interactions, Younesian and colleagues (2021) examined a sample of full-term and pre-term infants and found concurrent positive

associations between self-reported maternal responsiveness and assessed language development when children were between 2- and 3-years-old. Similarly, Pungello and colleagues (2009) found maternal sensitivity (i.e., sensitive, responsive, warm) from 12- to 24-months postpartum to be positively related to the growth rate of children's receptive and expressive language assessed across 18-to 36-months with maternal intrusiveness being negatively related. Altogether, when aspects of supportive parenting are examined collectively or individually in relation to children's language, these constructs tend to be positively associated.

Additional work has focused on the intrusiveness aspect of parent-child interactions in relation to children's language development. Using a large, nationally representative sample of the U.S., Wang and Dix (2013) examined latent classes of mothers' parenting behaviors and depressive symptoms in relation to children's language development. Compared to non-depressed mothers and depressed mothers low in intrusive parenting behaviors across 6- to 24-months postpartum, children of mothers who were considered depressed and intrusive in their parenting behaviors performed worse on assessments of receptive and expressive language at 36-months postpartum. Haabrekke et al. (2015) examined a variety of potential risk factors in relation to children's language development in a sample of mothers with a history of substance abuse or psychiatric problems. Accounting for these factors, maternal intrusiveness (i.e., rigidity, insensitivity, intrusive behavior) when children were 1-year-old was negatively related to children's expressive language 1-year later. Lastly, Conway et al. (2018) found observed directive behavior (i.e., shift focusing) at 24-months postpartum to be negatively related to assessments of children's expressive language 2-years later. In sum, specific and collective intrusive parenting behaviors have been found to be negatively related to children's language development.

Despite this work on relations between parental supportiveness or intrusiveness and children's language development, there are still questions to be addressed. First, significant associations between mothers' supportiveness or intrusiveness and children's language outcomes are not detected in all studies. For example, Laake and Bridgett (2018) examined associations between mothers' supportiveness at 10-months postpartum and children's receptive and expressive language at 14-months. Much of the relevant work examined language during and after the second year of life when children typically make large strides in their language development (Pace et al., 2017). It may be that the effects of parental supportiveness and intrusiveness require more time to manifest in children's language development. Some work has suggested significant concurrent relations amongst these constructs later when children were on average 32-months old (Younesian et al., 2021). It may be that relations between these constructs begin to manifest later during the second year of life.

Second, despite theoretical frameworks outlining the role of fathers in children's development (e.g., Cabrera et al., 2014) the majority of studies on these relations only focus on mother-child interactions. There are a few exceptions. For instance, Cabrera and colleagues (2007[b]) found fathers' supportiveness to be positively related to children's receptive and expressive language, whereas parental intrusiveness was negatively related to children's receptive language. In addition, using data from a large Early Head Start program study, Martin and colleagues (2007) examined children's receptive and expressive language scores at 5-years-old to be highest when both parents were rated high in supportiveness when children were 2-years-old. Additional research is needed to examine role of father-child interactions in facilitating or interrupting children's language development.

Third, when examining relations between parent-child interactions and children's language development, to my knowledge, no studies have captured children's language development in the home context using observational methods. To my knowledge, all of the previous work has utilized parent-reports or researcher-led assessments of the child's language. Utilizing observational methods to capture children's language would more precisely tap into children's language abilities thereby increasing construct validity. The preciseness of this approach would be especially enhanced in an environment that is natural and familiar to them.

Supportiveness and Intrusiveness as Mediators of the Relations between Mothers' and Fathers' Depression and Children's Language Development

Other researchers have conceptualized parent-child interactions to be potentially important mediating mechanisms in the relations between parental depression and children's language development (Ahun & Côté, 2019; Bornstein & Tamis-LeMonda, 2001). As reviewed previously, depressed mothers and fathers may struggle to engage in parenting behaviors that are optimal for children's healthy language development and may be more likely to engage in parenting behaviors that interrupt or disrupt language development (e.g., Martin et al., 2007; Wilson & Durbin, 2010). However, to my knowledge, only two studies have examined parent-child interactions as mediators of the relations between parental depression and children's language development.

First, Stein and colleagues (2008) examined a large sample of mothers and their children in the United Kingdom. Mothers' depression was assessed at 3- and 10-months postpartum and again at 36-months post-birth. Maternal caregiving was observed and assessed 10- and 36-months post-birth and comprised of two dimensions: responsivity and home opportunities for learning. Bivariate associations indicated positive relations between both of these dimensions of caregiving at both time points and receptive and

expressive language at 36-months. In structural equation models, responsivity and home opportunities for learning were combined into latent variables at 10- and 36-months. Results indicated that depressive symptoms during the postnatal period was negatively associated with children's language development (a combined receptive and expressive language composite) at 36-months and that these relations were mediated by maternal caregiving at 10- and 36-months. The authors conducted a subsequent multiple-group analysis to examine whether SES moderated these results. The mediational effect remained significant for families of lower and non-lower SES, however, the effect from mothers' depression to maternal caregiving was stronger in families of lower SES. These results provide empirical evidence that maternal caregiving may play a role as an intervening variable between mothers' depression and children's later language development. However, by combining measurements of maternal responsivity and warmth with other aspects of the home environment (e.g., organization, play materials, stimulation), it is difficult to determine which of these constructs drive these relations. In addition, by combining receptive language and expressive language into a single composite, it is difficult to conclude whether these relations are present for both aspects of language. However, bivariate associations indicated negative associations between mothers' depression and later receptive language and expressive language.

Second, Justice and colleagues (2019) examined a community sample of children born into low-income families. Children's receptive and expressive language were assessed when children were 2-years-old and mothers reported on their depressive symptoms when children were between 4- and 7-months-old. Mothers also self-reported on their parent-child dysfunctional interactions between 4- and 7-months postpartum capturing the parent's perception of their interactions with the child. In contrast to similar studies over a similar timeframe (e.g., Bornstein et al., 2021), the authors found

no bivariate associations between mothers' depressive symptoms and children's receptive or expressive language. Mothers' depressive symptoms were positively associated with parent-child dysfunctional interactions, however, parent-child dysfunctional interactions were unrelated to either language outcome.

One factor worth noting is that the language development outcomes of the first study (Stein et al., 2008) occurred as much as 12 months later (36- vs. 24-months) than the language assessments in the second study (Justice et al., 2019). It may be that the effects of depression required time to manifest in children's language development (e.g., Bornstein et al., 2022). Alternatively, assuming the effects of depression are consistently impacting parent-child interactions over time, the cumulative effect of this impact is required over a longer period of time in order to impact children's language. In addition, given that indirect effects between mothers' depression and children's language were only found when examining positive aspects of parent-child interactions (e.g., Stein et al., 2008) it may be that only a lack of positive parent-child interactions play a mediational role in these relations as opposed to negative parent-child interactions (Justice et al., 2019). However, it is unclear what specific aspects of positive parent-child interactions play a role in these relations given the multiple aspects of parent-child interactions incorporated into the authors' "maternal caregiving" variable.

Other factors that may have played a role in these discrepant findings include the sample sizes and the varying measures to account for parent-child interactions and child language development. Stein and colleagues (2008) utilized a much larger demographically diverse sample from two hospitals and used observational methods and assessments completed in the home to capture parent-child interactions (i.e., HOME [Bradley, 1988]; Caregiver Interaction Scale [Arnett, 1989]; Observation Rating Scale of the Environment [NICHD, 1996]) and children's language abilities (Reynell

Developmental Language Scale [Reynell, 1990]). In contrast, Justice et al. (2019) recruited a smaller community sample of low-income children and utilized subscales from a questionnaire to capture parent-child interactions (Parenting Stress Index – Short Form [Abidin, 1990]) while assessing children's language abilities in the home (Bayley Scales of Infant and Toddler Development – Third Edition [Bayley, 2005]). Both studies utilized the same self-report measure to capture mothers' depression (Edinburgh Postnatal Depression Scale [Cox et al., 1987]).

Altogether, conclusions from the two studies examining the mediating role of parent-child interactions in the relations between parental depression and children's language development are limited. Within the scope of the present study, the parent-child interaction conceptualizations used in the two reviewed studies only partially overlap with parental supportiveness and intrusiveness. Additional work is needed with clear operationalizations of aspects of parent-child interactions that match previous conceptual and empirical literature. Further, no studies examined the role of fathers in these relations, specifically the potential effects of fathers' depression, supportiveness, or intrusiveness on children's language development. Other studies have touched on related constructs (Fredriksen et al., 2019 [parenting stress]; Paulson et al., 2009 [parent-to-child reading]) as mediators between fathers' depression and children's language development, however, parent-child interactions remain untested. A strength of the previous work examining parental depression and parent-child interactions in relation to children's language is the use of assessments that capture the receptive and expressive aspects of language. This work can be enhanced by using a more ecologically valid observational method to capture children's language abilities.

The Present Study

Given the scant research on the longitudinal relations between parental depression and children's expressive language as mediated by parent-child interactions, the present study aimed to contribute to this literature while addressing some key limitations.

First, previous studies have confounded aspects of parent-child interactions with each other (i.e., Stein et al., 2008). This makes it difficult to ascertain what specific aspects of parent-child interactions facilitate or interrupt healthy language development. I aim to examine two distinct aspects of parent-child interactions (i.e., supportiveness, intrusiveness) which have been found to be associated with children's language as mediators of the relations between mothers' and fathers' depression and children's language development.

Second, given the limited work on this topic, we know little about whether specific aspects of parent-child interactions are salient to children's language development at different points during early childhood. Further, previous studies only assessed language development once as the outcome variable. Using a longitudinal design, I aim to provide a snapshot of development over the course of three years, examining parental depression when children are 6-months-old as it relates to children's language development at 30-months-old via parent-child interaction at 18-months-old. In addition, I plan to account for children's previous expressive language at 18-months-old in the prediction of language development at 30-months-old.

Third, though studies have examined longitudinal relations between mothers' and fathers' depression in the prediction of children's language development, no studies have examined parent-child interactions as mediators of these relations in the same statistical model. Fourth, most previous work examining relations between parental

depression and children's language development have relied on parental reports or assessments of children's expressive language (see Clifford et al., 2021, for an exception). Many of these assessments occur in a lab setting with a researcher. In the present study, I aim to address this methodological gap in the literature by utilizing an in-home observational measure to obtain more precise and valid estimates of children's expressive language as this construct is captured in the child's natural environment. To address these gaps in the literature and add empirical findings to this literature, I next present a method to test five specific hypotheses regarding the relations between parental depression, parent-child interactions, and children's language development.

Hypotheses

To guide my examination, I generated 5 hypotheses based on the previous theoretical and empirical work reviewed above. See Figure 4 for complete model.

Hypothesis 1. I expect mothers' and fathers' depressive symptoms at W1 and W2 to be negatively associated with children's later indices of expressive language at W2 and W3 (see Figure 1).

Hypothesis 2. I expect concurrent and longitudinal associations between mothers' and fathers' depressive symptoms and parental supportiveness to be negative. Moreover, I expect concurrent and longitudinal associations between mothers' and fathers' depressive symptoms and parental intrusiveness to be positive. I will also explore "spillover" effects from mothers' and fathers' depression into the other parents' parental supportiveness and intrusiveness. For example, I expect mothers' depression to be associated with fathers' supportiveness and intrusiveness (see Figure 2).

Hypothesis 3. I expect concurrent and longitudinal associations between mothers' and fathers' supportiveness and children's indices of expressive language to be positive. Moreover, I expect concurrent and longitudinal associations between mothers'

and fathers' intrusiveness and children's indices of expressive language to be negative (see Figure 3).

Hypothesis 4. I expect mothers' and fathers' depressive symptoms to be indirectly longitudinally associated with children's indices of expressive language through mothers' and fathers' supportiveness and intrusiveness. More specifically, I expect mothers' and fathers' depressive symptoms to be negatively associated with their respective supportiveness, which will in turn be positively associated with children's later expressive language. Similarly, I expect mothers' and fathers' depressive symptoms to be positively associated with their respective intrusiveness, which will in turn be negatively associated with children's later expressive language (see Figure 4).

CHAPTER 2

METHOD

Participants

Participants for this study are from Project M.E.D.I.A., an ongoing longitudinal study of families with young children residing in a large city of the Mountain West region of the U.S. Beginning in summer 2017 (Wave 1; W1). Several strategies were used to recruit a community sample of recently born children (< 1-year-old) and their caregivers in the area. Participants were required to be proficient in English. First, mailers were sent using information provided through the Colorado Office of Health and Vital Records, which identified local families who had children during the past year (27% of W1 sample). Trained research assistants then visited the homes of potential participants and invited families to participate. Of the families visited using this strategy, 66% participated at W1 of the study. Second, participants were recruited through flyers posted in pediatrician offices, social services offices, businesses focused on young children's entertainment, free clinics, public parks and play spaces, or through a family friend who also participated (23% of sample). Third, a large proportion of the sample was recruited through an external data collection company (50% of sample). All recruited families completed online surveys and in-home assessments during W1 (500 infants, 500 primary caregivers, and 357 secondary caregivers). During Wave 2 (W2) of data collection (Summer 2018), a subset of the total sample was asked to complete the survey and in-home portions of the study while the rest of the sample only completed the online survey portion of the study. For the in-home sample, primary caregiver-infant dyads were contacted again with the goal of recruiting a diverse sample based on household income. All participating families from W1 who reported a household income below $50,000 were invited to participate in W2 (n =169). Next, families reporting a

household income over $50,000 were stratified based on income brackets and randomly selected to participate in W2 of the study (n = 83). If families reporting an income above $50,000 declined to participate during W2 (3% of sample), other families were randomly selected from the same income bracket and invited to participate. A small number (n = 19) of additional families reporting a household income below $50,000 who did not participate in W1 were recruited to participate using information through the Colorado Office of Health and Vital records. This record identified families in the local area who had a child between 1- and 2-years old. Similar to the recruitment strategy used at W1, research assistants visited the homes of potential participant families and invited them to participate. Of the families visited by research assistants 60% agreed to participate in W2 of the study. This resulted in 249 infants, 249 primary caregivers, and 217 secondary caregivers completing the survey and in-home portions of the study at W2. In addition, 252 infants, 252 primary caregivers, and 238 secondary caregivers completed the survey portion only at W2. At Wave 3 (W3) of data collection (Summer 2019), 221 infants, 221 primary caregivers, and 194 secondary caregivers completed the survey and in-home portions of the study. In addition, 280 infants, 280 primary caregivers, and 261 secondary caregivers completed the survey portion only at W3. Demographic data for the final sample used in the present study are presented in Table 1.

Given our use of both the survey only and in-home participants at W2 and W3 (recall that all participants completed the survey and in-home data collections at Wave 1), I explored differences in demographic variables using independent-samples t-tests (two-tailed tests using $\alpha = .05$) and chi-square analyses between families who participated in any of the in-home measures at W2 or W3 (N = 249) and participants who only participated in the survey portion of the study at W2 and W3 (N = 252; 0 = survey only; 1 = in-home data at W2 or W3). Variables tested included: mother- and

father-reported household income, mothers' education, fathers' education, the number of children in the home, mothers' and fathers' depression at W2 and W3, mothers' and fathers' race/ethnicity, and child sex. As described previously, efforts were made to recruit participants from lower-income households for the in-home portion of the study. As expected, in-home participant mothers (M = 6.35, SD = 3.55) and fathers (M = 7.07, SD = 3.41) reported significantly lower household income (reported from 1 = "less than, $10,000" to 12 = "more than $150,000") compared to survey-only mother (M = 8.98, SD = 3.18), $t(481.51) = 8.62$, $p < .001$) and father participants (M = 8.81, SD = 2.69), $t(324.72) = 5.26$, $p < .001$). Chi-square analyses revealed differences in mothers', $c^2(3, N = 496) = 24.32$, $p < .001$, but not fathers' education (reported from 1 = "no formal school" to 8 = "Doctoral or professional degree"); in-home participant mothers reported lower levels of education. Further, in-home participants (M = 3.18, SD = 1.22) reported having more children in the home compared to survey-only participants (M = 2.93, SD = 1.23), $t(490) = -2.21$, $p = .03$. Chi-square analyses indicated significant differences in race/ethnicity (1 = White, 2 = African American, 3 = U.S. Latino or Hispanic, 4 = Asian American, 5 = Other) between in-home and survey-only participating mothers, $c^2(1, N = 495) = 11.34$, $p < .001$. These differences between in-home and survey-only participants suggested that participants who had versus did not have data for key study variables collected only with in-home procedures at W2 and W3 (e.g., parent-child interaction, child expressive language) may differ in important ways. In other words, missingness on some W2 and W3 variables could be associated with demographics. To improve the likelihood that the Missing at Random Assumption was met, I included mother- and father-reported household income, mothers' education, the number of children in the home, and mothers' race/ethnicity as covariates in my main analyses.

In addition, I conducted attrition analyses to examine whether demographic characteristics or key study variables were associated with participants' drop out of the study over time, and whether these variables should be included as covariates. In total, 414 participants had data at W1, W2, and W3. However, 33 participants participated at W1 and W2 but not W3, and 37 participants participated at W1 but not W2 and W3. Next, independent-samples *t*-tests or chi-square analyses (0 = complete data; 1 = dropped out at W2 or W3) were conducted to assess differences between attritted and non-attritted participants on mothers' and fathers' reported household income, mothers' and fathers' education, W1 mothers' and fathers' depression, mothers' and fathers' race/ethnicity, the number of children in the home, and child sex. Results indicated three differences between non-attritted and attritted participants. Chi-square analyses revealed differences in mothers', c^2 (3, N = 480) = 17.02, p < .001, but not fathers', education; attritted participant mothers reported lower levels of education. Moreover, chi-square analyses revealed differences in mothers', $\square^2$ (1, N = 478) = 5.43, p = .02, and fathers', $\square^2$ (1, N = 345) = 11.32, p < .001, race/ethnicity; attritted participants were more likely to be non-white. Chi-square analyses also revealed differences in child sex between attritted and non-attritted participants, $\square^2$ (1, N = 345) = 11.32, p < .001, as there were more boys participating in the in-home and survey portions of the study. Thus, mothers' education, child sex, and mothers' and fathers' ethnicities/races were included as covariates in my main analyses to improve the likelihood of meeting the Missing at Random assumption.

Procedure

Study procedures were approved by the primary investigators' Institutional Review Board [*masked for review*]. Primary caregivers provided informed consent. Primary and secondary caregivers were compensated in the form of Visa or Amazon gift

cards at each wave of data collection for completing the online survey (up to $200) and in-home visit (up to $50) portions of the study.

Data were collected through online surveys and during in-home visits. Online surveys included questions about participants' demographic information (e.g., household income, education), children's behavior (e.g., language, media use behaviors), and caregivers' characteristics and behaviors (e.g., mental health, parenting styles). Primary and secondary caregivers completed an online survey (up to 2 hours) using a secure hosting site with custom links that were unique to each participant. Primary and secondary caregivers were asked to complete the online survey in thirty-minute sessions within two weeks of receiving the links. Participants without access to computers or Wi-Fi were provided iPads and mobile hotspots to complete the survey.

In-home visits occurred at each wave of data collection (albeit not for all participants at W2 and W3, as was previously described) and involved two visits at each wave lasting around 1.5 hours each. In-home visits involved observed tasks (e.g., free-play), home language recording devices, and assessments (e.g., Individual Growth and Development Indicator). Observed procedures relevant to variables used in this study are described below.

Parent-child interactions for participating mothers and fathers were video recorded during the in-home visits during an unstructured free-play session for four minutes at Wave 1, Wave 2, and Wave 3. An assortment of toys was placed in an open floor area and caregivers were instructed to play or interact with their child as they normally would. Videos were coded using a coding scheme focused on parent and child behaviors (Barr et al., 2014; Hackworth et al., 2017) in eight, 30-second epochs for the frequency of target behaviors. For the present study, only the parent target behavior codes were used. These are described in the Measures section.

A “gold standard” approach was used to code videos. Gold standard coders are trained by another gold standard coder who has published using the coding scheme until consensus is reached and the new gold standard coder is approved. This coding lead acted as the gold standard while other undergraduate research assistants learned and coded the recorded interactions to achieve consensus and acceptable inter-rater reliability. Each coder coded at least 25 videos during the reliability attuning process to achieve 85% reliability with each individual code. Coders were required to be within one of the coding leader’s frequency totals for each code to be considered reliable. To maintain reliability and prevent coder drift, each trained coder coded a shared group of 10 videos weekly and 20% of these videos were randomly selected and compared with the coding leader’s gold standard. Inter-rater agreement across all coded behaviors for each wave was 95.76% (W1), 96.25% (W2), and 96.25% (W3).

Children’s expressive language was captured and measured using the Language Environment Analysis System (LENA), which is designed to provide researchers, parents, and clinicians detailed information about children’s home environments and expressive language abilities. During an in-home visit at W2 and W3 caregivers placed a small digital recording device in the pocket of a custom-made vest which the child wore over their clothing. Caregivers were instructed to have the child go about their typical day with the vest being worn over a period of 24 hours. During sleep, swimming, or bath times, caregivers were instructed to remove the vest and place it near the child to continue recordings. After these activities, caregivers were instructed to dress the child in the vest again. This device records the overheard and child-directed speech in the environment and the vocalizations of children. The raw audio files are electronically transferred to the LENA foundation (physically located in Boulder, Colorado), securely stored, and analyzed using advanced natural language-related algorithms to produce

core reports representing children's home language environments and expressive language (Xu et al., 2009). The measurements used in the present study are described in the Measures section.

Measures

Mothers' and Fathers' Depression

Mothers' and fathers' depressive symptoms were measured at W1, W2, and W3 using ten items (see Table 2) from the Center for Epidemiological Studies Short Depression Scale (CES-10; Levine, 2013). Parents responded to statements about their own feelings and behaviors in the last week. To do so, parents rated various statements on a four-point Likert Scale ranging from 1 (*Rarely or none of the time [less than 1 day]*) to 4 (*All of the time [5-7 days]*). Sample items include, "I felt that everything I did was an effort" and "I felt lonely." All items were recoded from a 1 to 4 scale to a 0 to 3 scale. Next, two items were reverse-coded. Higher scores indicate more depressive symptoms. Summed scores across all items greater than nine are considered indicative of clinical depression. In the present community sample, 15-16% of mothers and 13% of fathers reported clinical levels of depression at Wave 1, 2, and 3. Cronbach's alphas at estimated at each wave for mothers (☐ = .78-81) and fathers (☐ = .75-79).

Quality of Parent-child Interactions

The four-minute recorded free-play observations were coded in 30-second epochs (8) using a previously developed coding scheme (Barr et al., 2014; Hackworth et al., 2017). Mothers' and fathers' behaviors (e.g., warmth and acceptance, harsh criticism) were coded in separate play sessions with their child and were categorized into parental supportiveness and intrusiveness. Behaviors were coded as 0 = absent and 1 = present within each epoch. Codes were not mutually exclusive, as multiple behaviors could be coded within the same 30-second epoch. Codes were summed across epochs (range 0 -

8). Specific behavior summed scores were used individually or averaged into mean composites to capture mothers' and fathers' parent-child interaction quality. See *Data Reduction* section in the results for associations between behavior codes.

Acceptance/warmth. Mothers' and fathers' acceptance/warmth was coded when caregivers engaged in praising, comforting, and encouraging behaviors.

Supportiveness. Mothers' and fathers' supportiveness was comprised of two behavioral codes: descriptive language and following the child's lead. Descriptive language was coded when caregivers directed comments towards the child or describes the child's actions or environment using various grammatical combinations (e.g., noun + verb). Following the child's lead was coded when parents follow the signals and actions of the child, imitates the child's actions or vocalizations, follow the directions of the child, or provides help or assistance to the child. The summed scores of these two codes across epochs were then combined into mean composites for mothers' and fathers' supportiveness.

Intrusiveness/restrictiveness. Intrusiveness/restrictiveness was coded when caregivers engaged in taking something away from the child without explanation, commanding the child by saying phrases like "no", "stop," or "don't," making rough physical contact with the child, spanking, or physically restraining the child.

Children's Expressive Language

Children's expressive language was captured using LENA at W2 and W3. This measure yielded three indices of expressive language including: the number of *Child Vocalizations*, a *Vocal Productivity Score* (VP; an automated canonical syllable count per conversational turn score), and the *Automatic Vocalization Assessment* (AVA; a categorized and quantified score of children's protophones and phonemes). There is empirical support for the reliability and validity of home language environment and

expressive language indices provided through LENA (e.g., Cristia et al., 2020; Wang et al., 2020). For example, Cristia and colleagues (2021) found LENA's performance in capturing adult words and child vocalizations to be more accurate than conversational turns. The other indices of children's expressive language assessed in the present study (VP, AVA) have received less attention but have demonstrated concurrent validity with other widely used measures and assessments of language (Du et al., 2017; Richards et al., 2008). Thus, the results of the present study should be interpreted with some caution until further reliability and validity work is established. The indices used in the present study were standardized by age and gender for analysis using a norm-referenced dataset to yield variables of children's expressive language.

Child Vocalizations. This estimate of children's expressive language is the number of times children produce communicative vocalizations. This excludes vegetative sounds (e.g., loud respirations, digestion) or other vocalizations (e.g., crying). Vocalizations are considered distinct when separated by at least 300 milliseconds. For example, babbling sounds such as "mamama" and "Can I have a cookie" would each count as one vocalization. In contrast, if a child vocalizes, pauses, and vocalizes again after 300 milliseconds, this would count as two vocalizations. Child vocalizations have been widely used in the observational research of children's expressive language (e.g., Lopez et al., 2020).

Automatic Vocalization Assessment. Similar to mean length of utterance which estimates the average number of morphemes in an utterance (Brown, 1973), LENA generates a measure of vocalization complexity by categorizing and quantifying children's protophone (i.e., early speech-like sounds) and phoneme (i.e., sound) production. Early infant vocalizations differ from adults in that they are less organized and mature (Oller, 2000). As children incorporate more speech sounds into their

language repertoire and refine those sounds to become more adult-like, children's speech more closely approximates that of adults (Fitch & Giedd, 1999). The AVA has demonstrated similar test-retest reliability to other widely used assessments) of children's expressive language and is strongly correlated with these other assessments (e.g., Preschool Language Scale-4th Edition; Receptive Expressive Emergent Language Scale, 3rd Edition; Richards et al., 2008).

Vocal Productivity. Similar to mean-length-of-utterance and the AVA, vocal productivity is a measure of vocalization complexity using canonical syllables (i.e., consonant-vowel combinations). Beginning between 7-9 months and developing throughout infancy and early childhood, children add multi-syllabic words to their expressive language. These vocalizations develop into multi-phrasal and more complex sentences with higher syllable counts (Fromkin et al., 2013). The VP score has been demonstrated to produce reliable and valid estimates compared to established transcribing and coding protocols measuring children's observed canonical syllables (Oller et al., 2010) and measures of MLU. The VP score is also moderately correlated with AVA indicating that although both track children's expressive language development, they likely capture somewhat different aspects of language (Du et al., 2017). Additional information on these measures are provided by LENA in their previously cited technical reports and other reports (e.g., Gilkerson et al., 2008; Gilkerson et al., 2017).

Covariates

Household Income. Both parents were asked, "In which of these ranges does your family's yearly income lie before taxes for last year?" at W1 and W2. Responses ranged from 1 = "less than $10,000" to 12= more than $150,000. Household income was highly consistent in terms of rank order across W1 and W2 for both caregivers (e.g.,

$r[249] = .69$, $p < .001$), and both mothers' and fathers' reports of household income were highly correlated with each other (e.g., $r[386] = .70$, $p < .001$). Thus, I created a mean composite of mother's and father's income at W1 to be used as a covariate in my analyses.

Mothers' and Fathers' Education. Both parents were asked, "What is the highest level of education you have completed?" at W1 and W2. Responses ranged from 1 = no formal school to 6 = doctoral or professional degree. Parent education was highly consistent in terms of rank order across W1 and W2 for primary ($r[448] = .79$; $p < .001$) and secondary caregivers ($r[328] = .69$; $p < .001$) and primary and secondary caregivers education was correlated at both waves (e.g., $r[391] = .38$ $p < .001$). Both parents' education at W1 were used as covariates for main analyses.

Children in the Home. Primary caregivers responded to the item "How many children do you have at home?" and responses were recoded as 1 = one child in the home, 2 = two children in the home, etc. The majority of families who had children participating in the study had one child in the home (42%), while many families had two children in the home (30%).

Caregiver Race/Ethnicity. Primary and secondary caregivers were asked "What is your ethnicity?" at W1 and responded with 1 = "White, 2 = "African American", 3 = "U.S. Latino or Hispanic", 4 = "Asian American", or 5 = "Other." Over 70% of the mothers and fathers self-identified as "White" resulting in very small cell sizes for other races/ethnicities. These small cell sizes complicate analyses, so I recoded the mother and father race/ethnicity variables (0 = "White", 1 = "Non-White") to be used as covariates in my analyses.

CHAPTER 3

RESULTS

Analytic Plan

Preliminary data analyses were conducted in SPSS 27 and main analyses were conducted in M*plus* 8.3. To help verify data accuracy, variables were examined using descriptive statistics to ensure the sample sizes appear accurate for each variable, that the data values for each variable fit within the expected ranges, and that missing data were coded properly. Errors were investigated and corrected. See Table 3 for complete descriptive statistics.

Data were examined for violations of statistical assumptions, such as normality. Descriptive statistics (*M*, *SD*, skewness, kurtosis) and histograms of each variable were examined. None of the variables were excessively skewed or kurtotic (Kline, 2016). However, some variables were not normally distributed. As such, an estimator that adjusts the standard errors and chi-square test of model fit was used in statistical analyses. For example, child vocalizations was not normally distributed, hence, structural equation models were conducted using Maximum Likelihood Robust (MLR) estimation. Without altering our estimator, the standard errors may be biased and influence the *p*-values.

The data were also examined for univariate outliers (Tabachnick & Fidell, 2013; ±3.29 *SD*). Sensitivity analyses were conducted with the final models to determine if Winsorizing the outliers (changing extreme values to be less extreme) changed the results.

As was described in the *Participants* section, there were missing data. Accordingly, the primary data analyses were estimated with a full-information-maximum-likelihood (FIML) estimator (i.e., MLR) to retain as many cases as possible.

FIML relies on the assumption that the missing data mechanism is either Missing Completely at Random (MCAR) missing, that is, probability of missingness or the missing values on measured variables are not related to the underlying values of the variable or to other measured variables, or that the mechanism of missingness is Missing at Random (MAR), that is, probability of missingness or the missing values on measured variables are not related to the underlying values of the variable, rather, missingness is related to other measured variables (Enders & Peugh, 2004). To improve the likelihood that MAR is met, variables that had differences based on having vs. missing data (e.g., missing on in-home measures, or missing due to drop out) were included as covariates in the primary models.

Correlation Analyses

Zero-order correlations were examined amongst study variables and covariates to assist in data reduction, assess the stability of variables at each wave, help select covariates for structural equation models, and examine relations between variables of interest.

Data Reduction

For two constructs (i.e., parent-child interaction quality, expressive language) measured variables were associated indicating they could reflect underlying constructs. By reducing or combining variables, analyses can be made more manageable and yield more stable and reliable variables (Rushton et al., 1983).

First, some associations emerged from the six measured parent-child interaction quality variables. Previous studies using this measure suggest a supportiveness dimension that includes the acceptance/warmth, descriptive language, following the child's lead, and maintaining/extending variables, as well as an intrusiveness dimension that includes the intrusiveness/restrictiveness and harsh criticism variables (Barr et al.,

2014; Hackworth et al., 2017). However, the correlations from the present data did not support these dimensions (see Table 4 for correlations among mothers' parent-child interaction variables and Table 5 for correlations among fathers' parent-child interaction variables). It is possible correlations were attenuated because several variables were coded as occurring infrequently. For example, maintaining/extending and harsh criticism were seldomly observed or coded in the present data; maintaining/extending and harsh criticism were not significantly correlated (or were inconsistently correlated) with other parent-child interaction quality variables at W1, W2, or W3. Thus, maintaining/extending and harsh criticism were dropped from further analyses.

However, mothers', $r(217\text{-}473) = .45\text{-}.73$, $p < .001$, and fathers', $r(163\text{-}316) = .52\text{-}.73$, $p < .001$, descriptive language and following the child's lead variables were positively and consistently correlated within W1, W2, and W3 indicating there may be a construct, that I label *supportiveness*, underlying these variables. Mothers' and fathers' acceptance/warmth did not consistently correlate with descriptive language or following the child's lead within W1, W2, or W3.

Other potential methods for data reduction were explored. I examined the potential negative associations between mothers' and fathers' intrusiveness/restrictiveness variables and the acceptance/warmth, descriptive language, and following the child's lead variables. The intrusiveness/restrictiveness variables were not consistently negatively correlated with any of these other parent-child interaction quality variables.

Thus, I proceeded with three parent-child interaction quality variables for mothers and for fathers: acceptance/warmth, supportiveness (i.e., mean composite of descriptive language and following the child's lead), and intrusiveness/restrictiveness.

Second, the three LENA-measured indices of expressive language were positively correlated within W2, $r(182\text{-}190) = .36\text{-}.48$, $p < .001$, and within W3, $r(202) = .62\text{-}.70$, $p < .001$. These correlations suggest that a construct that I label *expressive language* may underly these three variables at W2 and W3. This assertion was tested as the measurement model in Structural Equation Modeling (SEM).

Rank-order Stability of Study Variables

Next, I examined the rank-order stability of the study variables across W1 through W3 (Table 6). Mothers' depression was moderately stable across W1 through W3, $r(412\text{-}431) = .53\text{-}.64$, $p < .001$. Similarly, fathers' depression was moderately stable across W1 through W3, $r(259\text{-}292) = .49\text{-}.60$, $p < .001$.

Mothers' acceptance/warmth, $r(213\text{-}236) = .18\text{-}.46$, $p < .01$, supportiveness, $r(213\text{-}238) = .29\text{-}.53$, $p < .001$, and intrusiveness/restrictiveness, $r(213\text{-}238) = .14\text{-}.14$, $p < .05$, demonstrated some stability. Fathers' acceptance/warmth, $r(122\text{-}153) = .26\text{-}.37$, $p < .01$, supportiveness, $r(122\text{-}153) = .30\text{-}.43$, $p < .001$, and intrusiveness/restrictiveness, $r(153) = .18$, $p < .05$, demonstrated various levels of stability. Two exceptions emerged in that mothers' intrusiveness/restrictiveness parenting at W1 and W3 were not significantly correlated, and fathers' intrusiveness/restrictiveness parenting at W1 and W3 were not significantly correlated.

Child vocalizations, $r(188) = .36$, $p < .001$, AVA scores, $r(167) = .24$, $p < .001$, and, VP scores $r(165) = .15$, $p = .05$, demonstrated various degrees of stability across W2 and W3.

Associations between Covariates and Study Variables

In approaching the SEM portion of analyses, I examined the correlations between covariates and the study variables. Using a model-building approach, if relations between a covariate and a study variable were significant, I included the pathway in the

SEM. First, associations between covariates and the LENA expressive language variables (i.e., child vocalizations, AVA score, VP Score) were examined (Table 7). Household income was positively correlated with child vocalizations at W2, $r(214) = .15$, $p = .03$, and W3, $r(195) = .22$, $p < .002$, and with AVA scores at W3, $r(195) = .28$, $p < .001$. Mothers' education was positively correlated with child vocalizations at W2, $r(220) = .14$, $p = .04$, and W3, $r(201) = .18$, $p = .01$, and was positively associated with children's AVA scores at W3, $r(201) = .21$, $p = .004$. The number of children in the home was negatively correlated with child vocalizations at W3, $r(198) = -.15$, $p = .04$, AVA scores at W2 $r(189) = -.22$, $p = .002$, and AVA scores at W3, $r(198) = -.16$, $p = .03$. Mothers' race/ethnicity ("White" = 0, "Non-white" = 1) was negatively related to child vocalizations at W2, $r(220) = -.14$, $p = .04$, and W3, $r(202) = -.26$, $p < .001$, and was negatively related to AVA at W3 $r(202) = -.22$, $p = .001$, and VP scores at W3, $r(202) = -.23$, $p = .001$. Fathers' race/ethnicity was negatively related to children's AVA scores at W3, $r(148) = -.18$, $p = .03$. Care outside the home ("Primary care only in the home" = 0, "Has primary care outside the home" = 1) was unrelated to children's expressive language.

Second, associations between the covariates and parental depression were examined (Table 8). Household income was negatively correlated with mothers' depression at W1, $r(472) = -.13$, $p = .005$, and W2, $r(422) = -.12$, $p = .02$. Mothers' education was negatively correlated with mothers' depression at W1, $r(486) = -.13$, $p = .01$. Care outside the home was negatively related to mothers' depression at W1, $r(481) = -.10$, $p = .03$. No other associations were found between the covariates and mothers' and fathers' depression.

Third, associations between covariates and mothers' and fathers' parent-child interaction quality variables were examined (Tables 9 and 10). Household income was positively correlated with mothers' acceptance/warmth at W1, $r(458) = .18$, $p < .001$, and

W2, $r(233) = .16$, $p = .02$., as well as mothers' supportiveness at W1, $r(458) = .24$, $p < .001$, W2, $r(233) = .30$, $p < .001$, and W3, $r(208) = .37$, $p < .001$. Similarly, household income was positively correlated with fathers' supportiveness at W2, $r(181) = .18$, $p = .02$, and W3, $r(167) = .28$, $p < .001$. Mothers' education was positively correlated with mothers' acceptance/warmth at W1, $r(472) = .13$, $p = .006$, and W3, $r(241) = .20$, $p = .002$; mothers' supportiveness at W1, $r(472) = .35$, $p < .001$, W2, $r(241) = .29$, $p < .001$, and W3, $r(216) = .32$, $p < .001$; and fathers' supportiveness at W1, $r(311) = .17$, $p = .003$, W2, $r(183) = .30$, $p < .001$, and W3, $r(162) = .21$, $p = .007$. Fathers' education was positively correlated with mothers' supportiveness at W1, $r(336) = .14$, $p = .01$ and, W3, $r(153) = .36$, $p < .001$, as well as fathers' supportiveness at W3, $r(134) = .23$, $p = .007$. The number of children in the home was negatively correlated with mothers' acceptance/warmth at W2, $r(237) = -.15$, $p = .02$, and mothers' supportiveness at W2, $r(237) = -.17$, $p = .009$. Mothers' race/ethnicity was negatively related to mothers' acceptance/warmth at W1, $r(472) = -.20$, $p < .001$, and W2, $r(241) = -.16$, $p = .01$, as well as mothers' supportiveness at W1, $r(472) = -.19$, $p < .001$, W2, $r(241) = -.21$, $p < .001$, and W3 $r(216) = -.20$, $p = .003$. Mothers' race/ethnicity was also negatively related to fathers' acceptance/warmth at W3, $r(163) = -.17$, $p = .04$, as well as fathers' supportiveness at W2, $r(184) = -.21$, $p = .004$, and W3, $r(163) = -.17$, $p = .03$. Fathers' race/ethnicity was negatively related to fathers' acceptance/warmth at W3, $r(134) = -.25$, $p = .004$, as well as fathers' supportiveness at W1, $r(315) = -.13$, $p = .02$, W2, $r(152) = -.30$, $p < .001$, and W3, $r(134) = -.24$, $p = .005$. Fathers' race/ethnicity was negatively related to mothers' acceptance/warmth at W2, $r(171) = -.25$, $p = .001$, and mothers' supportiveness at W1, $r(336) = -.14$, $p = .01$, W2, $r(171) = -.28$, $p < .001$, and W3, $r(153) = -.25$, $p = .002$. Care outside the home at W1 was positively related to mothers' supportiveness at W1, $r(467) = .12$, $p = .009$.

Household income was negatively correlated with mothers' intrusiveness/restrictiveness at W1, $r(458) = -.21$, $p < .001$, W2, $r(233) = -.16$, $p = .01$, and W3, $r(208) = -.22$, $p = .002$, as well as fathers' intrusiveness/restrictiveness at W1, $r(314) = -.15$, $p = .007$. Fathers' education was negatively correlated with mothers' intrusiveness/restrictiveness at W1, $r(336) = -.20$, $p < .001$, and W3, $r(153) = -.19$, $p = .02$. Mothers' education was negatively correlated with mothers' intrusiveness/restrictiveness at W1, $r(472) = -.28$, $p < .001$, W2, $r(241) = -.23$, $p < .001$, and W3, $r(216) = -.18$, $p = .01$, as well as fathers' intrusiveness/restrictiveness at W1, $r(311) = -.15$, $p = .008$. The number of children in the home was positively correlated with fathers' intrusiveness/restrictiveness at W3, $r(162) = .23$, $p = .003$. Mothers' race/ethnicity was positively related to mothers' intrusiveness/restrictiveness at W1, $r(472) = .18$, $p < .001$. Fathers' race/ethnicity was positively related to fathers' intrusiveness/restrictiveness at W1, $r(315) = .16$, $p = .004$, and W2, $r(152) = .19$, $p = .02$.

Associations between Study Variables

Correlations were examined between parents' depression, parents' parent-child interaction quality, and children's expressive language. In terms of depression and children's expressive language, mothers' depression at W2 was negatively associated with children's AVA scores at W2 $r(191) = -.17$, $p = .02$. No other bivariate correlations were found between mothers' or fathers' depression and children's expressive language variables (Table 11).

Next, several associations between parents' depression and parent-child interaction variables were significant (Table 12). Some were between the same parent's depression and parent-child interactions, and some were between one parent's depression and the other parent's parent-child interactions. Fathers' depression at W1, $r(330) = -.11$, $p = .05$, W2, $r(341) = -.13$, $p = .01$, and W3, $r(300) = -.14$, $p = .02$, were

negatively correlated with mothers' acceptance/warmth at W1. Mothers' depression at W1 was negatively correlated with mothers' supportiveness at W2, $r(241) = -.17$, $p = .01$, and fathers' supportiveness at W2, $r(183) = -.17$, $p = .02$, and W3, $r(162) = -.19$, $p = .02$. Fathers' depression at W2 was positively correlated with fathers' intrusiveness/restrictiveness at W1, $r(264) = .13$, $p = .03$.

Several associations were also significant between mothers' and fathers' parenting behaviors and children's expressive language (Table 13). Mothers' acceptance/warmth at W1 was positively correlated with child vocalizations at W2, $r(218) = .14$, $p = .04$. Mothers' acceptance/warmth at W2 was positively correlated with child vocalizations, $r(201) = .20$, $p = .004$, AVA, $r(201) = .32$, $p < .001$, and VP scores, $r(238) = .18$, $p = .005$, at W3. Mothers' acceptance/warmth at W3 was positively correlated with AVA, $r(202) = .27$, $p < .001$, and VP scores, $r(202) = .14$, $p = .05$, at W3. Mothers' supportiveness at W1 was positively correlated with children's AVA scores at W3, $r(199) = .17$, $p = .02$. Mothers' supportiveness at W2 was positively correlated with child vocalizations at W2, $r(220) = .24$, $p < .001$, and W3, $r(201) = .24$, $p < .001$, and was positively correlated with child AVA, $r(201) = .29$, $p < .001$, and VP, $r(201) = .20$, $p = .004$, at W3. Mothers' supportiveness at W3 was positively correlated with child vocalizations at W2, $r(198) = .20$, $p = .004$, and W3 $r(202) = .22$, $p = .002$, and with child AVA scores at W3, $r(202) = .26$, $p < .001$. Mothers' intrusiveness/restrictiveness at W1 was negatively correlated with VP scores at W2, $r(183) = -.18$, $p = .02$. Mothers' intrusiveness/restrictiveness at W2, $r(201) = -.18$, $p = .01$, and W3, $r(202) = -.16$, $p = .02$, were negatively correlated with children's AVA scores at W3.

Fathers' supportiveness at W1 was negatively correlated with VP scores at W2, $r(122) = -.22$, $p = .02$, and was positively correlated with child vocalizations at W3, $r(132) = .17$, $p = .05$. Fathers' supportiveness at W2 was positively associated with child

vocalizations at W2, $r(171) = .26$, $p < .001$, and AVA scores at W2, $r(155) = .17$, $p = .03$, as well as child vocalizations, $r(161) = .28$, $p < .001$, AVA, $r(161) = .30$, $p < .001$, and VP scores, $r(161) = .22$, $p < .001$, at W3. Fathers' supportiveness at W3 was positively correlated with AVA scores at W2, $r(140) = .20$, $p = .02$, and child vocalizations, $r(158) = .17$, $p = .03$, and AVA scores at W3, $r(158) = .18$, $p = .02$. Fathers' acceptance/warmth and intrusiveness/restrictiveness was not correlated with children's expressive language.

Structural Equation Modeling

Structural equation modeling (SEM) was conducted in M*plus* using MLR estimation. Model fit was evaluated using several indices including the chi-square (x^2) test of model fit. Because the x^2 test is a test of whether the specified model is an exact fit to the observed data and because it is overly sensitive to trivial influences using moderate-to-large sample sizes, additional indicators were used to evaluate model fit (Little, 2013, p. 115). As tests of absolute fit, root mean square error of approximation (RMSEA) and standardized root mean square residual (SRMR) indicate acceptable fit when values are below .08. The comparative fit index (CFI) indicates acceptable fit when values are between .90 and .99.

Modeling proceeded in 2 stages. First, I estimated a measurement model. Second, I estimated structural equation models.

Measurement Model

I specified a measurement model of study variables while considering theory, the nature of the data, and the number of parameters to be estimated as to avoid the model being under-identified (Little, 2013). When specifying a structural equation model, the goal is to specify models that resemble the observed data or are "plausible" in identifying a parsimonious, meaningful representation of the observed data (MacCallum & Austin, 2000). If model fit is acceptable and the factor loadings are significant and positive, then

there is evidence that the indicators capture an underlying factor that can be used in the structural model for hypothesis testing.

First, I explored the three expressive language variables (child vocalizations, AVA scores, VP scores) as indicators of a latent factor at W2 and W3 separately. These cross-sectional models were just identified (fit could not be evaluated), but the loadings were positive and significant.

Next, I estimated the longitudinal model, and allowed the W2 and W3 expressive language factors to covary. Model fit for this specification was acceptable (x^2 [N = 236, df = 8] = 16.27; p = .04; RMSEA = .07; CFI = .98; SRMR = .03), and standardized factor loadings were all significant, positive, and > .56.

Then, I explored whether these two latent factors demonstrated measurement invariance of factor loadings across W2 and W3. To do so, I constrained the factor loadings of the corresponding indicators to be equal across W2 and W3. Next, I conducted an adjusted chi-square difference test (accounting for non-normality in the data and the MLR estimator; Widaman & Thompson, 2003) between the model with loadings constrained equal and the model with unconstrained loadings to determine whether constraining these factor loadings significantly contributed to additional model misfit. The constrained model yielded acceptable model fit (x^2 [N = 236, df = 10] = 20.92; p = .02; RMSEA = .07; CFI = .97; SRMR = .04). The difference test using the Satorra-Bentler Scaled chi-square indicated that the constrained model was not a significantly worse fit compared to the unconstrained model (Δx^2 = 4.80 [Δdf = 2]). Thus, I concluded that the expressive language factor loadings were invariant across W2 and W3 and retained the model with constrained loadings for the structural model.

I also explored latent factors for the depression and parent-child interaction variables. Ultimately, I chose against the use of latent variables to represent these

constructs for two reasons. For depression, scales consisted of many items, which would have meant too many parameters being estimated relative to the sample size (analytic sample $N = 483$). I considered forming parcels with items to reduce the number of estimates but several of the individual items for mothers' and fathers' depression were not correlated consistently across W1, W2, and W3. Moreover, in some cases, one item was uncorrelated with all other items within wave.

For parent-child interaction variables, as was discussed above, variables were not consistently correlated across waves and at times were not correlated with each other. Hence, rather than combine depression items and parent-child interaction variables into latent factors, I proceeded as had been done in previous studies by creating sum scores for mothers' and fathers' depression (Levine, 2013) at each wave. Further, as described in the "*Data Reduction"* section, I created mean composites of mothers' and fathers' supportiveness using the descriptive language and following the child's lead variables at each wave and separately used the acceptance/warmth and intrusiveness/restrictiveness variables to capture parent-child interactions (Barr et al., 2014; Hackworth et al., 2017). Thus, the parents' depression and parent-child interactions variables were specified as manifest observed variables in the structural model.

Structural Models

Structural equation model specifications were informed by Cole and Maxwell's longitudinal framework (2003; with the exception of expressive language only being available at W2 and W3). Mothers' and fathers' depression were specified as the "X" variables, and children's latent factors of children's expressive language were specified as the "Y" variables. Parent-child interaction variables (i.e., acceptance/warmth, supportiveness, intrusiveness/restrictiveness) were specified as the "M" variables.

Previous levels of expressive language were accounted for in the models using an autoregressive path between expressive language from W2 and W3. Further, autoregressive paths were specified between mothers' and fathers' depression from W1 to W2 and from W2 to W3. Similarly, autoregressive paths were specified between mothers' and fathers' acceptance/warmth, supportiveness, and intrusiveness/restrictiveness from W1 to W2 and from W2 to W3.

Household income, mothers' and fathers' education, mothers' and fathers' races/ethnicities, the number of children in the home, and whether children were cared for outside the home were included as covariates in the models. Given that many of my covariates were "static" or demonstrated high rank-order stability from one wave to the next, only W1 covariates were included (with the exception of care outside the home) using a "model-building" approach informed by correlation analyses. Study variables at W1, W2, or W3 were regressed on covariates that were significantly correlated with study variables as reported in the "Associations between Covariates and Study Variables" section.

Covariances were specified within time between exogenous variables. In addition, covariances were specified between the residuals of endogenous variables within time.

The longitudinal relations between parental depression, parent-child interactions, and children's expressive language were examined. Paths from W1 depression to W2 parent-child interactions, as well as from W2 depression to W3 parent-child interactions were estimated. Paths from W1 parent-child interactions to W2 expressive language, as well as from W2 parent-child interactions to W3 expressive language were estimated. Paths from W1 depression to W2 expressive language, as well as from W1 and W2 depression to W3 expressive language were estimated.

Further, indirect effects from mothers' and fathers' depression to children's later expressive language were tested using parent-child interactions as mediators of these relations. Indirect effects were specified using M*plus*'s "Model Indirect" command. Significance of indirect effects was tested using bootstrapped bias-corrected 95% confidence intervals (5000 draws) to account for non-normal distributions of the indirect effects.

The hypothesized model demonstrated poor model fit (x^2 [N = 483, df = 451] = 803.44; p < .001; RMSEA = .04; CFI = .81; SRMR = .07). Several theoretically sound modification indices were suggested that would significantly reduce model misfit. First, care outside of the home at W2 was regressed on care outside of the home at W1. Second, previous levels of one parents' depression (i.e., mothers' and fathers' depression) were used to predict the *other* parents' later depression.

This respecified model yielded acceptable model fit (x^2 [N = 483, df = 425] = 567.85; p < .001; RMSEA = .03; CFI = .93; SRMR = .06). Suggested modification indices for this respecified model made little theoretical sense. Hence, no additional paths based on modification indices were added. Henceforth, it is labeled the final model. Figure 5 illustrates this model.

Next, I report the unstandardized coefficients of the autoregressive stability paths, *c'* paths, *a* paths, *b* paths, and paths from covariates. Expressive language from W2 to W3 was positively related (b = .30; p = .04). Autoregressive paths for mothers' depression were positive and significant from W1 to W2 (b = .61; p < .001) and W2 to W3 (b = .59; p < .001). Likewise, autoregressive paths for fathers' depression were positive and significant from W1 to W2 (b = .49; p < .001) and W2 to W3 (b = .56; p < .001). Autoregressive paths for mothers' acceptance/warmth were positive and significant from W1 to W2 (b = .13; p = .03) and W2 to W3 (b = .44; p < .001). Fathers'

acceptance/warmth at W1 was positively and significantly related to fathers' acceptance/warmth at W2 (b = .20; p = .009). Autoregressive paths for mothers' and fathers' supportiveness were positive and significant from W1 to W2 (b = .23; p < .001 / b = .29; p < .001) and W2 to W3 (b = .32; p < .001 / b = .23; p < .001). Autoregressive paths between mothers' and fathers' intrusiveness/restrictiveness were not significant. Care outside the home at W1 was positively related to care outside the home at W2 (b = .67; p < .001).

Mothers' and fathers' depression at W1 were not significantly related to children's expressive language at W2 or W3. Thus, c' paths were not significant.

Mothers' and fathers' depression were not significantly related to mothers' or fathers' acceptance/warmth. Mothers' depression at W1 was negatively related to mothers' supportiveness (b = -.05; p = .02) and fathers' supportiveness (b = -.06; p = .02) at W2. Mothers' and fathers' depression were not significantly related to mothers' or fathers' intrusiveness/restrictiveness parenting. Thus, only two out of the 24 a paths were significant.

Mothers' acceptance/warmth at W2 was positively related to expressive language at W3 (b = .02; p = .02). Fathers' supportiveness at W2 was positively related to expressive language at W3 (b = .03; p = .03). Thus, only two out of the 12 b paths were significant.

Several paths from covariates to study variables were significant. Household income was positively related to mothers' acceptance/warmth at W1 (b = .07; p = .03) and negatively related to mothers' intrusiveness/restrictiveness at W3 (b = -.05; p = .04). Mothers' education was positively related to mothers' supportiveness at W1 (b = .50; p < .001), fathers' supportiveness at W1 (b = .35; p = .003) and W2 (b = .38; p = .01), and was negatively related to mothers' intrusiveness/restrictiveness at W1 (b = -.23; p <

.001) and W2 (b = -.17; p = .02). Fathers' education was positively related to mothers' supportiveness at W3 (b = .22; p = .007), and was negatively related to mothers' intrusiveness/restrictiveness at W1 (b = -.13; p = .05) and W3 (b = -.13; p = .04). The number of children in the home was negatively related to expressive language at W2 (b = -.03; p = .02) and mothers' supportiveness at W2 (b = -.19; p = .05), and was positively related to mothers' supportiveness at W3 (b = .15; p = .02). Mothers' race/ethnicity (0 = White; 1 = Non-white) was negatively related to expressive language at W3 (b = -.11; p = .02), and mothers' acceptance/warmth at W1 (b = -.69; p = .001). Fathers' race/ethnicity was negatively related to fathers' acceptance/warmth at W3 (b = -.90; p = .04), mothers' supportiveness at W2 (b = -.67; p = .03), and fathers' supportiveness at W2 (b = -.84; p = .02).

The significance of indirect effects was examined using bootstrapped bias-corrected 95% confidence intervals to account for non-normal distributions of the indirect effects. No indirect effects were significant from mothers' or fathers' depression to children's expressive language through parent-child interaction variables.

Sensitivity Analyses

In addition to the analyses and results described above, I conducted several sensitivity analyses to account for outliers, examine mothers' and fathers' depression as dichotomous variables, and estimate a model for just mothers and just fathers.

Outliers

Several observations were more than 3.29 *SD*s below or above the means of study variables (Tabachnick & Fidell, 2013). These observations merited attention to determine whether they exerted disproportionate influence on statistical analyses and to reduce Type I error (Barnett & Lewis, 1994). Each of these observations was examined using descriptive statistics and histograms to determine if the observation was

excessively outside the distribution of the data of each study variable. When observations were apart from the remainder of the distribution, they were Winsorized (Dixon & Yuen, 1974). New variables were created to replace the following study variables: mothers' depression at W1 (1 Winsorized observation), mothers' depression at W3 (4), fathers' depression at W3 (2), mothers' supportiveness at W3 (1), fathers' supportiveness (2), mothers' intrusiveness/restrictiveness at W3 (2), and fathers' intrusiveness/restrictiveness at W3 (2).

The new study variables with Winsorized observations replaced the corresponding study variables used in the previously estimated final model. The outlier sensitivity model yielded adequate model fit (x^2 [N = 483, df = 437] = 573.49; p < .001; RMSEA = .03; CFI = .93; SRMR = .06). No practical or differences in levels of significance between the coefficients of the final model and this outlier sensitivity model emerged.

Dichotomous Depression

I was interested in examining whether results were different when depression was dichotomized based on clinical depression criteria. A separate model was estimated using dichotomous mothers' and fathers' depression variables (0 = non-depressed; 1 = depressed [> 9 summed score]) using the final model.

This model demonstrated slightly worse fit compared to the respecified model using continuous depression variables (x^2 [N = 483, df = 437]= 550.61; p < .001; RMSEA = .02; CFI = .92; SRMR = .06). Few meaningful differences emerged between the respecified model (using continuous symptoms of depression) and dichotomous depression models. Overall, significant coefficients reported in the respecified model were smaller in size in the dichotomous depression model. In the dichotomous depression model, mothers' depression at W1 was no longer significantly negatively

related to mothers' supportiveness at W2. Similarly, mothers' depression at W1 was no longer significantly negatively related to fathers' supportiveness at W2. However, one finding emerged in the dichotomous depression model that was not present in the final model (using continuous depression). Fathers' depression at W2 was negatively related to fathers' supportiveness at W3 (b = -.79; p = .02).

Separate Models for Mothers and Fathers

I had some concern about the amount of missing data for fathers, and that this might affect the model estimates, particularly given the complexity of the model. Hence, I tested separate models for mothers and fathers.

The mothers' model was specified by removing fathers' depression, acceptance/warmth, supportiveness, and intrusiveness/restrictiveness from the analyses. The mothers' model yielded acceptable model fit (x^2 [N = 483, df = 304]= 281.110; p < .001]; RMSEA = .03; CFI = .94; SRMR = .05). Significant autoregressive paths paralleled those found in the respecified model. As in the final model, mothers' acceptance/warmth at W1 was negatively related to expressive language at W3 (b = -.02; p = .04) and mothers' acceptance/warmth at W2 was positively related to expressive language at W3 (b = .03; p = .01). Mothers' depression at W1 was negatively related to mothers' supportiveness at W2 (b = -.05; p = .02). Altogether, the model using just mothers' depression and parenting did not meaningfully diverge from the final model containing mothers' and fathers' depression and parenting.

A fathers' model was specified using the opposite approach (i.e., removing mothers' depression and parenting from the analyses). The fathers' model yielded acceptable model fit for most indices but poor model fit for the CFI (x^2 [N = 483, df = 214]= 317.52; p < .001; RMSEA = .03; CFI = .90; SRMR = .06). Significant autoregressive paths paralleled those found in the final model with one exception for the

fathers' model. Fathers' intrusiveness at W2 was positively related to fathers' intrusiveness at W3 (b = .14; p = .05). However, no significant relations were found between fathers' depression, fathers' acceptance/warmth, fathers' supportiveness, intrusiveness/restrictiveness, and children's expressive language.

CHAPTER 4

DISCUSSION

The purpose of the present study was to explore relations between mothers' and fathers' depression, positive and negative aspects of parent-child interactions, and children's early language development. I also examined whether positive or negative aspects of parent-child interactions mediated the relations between mothers' and fathers' depressive symptoms and children's early language development. Previous conceptual and empirical work provided a framework for this study and informed my hypotheses, which received various levels of support.

Hypothesis 1 was that I would find negative relations between mothers' and fathers' depressive symptoms at W1 and W2 and children's later expressive language at W2 and W3. Hypothesis 1 received little empirical support as little evidence was found of relations between parents' depression and children's language development.

At the bivariate level, I found no significant correlations between mothers' or fathers' depressive symptoms and indices of children's expressive language (i.e., child vocalizations, AVA scores, VP scores) with the exception of one negative correlation between mothers' depression at W1 and children's AVA scores at W2. In my SEMs, mothers' and fathers' depressive symptoms at W1 and W2 were not related with children's later expressive language.

Hypothesis 2 was that I would find negative relations between mothers' and fathers' depressive symptoms and parental supportiveness. I also expected positive relations between mothers' and fathers' depressive symptoms and parental intrusiveness. Hypothesis 2 was partially supported as some significant relations were found between mothers' and fathers' depression and parent-child interactions.

At the bivariate level, mothers' depression at W1 was negatively correlated with mothers' supportiveness at W2. Fathers' depression at W2 was positively associated with earlier fathers' intrusiveness/restrictiveness (at W1).

I also explored cross-parent relations between parental depression and parent-child interactions. Mothers' depression at W1 was negatively correlated with fathers' supportiveness at W2 and W3, and mothers' depression at W2 was negatively correlated with fathers' supportiveness at W3. In addition, fathers' depression at W1, W2, and W3 was negatively correlated with mother's acceptance/warmth at W1.

Two of these significant relations between parental depression and parent-child interactions were also present in my SEM. Mothers' depression at W1 was negatively related to mothers' and fathers' supportiveness at W2.

Hypothesis 3 was that mothers' and fathers' supportiveness would be positively related to children's expressive language, and that mothers' and fathers' intrusiveness would be negatively related to children's expressive language. Hypothesis 3 was partially supported.

At the bivariate level, mothers' acceptance/warmth at W1 was positively related to child vocalizations at W2; in addition, mothers' acceptance/warmth at W2 was positively related to child vocalizations, AVA, and VP scores at W3. Mothers' supportiveness at W1 was positively related to AVA scores at W3. Mothers' supportiveness at W2 was positively related to child vocalizations at W2 and W3, and with AVA and VP scores at W3. Mothers' supportiveness at W3 was positively related to child vocalizations at W2 and W3, and with AVA scores at W3. Fathers' supportiveness at W1 was positively related to child vocalizations at W3, yet, negatively related to VP scores at W2. Fathers' supportiveness at W2 was positively related to VP scores at W3 and positively related to child vocalizations and AVA scores at W2 and W3. Fathers'

supportiveness at W3 was positively related to child vocalizations at W3, and with AVA scores at W2 and W3. Three bivariate relations emerged between parental intrusiveness/restrictiveness and children's expressive language indices. Mothers' intrusiveness/restrictiveness at W1 was negatively related to VP scores at W2. In addition, AVA scores at W3 were negatively related to mothers' intrusiveness/restrictiveness at W2 and W3.

Two of these relations were also present in my SEM. Mothers' acceptance/warmth and fathers' supportiveness at W2 were positively related to expressive language at W3. No other significant relations were found between mothers' or fathers' parent-child interactions and children's expressive language in my SEM.

Hypothesis 4 was that mothers' and fathers' depressive symptoms would be indirectly related to children's later expressive language through mothers' and fathers' supportiveness and intrusiveness. Hypothesis 4 was not supported. In the SEMs, no significant direct relations (i.e., the c-prime paths) were found between mothers' and fathers' depression and children's later expressive language, and no indirect effects through parent-child interactions were found between these constructs.

Synthesis of Findings

Within the frameworks of the ECM of language development (Hollich et al., 2000) and Goodman and Gotlib's theory of risk transmission (2011), parents' depression was expected to be negatively related to children's language development through one specific mechanism, that of children's exposure to the negative affect and behaviors often manifested by depressed parents. These behaviors and affect were thought to affect the quality of interactions between parents and their children. As outlined by previous conceptual and empirical work, children best develop language in environments that are positive, interactive, and responsive (e.g., Baydar et al., 2014; Clay et al., 2007).

Using data from nearly 500 families in the U.S., I tested hypotheses informed by these theories using three waves of data when children were 6-, 18-, and 30-months-old using Cole and Maxwell's longitudinal framework (2003). I accounted for three waves of mothers' and fathers' depressive symptoms and parenting using three dimensions of their parent-child interactions (i.e., acceptance/warmth, supportiveness, intrusiveness/restrictiveness). Further, I accounted for two waves of children's expressive language development from 18-months to 30-months old using three indices of expressive language (i.e., child vocalizations, automatic vocalization assessment scores, vocal productivity scores).

Relations between Parental Depression and Children's Language Development

With the exception of one bivariate finding between mothers' depression and children's AVA scores at W2, no other significant relations were found between mothers' and fathers' depression and children's expressive language. If the negative affect, mood, and/or irritability resulting from mothers' and fathers' depression relates to children's demonstrated ability to express themselves through language, I was unable to detect such a relation with the present study. These findings are somewhat surprising as several previous studies have found negative relations between mothers' and fathers' depression and children's language abilities both concurrently (Choe et al., 2020; Clifford et al., 2021) and prospectively (Bornstein et al., 2021; Brookman et al., 2020; Fredriksen et al., 2019; Paulson et al., 2009). Yet, the results of the present study parallel those of other studies that found no significant relations between these constructs (Justice et al., 2019; Peterson et al., 2019; Zajicek-Farber, 2009). The discrepancy in these findings may be a result of differences in populations sampled and/or measurement across studies. These issues are subsequently discussed here and in the limitations section.

The contributions of the present study regarding this hypothesis pertain to its methods and its results. In addition to adding another layer of findings regarding the relations between parental depression and children's language development, the present study captured a more complete picture of the family dynamics in families where there are multiple caregivers in the home (mother and father). More specifically, this is the first study to incorporate both parents' depression into the study design when examining parent-child interactions as a mediator of the relations between parental depression and children's expressive language.

Despite capturing this more complete picture, parental depression appeared to have little relation to children's expressive language. No bivariate relations emerged between fathers' depression and children's expressive language and mothers' depression was only concurrently related to AVA at the bivariate level. Further, I tested these this hypothesis using a "reduced" models, only including mothers' data for one SEM and then including fathers' data for another SEM (see Separate Models for Mothers and Fathers section). These models did not reveal additional insights into the lack of associations between parental depression and children's expressive language. Other studies accounting for both parents' depression are present in the literature, however, other mediators were examined these studies (Fredriksen et al., 2019; Paulson et al., 2009).

In addition, this is one of the first studies to examine these relations longitudinally using a relatively new observational method for capturing children's expressive language in the home environment (i.e., LENA). Previous work has examined relations between these constructs longitudinally using parent reports or assessments of children's language resulting in mixed findings (e.g., Fredriksen et al., 2019). In addition, previous work using these same data at 18-months postpartum found negative concurrent relations between the primary caregivers' depression and the number of child

vocalizations produced and AVA scores as captured by LENA (Clifford et al., 2021). However, the present study is the first to examine longitudinal relations between earlier reports of mothers' and fathers' depression and children's expressive language as captured by LENA. Indeed, including three waves of parental depression and parent-child interactions data while accounting for children's earlier language abilities was a strength of the present study as it captured a more complete picture of these relations, and allowed me to examine these associations over time using a newer observational method in a longitudinal framework. The findings from the current study indicated that when capturing a more complete picture of these relations over time, mothers' and fathers' depression at 6- and 18-months were not predictive of children's expressive language 1-year later.

Relations between Parental Depression and Aspects of Parent-Child Interactions (Parental Acceptance/Warmth, Supportiveness, and Intrusiveness/Restrictiveness)

There was some support for my second hypothesis that mothers' and fathers' depression would be related to mothers' and fathers' acceptance/warmth, supportiveness, and intrusiveness/restrictiveness. As described previously, several significant associations between these constructs were found at the bivariate level. When the parental depression, parent-child interaction quality, expressive language variables, and covariates were examined using SEM, two longitudinal findings emerged. Mothers' depression at W1 was negatively related to mothers' supportiveness at W2. Moreover, mothers' depression at W1 was negatively related to fathers' supportiveness at W2. However, surprisingly, neither of these two relations were present from W2 to W3 despite bivariate associations being found between these variables. These findings suggest that mothers' depression may only relate to their own and their partners'

supportiveness one year later from when children are 6-months old to 18-months old. Thus, it appears that mothers' depression at 6-months old (W1) plays a role in the parent-child interaction dynamics for both parents at 18-months (W2) insomuch that when mothers reports higher levels of depression, both parents are less likely to provide descriptive language and follow the lead of children during the second year of life.

In addition, it was surprising that concurrent bivariate associations did not emerge between mothers' depression and mothers' and fathers' supportiveness at 6-months (W1). It may be that mothers' depression may only be related to mothers' and fathers' supportiveness one year later as the concept of supportiveness somewhat depends on the capacity of the child. Parenting behaviors such as descriptive language and following the child's lead (i.e., supportiveness) may require children to be more autonomous and interactive with their environment, thereby enabling the parent to describe things in the environment and follow the child in their autonomous play. Accordingly, supportiveness when the child is 6 months old may require different skills from the parent than supportiveness when the child is 18 months old. It is also possible children provide more opportunities for parental supportiveness at 18 versus 6 months. In contrast, acceptance and warmth may be more stable and prevalent throughout early childhood, even as early as 6-months old (W1), and these behaviors have been found to be related to parental depression. For instance, negative bivariate associations were found between fathers' depression at each wave and mothers' acceptance/warmth at W1. However, none of these relations emerged in the main analyses. Thus, it appears that some form of lagged effect exists between mothers' depression 6-months postpartum and parenting behaviors one year later.

Interestingly, similar findings were not present for fathers' depression and later parent-child interactions. Though speculative, it may be that fathers' depression

manifests itself in a way that is distinct from mothers' depression having little to no effect on their parenting behaviors. Several frameworks have been used to examine differences in women's and men's depression intersecting with topics of gender and culture (Martin et al., 2013). For example, masculine depression frameworks posit that rather than manifesting sadness, men may be more likely to manifest their depression through irritability and anger because of gender norms and expectations (Addis, 2008). Hence, it may be that depressed fathers are more prone to intrusive/restrictive parenting behaviors as a result of their depression induced irritability or anger. Yet, the present study only found one positive bivariate association between fathers' intrusiveness/restrictiveness at W1 and fathers' depression at W2, and no longitudinal relations between these constructs. Additional research would clarify how mothers' and fathers' depression relates to their parenting behaviors and subsequent child outcomes (e.g., Paulson et al., 2009).

Moreover, the findings from the present study provide some supporting evidence for the notion that depressive symptoms in one parent during the perinatal period are related to the mental health and parenting of the other parent (e.g., Thiel et al., 2020; Paulson & Bazemore, 2010). In the present study, mothers' and fathers' depression predicted each other over time. These two findings align with concepts of family systems theory and reinforce the notion that parents' depression is a "family affair" (Letourneau, et al., 2012). For example, mothers' depression can not only impact their own dyadic relations with the child, but also the dyadic relations between other members of the family (e.g., father-child) and the family processes as a whole (Vakrat et al., 2018).

Despite previous conceptualizations and findings, little support emerged for relations between mothers' and fathers' depression and mothers' and fathers' acceptance/warmth or intrusiveness/restrictiveness. This absence of findings was

surprising because previous work has found relations between similar constructs. Previous meta-analyses and systematic reviews suggest parental depression to be concurrently related to generalist conceptualizations of parent-child interactions. That is, mothers' (e.g., Field et al., 2010) and fathers' depression (e.g., Cheung & Theule, 2019) tends to be negatively related to positive parent-child interactions and positively related to negative parent-child interactions. More specifically, previous work has found depressed mothers to be more likely to engage in intrusive (Herrera et al., 2004) and restrictive behaviors (Malphurs et al., 1996), while depressed mothers and fathers are less likely to exude parental warmth (Cummings et al., 2005).

I offer two potential explanations for the lack of findings in the present study. First, though the present study found no or few concurrent relations between parental depression and acceptance/warmth and intrusiveness/restrictiveness, these relations may unfold over time similar to the findings between mothers' earlier depression and later supportiveness. Though much of the previous work has found concurrent relations between parental depression and acceptance/warmth and intrusiveness/restrictiveness, few studies have examined these constructs longitudinally. It may be that bidirectional relations exist between these constructs. Similar models have been tested finding child-driven associations between maternal depression and child behavior problems (e.g., Curci et al., 2022). Thus, it may be that engaging in lower quality parent-child interactions with children relates to parents' later depressive symptoms. Additional work is needed to test this notion. Second, the absence of findings between parental depression and parental acceptance/warmth and intrusiveness/restrictiveness in the present study may be because of methodological differences as these parenting behaviors were only captured during a four-minute observation period at each wave. This may not

have been enough time to gather a clear understanding of typical interactions between parents and their children. This issue is discussed further in the limitations section.

Altogether, the present study provided some support for previous conceptual and empirical work regarding relations between parental depression and parenting-child interactions. Several relations emerged in the bivariate correlations both within and across time. Further, two longitudinal relations emerged in the main analyses. The longitudinal findings from the present study suggest that even when controlling for fathers' depression, previous levels of parent-child interactions, and covariates, mothers' depression at 6-months (W1) is negatively related to mothers' and fathers' supportiveness at 18-months (W2). In sum, it appears that mothers' depression when children are 6-months old has a lagged effect on her own and her partners' supportiveness.

Relations between Aspects of Parent-Child Interactions (Parental Acceptance/Warmth, Supportiveness, Intrusiveness/Restrictiveness) and Children's Language Development

As previously stated, there was mixed support for my third hypothesis that mothers' and fathers' acceptance/warmth, supportiveness, and intrusiveness/restrictiveness would be related to children's language development. At the bivariate level, several relations indicated mothers' and/or fathers' acceptance/warmth and supportiveness were positively related to aspects of children's expressive language. When longitudinal relations were examined using SEM two findings emerged. Mothers' acceptance/warmth and fathers' supportiveness at 18-months (W2) were positively related to children's expressive language at 30-months (W3).

Conceptually, parent-child interactions are considered to be a key social context for encouraging and scaffolding healthy language development (e.g., Hoff, 2006; Vygotsky, 1978). Several studies in the literature support this notion as positive parenting behaviors tend to be positively related to children's language abilities, and negative parenting behaviors tend to be negatively related to children's language abilities (Barnett et al., 2012; Madigan et al., 2019; Pungello et al., 2009; Tamis-LeMonda et al., 2009; Vernon-Feagans et al., 2012). However, in the present study, when examined in the hypothesized model, only some support of this notion emerged. The conceptualization and methods used to account for aspects of parent-child interactions in the present study differed somewhat from those in other studies. In addition to using a new coding scheme for these aspects of parent-child interactions, the data in the present study did not give rise to the same dimensions as those in previous studies using this measure. In fact, as described in the results, several variables were coded infrequently yielding a slightly altered conceptualization of acceptance/warmth, supportiveness, and intrusiveness/restrictiveness. The methodology for capturing parent-child interactions is discussed further in the limitations section.

An interesting contribution of these two findings is that they speak to more recently conceptualized ideas that mothers' and fathers' interactions with their children serve different functions (Newland et al., 2013; Owen et al., 2013). Specifically, some scholars posit that fathers tend to support children's exploration through play and scaffold children as they experience new or challenging situations while mothers tend to provide emotional support and security (Grossman et al., 2002; Paquette, 2004). Though previous empirical work has primarily focused on mothers, more recent studies have found fathers to play a unique role in the development of children. For example, in one study, fathers' supportiveness was found to play a unique role in children's cognitive

and language development distinct from mothers' supportiveness (Cabrera et al., 2007[b]; Varghese & Wachen, 2016). Yet currently, it is unclear whether the effects of mothers' and fathers' interaction quality, attachment, or parenting behaviors on children's development is additive (Roskam et al., 2014; Towe-Goodman et al., 2014) or interactive (Kochanska & Kim, 2013; Martin et al., 2007). The present study supports the idea that mothers' and fathers' parenting behaviors have unique influences on children's language development. That is, mothers' comforting and encouraging behaviors (i.e., acceptance/warmth) and fathers' use of descriptive language or following the signals and actions of the child (i.e., supportiveness) at 18-months (W2) are positively related to children's expressive language at 30-months (W3). Additional work is needed to explore these family dynamics and examine the unique, additive, and/or interactive effects that mothers' and fathers' parenting behaviors have on different domains of child development.

Parent-child Interactions as Mediators of the Relations between Mothers' and Fathers' Depression and Children's Language Development

As stated previously, results did not support my fourth hypothesis that parent-child interactions would mediate the relations between mothers' and fathers' depression and children's language development. Scholars have hypothesized parent-child interactions to be a potentially important mediating mechanism of the negative relations between parental depression and children's language development (e.g., Ahun & Côté, 2019; Bornstein & Tamis-LeMonda, 2001). This conceptualization results from empirical work showing that depressed mothers and fathers struggle to engage in optimal parenting behaviors while being more likely to engage in interrupting or disruptive parenting behaviors (e.g., Martin et al., 2007; Wilson & Durbin, 2010). Further, these parenting behaviors have been found to play a role in children's language development

(e.g., Madigan et al., 2019; Pungello et al., 2009). Broad theories of risk transmission (i.e., Goodman & Gotlib, 1999) provided additional framework for these hypotheses as children of depressed parents are more likely to be exposed to negative affect, cognitions, and behaviors during parent-child interactions. Hence, parent-child interactions were conceptualized and tested as mediators of the relations between parental depression and children's language development.

Two previously reviewed studies addressed research questions related to the present study. Stein and colleagues (2008) found longitudinal relations between mothers' depression during the postnatal period and children's language development at 36-months. Further, they found maternal caregiving (a latent variable of responsivity and opportunities for learning in the home) to mediate these relations. In contrast, Justice and colleagues (2019) found no relations between mothers' depression between 4- and 7-months postpartum and children's language development at 24-months and thus, no evidence of mediation was detected. The findings of the present study parallel those of Justice et al. (2019) as I found no longitudinal relations between parental depression and children's language development and no evidence of mediation. Given no direct relations were found between parental depression and children's language development (i.e., Hypothesis 1), it was unlikely indirect relations would be detected (i.e., Hypothesis 4). Altogether, the absence of these hypothesized findings in the present study do not support previous conceptualizations of these relations.

There are at least two possible methodological reasons the findings from the present study did not support current theory and the findings of Stein and colleagues. First, how much the measures of parent-child interactions overlap across these studies is worth discussing both in regards to specific conceptualizations and methods. For example, in the present study, I focused on the acceptance/warmth, supportiveness, and

intrusiveness/restrictiveness aspects of parent-child interactions, whereas Justice et al. (2019) measured parent-child dysfunctional interactions and Stein et al. (2008) measured maternal caregiving. One could argue that there is sufficient overlap amongst the constructs measured across these three studies, however, this assumption requires additional research and clarification. Another explanation could be the type of measurement used to capture parent-child interactions. Stein and colleagues (2008) used a combined measure of "maternal caregiving" using data from surveys (stimulation activities) and observations (responsivity, home environment) while Justice and colleagues (2019) used a mother-reported survey of parent-child dysfunctional interactions. One could suggest that the inclusion of observations of the actual parent-child interactions may be a more reliable and valid assessment, thus leading one to be more likely to trust the findings of Stein and colleagues (2008). However, there are limitations to the parent-child interaction measure in the present study (to be discussed later), I utilized observational data of several aspects of parent-child interactions and found findings inconsistent with those of Stein et al. Thus, how parent-child interactions are conceptualized and measured requires further consideration when examining this research question.

Second, it may be that the population sampled might explain these contrasting findings. In the present study, an economically diverse community sample was recruited from a city in the Mountain West region of the United States by stratifying participants by family income. Stein and colleagues (2008) recruited a larger community sample from two regions in England, resulting in an economically diverse sample that allowed for multiple-group comparisons between lower SES and non-lower SES families. As discussed previously, maternal caregiving was found to mediate the relations between parental depression and children's language development for both lower SES and non-

lower SES families. In fact, the effects of the relations between maternal depression and maternal caregiving were stronger for families in the lower SES group. In contrast, Justice et al. (2019) recruited children born into low-income families in a Midwestern city of the United States and found no evidence of mediation. Clearly more research is needed to clarify these findings or absence of findings.

Limitations

Despite the findings and contributions of the present study, there are a number of limitations. First, the sample for the present study may not have been ideally suited to examine these research questions. The data used for the present study was from a community sample with lower rates of depression compared to clinical or more targeted samples used in other studies. Indeed, only 15-16% of mothers (M = 6.09 – 6.31; SD = 4.39 - 4.60) and 13% of fathers (M = 5.52 - 5.72; SD = 4.07 - 4.31) reported having clinical levels of depression (> 9 summed scores) in the one week preceding their survey reports at 6-, 18-, and 30-months postpartum. This lack of variance likely attenuated the relations between parental depression and other constructs which formed the basis of several key hypotheses. In other words, there simply may not have been enough "depression" amongst the mothers and fathers in my sample to detect existing relations between parental depression and children's language development. In addition, upon examining the correlations between these constructs further, several of the bivariate associations between mothers' and fathers' depression and children's AVA scores were marginally significant. Though speculative, this may indicate that if these constructs were examined using a more targeted sampling approach toward parents at higher risk for depression, results may have indicated relations between these constructs. Additional work is needed to test this assertion.

Relatedly, one could argue that our examination of mothers' and fathers' depression as a continuous (rather than dichotomous) variable may have affected our results. The literature is mixed as to how to approach this construct, as previous studies have dichotomized parental depression using clinical thresholds corresponding to the specific measure (e.g., Ahun et al., 2017; Valla et al., 2016) while others have used a continuous variable to represent depressive symptoms (e.g., Peterson et al., 2019; Stein et al., 2008). However, as shown from the results of my final SEM model compared to my dichotomous depression sensitivity analyses, dichotomizing these variables appears to reduce variance, thereby attenuating results further. Additional work is needed to suggest best practices as to which approach (i.e., continuous or dichotomous) is more useful in examining this research question.

In addition, given the mixed support of the notion that children of depressed parents are more likely to struggle in their language development (e.g., Baydar et al., 2014; Clifford et al., 2021; Kaplan et al., 2014) future work is needed to clarify moderating variables in these relations such as the child's age of exposure to parent's depression, the severity and chronicity of depression, or other contextual variables (e.g., SES; Clifford et al., 2023; Stein et al., 2008).

Furthermore, one potential explanation for the absence of findings relating to hypotheses 2, 3, and 4 is the methodology used to capture mothers' and fathers' parent-child interactions. In the present study, mothers and fathers engaged in separate four-minute free play sessions with the child that were recorded and coded. While this recording occurred during home visits where the child would theoretically be the most comfortable and capture typical parent-child interactions, this method may have some limitations. A four-minute play session may not adequately represent the typical interactions between the parents and child. In other words, generalizing the typical

parent-child interactions from a four-minute observation period may be too big of a stretch for the aspects of interactions of interest for the present study. For example, parental intrusive or restrictive behaviors may occur less frequently and be driven by the behavior of the child, making them less likely to be coded during the four-minute windows of observation. Moreover, though captured in the home environment, the presence of researchers and new toys and equipment may have led to unnatural or atypical interactions between the parent and child. For example, parents may have behaved differently with their child compared to how they would typically because of the presence of the researchers. The low occurrence of intrusiveness/restrictiveness coded during these observation periods may be evidence of this atypical behavior (see Table 3) or of an insufficient length of observation, ultimately leading to little variation in these variables and potentially attenuating relations. Yet, it is also plausible that intrusive and restrictive behaviors occur at a lower rate compared to other parenting behaviors. Relatedly, children may have behaved differently than they normally would as a result of this potential change in the parents' behavior and/or because of the novel toys and equipment in the environment. As a result, though we followed the procedure for this measure in the present study, the variables used to account for acceptance/warmth, supportiveness, and intrusiveness/restrictiveness varied from previous studies using the same measure. Other methodology for capturing parent-child interactions would clarify these findings as some measures may more adequately capture these constructs depending on the type of interaction and the age of the child. Future work should also consider the findings that more specific parenting behaviors appear to be more potent predictors of language ability instead of more general parenting behaviors (Hirsh-Pasek et al., 2015; Topping et al., 2013).

Third, unlike the majority of previous studies (see Brookman et al., 2020 and Clifford et al., 2021 for exceptions), the present study used an observational measure of children's expressive language in the home using a home recording device worn by the child (i.e., LENA). The aim of using this methodology was to more precisely tap into children's language abilities in an environment that is natural and familiar to them. Other work has primarily used researcher-led assessments or parent-reported language measures that can be biased (e.g., Choe et al., 2020; Ibanez et al., 2015). It may be that LENA better captures children's actual expressive language abilities and, in these data, demonstrate no relations between parental depression and children's expressive language. However, it is also plausible that this measure did not accurately capture children's expressive language development. Recent efforts have been made to validate the accuracy and reliability of LENA, finding strong associations between LENA measures and other established measures (e.g., Cristia et al., 2021; Richards et al., 2008; Wang et al., 2020). However, additional measurement work is needed to ensure LENA and other measures accurately capture what researchers refer to as children's expressive language.

Future Directions

Given the body of empirical research examining relations between these constructs independently (i.e., parental depression and parent-child interactions; parent-child interactions and language development) and theories of mechanism suggesting indirect relations between parental depression and children's language development, future work on this topic can pursue several directions. First, though parent-child interactions were conceptualized to mediate the relations between parental depression and children's language development in the present study, other plausible mechanisms should continue to be considered. For example, previous work has found

other variables to mediate the relations between parental depression and children's language and cognitive development (Ahun & Côté, 2019) including parent-child reading behaviors (Paulson et al., 2009), parenting stress (Fredriksen, et al., 2019) and language/cognitive stimulation activities (Chapin & Altenhofen, 2010; Zajicek-Farber et al., 2009). Though the present study found no evidence of mediation, additional work in this direction is needed considering ecological approaches where several environmental factors are considered within the same model.

Second, though much of the previous literature has focused on mothers' depression and interactions with the child, despite conceptual work (e.g., Cabrera et al., 2014) suggesting fathers to play a unique role in the development of children. This theoretical work, coupled with recent empirical studies showing paternal but not maternal mental health, to relate to children's language development highlights the need for studies incorporating multiple parents or caregivers. For example, when accounting for both mothers' and fathers' depression and literacy activities with the child, Paulson et al. only found relations between fathers' depression, literacy activities, and children's language development (2009). Further, accounting for both mothers' and fathers' depression and parenting stress in relation to children's later language development, Fredriksen and colleagues only found these hypothesized relations for fathers (2019). Clearly additional work examining a more complete dynamic of the family environment is necessary as previous studies show that both mothers' and fathers' mental health and parenting behaviors play a role in children's development (e.g., Tamis-LeMonda et al., 2004; Volling et al., 2019). Moreover, as found in the current study (i.e., mothers' acceptance/warmth and fathers' supportiveness), the roles of each parent appear to make unique contributions to the development of children's language (Cabrera et al., 2007[b]; Grossman et al., 2002; Paquette, 2004; Varghese & Wachen, 2016).

Third, focusing on relations between parental depression and children's language development, future work should clarify at what age and under what circumstances these constructs are related. As demonstrated in the present study, evidence of these constructs being related is inconclusive (e.g., Baydar et al., 2014; Clifford et al., 2021; Kaplan et al., 2014) and these relations appear to be moderated by the aspect of language being examined, the child age of exposure to parents' depression, and the severity and chronicity of depression (Clifford et al., 2023). In addition, given the prevalence of parental depression in some populations, such as those of lower SES (Gavin et al., 2015; Gelaye et al., 2016), confounding variables should be considered and incorporated in future studies.

Fourth, although alternative theories provide a framework for examining bidirectional relations between parent and child variables (e.g., Davidov et al., 2015), to my knowledge, no studies have examined the bidirectional relations between parental depression and children's language abilities. Similar approaches have been used to study the bidirectional relations between maternal depressive symptoms and child behavioral problems, finding child-driven bidirectional relations between these constructs (Curci et al., 2022). Moreover, other work has found bidirectional relations between children's language abilities and their home learning environments in that quality stimulation and support in the home was positively related to children's later language skills which was in turn positively related to later stimulation and support in the home (Bornstein et al., 2020). Though relations are marginal, I found some support for this notion when examining bivariate correlations between earlier expressive language and later parental depression (see Table 11). Thus, some evidence suggests that children's abilities in the behavioral and language domains have the potential to influence their parents' mental

health and their own learning environments. Future research should test the hypothesis that children's language abilities relate to parents' later reports of depression.

Conclusion

In the present study, I aimed to test the assertion that mothers' and fathers' depression was related to children's later language abilities and that various aspects of parent-child interactions would mediate these relations. Though several of my hypotheses were not supported or received varying levels of support, several contributions to the research literature emerged that have implications for research and practice. Taken together, my results indicate mothers' depression to be related to her own and her partners' parental supportiveness one year later and that specific aspects of parent-child interactions (i.e., mothers' acceptance/warmth; fathers' supportiveness) related to children's later expressive language.

With three waves of data from 6- to 30-months postpartum, I was able to examine these relations concurrently and longitudinally (controlling for previous levels of outcomes and covariates). Further, I was able to more comprehensively capture aspects of the family dynamic that have the potential to shape children's language development. To do so, I accounted for mothers' and fathers' depression and several aspects of both parents' interaction behaviors with their child. My findings indicated no relations between parental depression and children's language development. Thus, the results of the present study suggest that mothers' and fathers' depression during the postpartum period has little to no effect on children's language development with the exception of a negative bivariate correlation between mothers' depression at W2 and AVA scores at W2.

Lastly, in line with recently published findings (Vakrat et al., 2018), I found evidence that one parent's depression may relate to the other parent's parenting

behaviors over time. Hence, greater attention and care should be provided to new parents who are experiencing feelings of depression because this struggle not only has implications for the depressed parent but other aspects of the family dynamic such as the other parent's parent-child interactions. Relatedly, I found evidence supporting the notion that mothers' acceptance/warmth and fathers' supportiveness make unique contributions to children's language development. Though there are large variations in parenting behaviors depending on family composition and culture, my results suggest that multiple caregivers have unique contributions to offer children in encouraging their language development.

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APPENDIX A

TABLES

Table 1

Sociodemographic Characteristics of Sample.

Variable	Wave 1	Wave 2	Wave 3
Children[1]			
N	487	249	221
Age in Months (*M*, *SD*)	5.83 (3.50)	17.77 (3.66)	29.68 (3.73)
Sex (% female)	47%	50%	47%
Mothers			
N	497	447	434
Age in Years (*M*, *SD*)	31.07 (8.28)	-	-
Household Income[2]	7.68 (3.61)	6.72 (3.21)	7.97 (3.33)
Education[3]			
Not completed H.S.	15%	-	-
Completed H.S. or equivalent	28%	-	-
Some college	33%	-	-
Completed Bachelors' Degree	19%	-	-
Completed Graduate Degree	6%	-	-
Ethnicity			
White	70%	-	-
African American	8%	-	-
Latino or Hispanic	15%	-	-
Asian American	3%	-	-
Other	4%	-	-

Fathers

N	356	362	325
Age in Years (*M*, *SD*)	32.54 (7.31)	-	-
Household Income[2]	7.95 (3.19)	7.19 (2.89)	8.43 (2.88)
Education[3]			
Not completed H.S.	15%	-	-
Completed H.S. or equivalent	31%	-	-
Some college	36%	-	-
Completed Bachelors' Degree	13%	-	-
Completed Graduate Degree	5%	-	-
Ethnicity			
White	72%	-	-
African American	7%	-	-
Latino or Hispanic	15%	-	-
Asian American	0%	-	-
Other	5%	-	-

[1]*Ns* only includes children who were observed in the in-home assessments.

[2]Income reported on a scale of 1 = "less than, $10,000" to 12 = "more than $150,000."

[3]Education ranged from 1 = "no formal school" to 8 = "doctoral or professional degree." Smaller categories such as "master's degree" and "doctoral or professional degree" were combined.

Table 2

Depressive Symptoms Items from the CESD-Short form[1]

Item #	
1	I was bothered by things that usually don't bother me
2	I had trouble keeping my mind on what I was doing
3	I felt depressed
4	I felt that everything I did was an effort
5	I felt hopeful about the future (*reverse-coded*)
6	I felt fearful
7	My sleep was restless
8	I was happy (*reverse-coded*)
9	I felt lonely
10	I could not "get going"

[1]Center for the Study of Epidemiology of Depression – Short Scale

Table 3.

Descriptive Statistics of Study Variables

	M	*SD*	Skewness	Kurtosis	Data Range
M Depression W1	6.09	4.39	1.01	0.84	0-24
M Depression W2	6.10	4.60	1.20	1.22	0-22
M Depression W3	6.31	4.57	1.08	1.41	0-25
F Depression W1	5.62	4.07	1.10	1.10	0-20
F Depression W2	5.52	4.27	1.09	1.04	0-21
F Depression W3	5.72	4.31	1.34	2.37	0-25
M Acceptance/Warmth W1	6.37	1.91	-1.22	0.59	0-8
M Acceptance/Warmth W2	5.40	1.87	-0.46	-0.49	0-8
M Acceptance/Warmth W3	5.82	1.82	-0.55	-0.75	0-8
F Acceptance/Warmth W1	5.82	2.09	-0.71	-0.52	0-8
F Acceptance/Warmth W2	5.05	2.04	-0.41	-0.68	0-8
F Acceptance/Warmth W3	5.52	1.99	-0.63	-0.44	0-8
M Supportiveness W1	4.98	2.01	-0.40	-0.76	0-8
M Supportiveness W2	5.24	1.75	-0.46	-0.46	0-8
M Supportiveness W3	6.19	1.37	-1.06	1.39	0-8
F Supportiveness W1	4.08	2.04	-0.03	-0.93	0-8
F Supportiveness W2	4.55	1.91	-0.19	-0.87	0-8
F Supportiveness W3	5.98	1.49	-0.84	0.71	0-8
M Intrusiveness W1	0.92	1.26	1.88	4.07	0-7
M Intrusiveness W2	0.86	1.01	1.04	0.40	0-4
M Intrusiveness W3	0.78	1.16	2.34	8.36	0-8
F Intrusiveness W1	0.79	1.23	2.04	4.43	0-6
F Intrusiveness W2	0.98	1.15	1.43	2.21	0-6
F Intrusiveness W3	0.80	0.98	1.76	5.41	0-6
Child Vocalizations W2	29.76	28.52	0.80	-0.54	0-98
AVA W2	39.24	26.68	0.34	-1.05	0-99
VP W2	44.69	28.83	0.22	-1.10	0-99
Child Vocalizations W3	35.55	31.46	0.43	-1.23	0-99
AVA W3	41.73	29.26	-0.04	-1.28	0-97
VP W3	43.97	32.17	0.16	-1.19	0-100

AVA = Automatic Vocalization Assessment Score; VP = Vocal Productivity Score

Table 4.

Correlations between Mothers' Parent-child Interaction Behaviors

	1.	**2.**	**3.**	**4.**	**5.**	**6.**	**7.**	**8.**	**9.**	**10.**	**11.**	**12.**	**13.**	**14.**	**15.**	**16.**	**17.**	**18.**
1. M Acceptance/warmth W1	—																	
2. M Acceptance/warmth W2	.18**	—																
3. M Acceptance/warmth W3	.26***	.46***	—															
4. M Descriptive Language W1	.17***	.05	.06	—														
5. M Descriptive Language W2	.08	.30***	.12	.37***	—													
6. M Descriptive Language W3	.13	.23***	.10	.24***	.48***	—												
7. M Following Child's Lead W1	.14**	.11	.13	.73***	.30***	.20**	—											
8. M Following Child's Lead W2	.05	.26***	.18**	.27***	.68***	.43***	.30***	—										
9. M Following Child's Lead W3	.18**	.16*	.11	.24***	.30***	.45***	.25***	.41***	—									
10. M Maintaining/extending W1	.05	.11	.06	.39***	.24***	.21**	.40***	.20**	.14*	—								
11. M Maintaining/extending W2	-.01	.10	.02	-.03	.05	.08	.01	.10	.08	.045	—							
12. M Maintaining/extending W3	-.04	.07	.09	.15*	.00	.13	.10	.12	.00	.04	-.05	—						
13. M Harsh Criticism W1	-.04	-.14	-.03	.11*	.09	.06	.02	.02	.02	.00	-.06	.03	—					
14. M Harsh Criticism W2	-.08	-.05	-.06	.00	-.07	.01	-.05	-.10	.02	.01	-.04	-.03	.03	—				
15. M Harsh Criticism W3	-.06	-.03	-.08	.01	-.06	-.04	-.01	-.14*	-.13	-.03	-.07	-.04	.01	.15*	—			
16. M Intrusion/restriction W1	-.08	-.14*	-.10	-.14**	-.15*	-.22**	-.17***	-.12	-.01	-.09	.03	.00	.19***	.12	.03	—		
17. M Intrusion/restriction W2	-.10	-.12	-.10	-.10	-.09	-.20**	-.12	-.23***	-.12	-.11	-.02	-.06	.04	-.01	-.02	.14*	—	
18. M Intrusion/restriction W3	-.13	-.14*	-.27***	.03	-.09	-.10	-.05	-.16*	-.21**	-.12	-.01	.06	.04	.03	.07	-.02	.14*	—

***$p \leq .001$; **$p \leq .01$; *$p \leq .05$; +$p \leq .10$

Table 5.

Correlations between Fathers' Parent-child Interaction Behaviors

	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.
1. F Acceptance/warmth W1	—																	
2. F Acceptance/warmth W2	.26**	—																
3. F Acceptance/warmth W3	.37***	.26***	—															
4. F Descriptive Language W1	.15***	.14	.22*	—														
5. F Descriptive Language W2	.11	.26***	.06	.40***	—													
6. F Descriptive Language W3	.11	.10	.05	.23*	.33***	—												
7. F Following Child's Lead W1	.14*	.19*	.18*	.73***	.42***	.16+	—											
8. F Following Child's Lead W2	.12	.30***	.18*	.30***	.71***	.24**	.34***	—										
9. F Following Child's Lead W3	.12	.18*	.14+	.30***	.30***	.52***	.31***	.32***	—									
10. F Maintaining/extending W1	-.03	.03	.05	.32***	.15+	.02	.34***	.05	.16+	—								
11. F Maintaining/extending W2	-.02	.11	.02	.01	.10	.05	-.01	.02	.00	.03	—							
12. F Maintaining/extending W3	.19*	.08	.03	.11	.08	.15+	.12	.05	.12	.40***	.15+	—						
13. F Harsh Criticism W1	.02	.16+	.12	.14*	.15+	.01	.06	.09	.08	.11	-.06	.01	—					
14. F Harsh Criticism W2	.04	-.07	-.03	-.03	-.08	-.02	-.03	-.14+	-.08	-.09	-.04	.07	-.07	—				
15. F Harsh Criticism W3	-.04	.06	.02	.07	.02	.02	-.11	.00	-.13	.03	-.07	-.07	.12	.12	—			
16. F Intrusion/restriction W1	-.07	-.05	-.25**	-.02	-.12	-.16+	-.03	-.11	-.21*	.02	-.10	-.08	.01	.07	-.01	—		
17. F Intrusion/restriction W2	.04	-.05	-.06	-.09	-.13+	-.03	-.05	-.19*	-.05	.06	-.06	-.06	-.03	.20**	-.17*	.14+	—	
18. F Intrusion/restriction W3	-.12	.11	.04	.06	-.01	-.10	.05	-.06	-.15+	-.06	.14+	-.03	-.08	.23**	.33***	-.04	.18*	—

***$p \leq .001$; **$p \leq .01$; *$p \leq .05$; +$p \leq .10$

Table 6.

Rank-order Stability of Study Variables over Time

	W1-W2	W2-W3	W1-W3
M Depression	.58***	.64***	.53***
F Depression	.49***	.60***	.51***
M Acceptance/Warmth	.18**	.46***	.26***
F Acceptance/Warmth	.26**	.26***	.37***
M Supportiveness	.36***	.53***	.29***
F Supportiveness	.43***	.37***	.30***
M Intrusiveness/restrictiveness	.14*	.14*	-.02
F Intrusiveness/restrictiveness	.14+	.18*	-.04
Child Vocalizations	--	.36***	--
AVA	--	.24**	--
VP	--	.15+	--

AVA = Automatic Vocalization Assessment Score; VP = Vocal Productivity Score
$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$; $^{+}p \leq .10$

Table 7.

Correlations between Covariates and Children's Expressive Language

	Child Vocalizations W2/W3	AVA W2/W3	VP W2/W3
Household Income W1	.15*/.22**	.13+/.28***	.04/.13+
M Education W1	.14*/.18*	.10/.20**	.00/.11
F Education W1	.10/.11	.11/.07	.07/-.06
M Race/Ethnicity W1	-.14*/-.26***	-.02/-.22***	.04/-.23***
F Race/Ethnicity W1	-.14+/-.15+	-.06/-.18*	-.07/-.09
Number of Children in the Home W1	-.13+/-.15*	-.22**/-.16*	-.02/-.09
Care Outside the Home W1	.01/.07	.07/.09	-.02/.05
Care Outside the Home W2	.05/.05	.13+/.07	-.06/-10

W2 and W3 expressive language coefficients separated by / .
AVA = Automatic Vocalization Assessment Score; VP = Vocal Productivity Score
Race/Ethnicity "White" = 0 "Non-white" = 1; Care Outside the Home "Primary care only in the home" = 0 "Has primary care outside the home" = 1
$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$; $^{+}p \leq .10$

Table 8.

Correlations between Covariates and Mothers' and Fathers' Depression

	M Depression W1\W2\W3	F Depression W1\W2\W3
Household Income W1	-.13**/-.12*/-.06	-.08/-.05/-.10+
M Education W1	-.13**/-.09+/-.09+	.02/.04/.04
F Education W1	.00/-.08/-.04	-.06/.02/-.13*
M Race/Ethnicity W1	-.04/-.02/-.01	-.06/-.07/-.06
F Race/Ethnicity W1	.00/-.05/-.04	-.05/-.09/-.06
Number of Children in the Home W1	-.06/-.04/-.06	.03/-.06/.01
Care Outside the Home W1	-.10*/-.03/-.04	-.01/.03/.08
Care Outside the Home W2	-.05/-.03/.08	.07/-.02/.06

W2 and W3 mothers' and fathers' depression coefficients separated by / .
AVA = Automatic Vocalization Assessment Score; VP = Vocal Productivity Score
Ethnicity "White" = 0 "Non-white" = 1; Care Outside the Home "Primary care only in the home" = 0 "Has primary care outside the home" = 1
***$p \leq .001$; **$p \leq .01$; *$p \leq .05$; +$p \leq .10$

Table 9.

Correlations between Covariates and Mothers' Parent-child Interactions

	M Acceptance/Warmth W1/W2/W3	M Supportiveness W1/W2/W3	M Intrusiveness/restrictiveness W1/W2/W3
Household Income W1	.18***/.16*/.11	.24***/.30***/.37***	-.21***/-.16*/-.22**
M Education W1	.13**/.20**/.12^{+}	.35***/.29***/.32***	-.28***/-.23***/-.18**
F Education W1	.08/.08/.06	.14**/.11/.36***	-.20***/-.03/-.19*
M Race/Ethnicity W1	-.20***/-.16*/-.09	-.19***/-.21***/-.20**	.18***/.11^{+}/.13^{+}
F Race/Ethnicity W1	-.07/-.25***/-.16^{+}	-.14*/-.28***/-.25**	.09/.03/.10
Number of Children in the Home W1	-.02/-.15*/-.11	-.03/-.17**/.02	.07/.02/.05
Care Outside the Home W1	-.01/-.01/-.04	.12**/.05/.09	-.01/-.05/-.07
Care Outside the Home W2	-.05/.05/-.06	.09^{+}/.11^{+}/.11^{+}	-.04/.01/.08

W2 and W3 expressive language coefficients separated by / .
AVA = Automatic Vocalization Assessment Score; VP = Vocal Productivity Score
Ethnicity "White" = 0 "Non-white" = 1; Care Outside the Home "Primary care only in the home" = 0 "Has primary care outside the home" = 1
$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$; $^{+}p \leq .10$

Table 10.

Correlations between Covariates and Fathers' Parent-child Interactions

	F Acceptance/Warmth W1/W2/W3	F Supportiveness W1/W2/W3	F Intrusiveness/restrictiveness W1/W2/W3
Household Income W1	.03/.01/.08	.06/.18*/.28***	-.15**/-.14^{+}/-.10
M Education W1	.04/-.02/.05	.17**/.30***/.21**	-.15**/-.12/-.04
F Education W1	.11^{+}/-.06/-.07	.06/.12/.23**	-.08/-.11/-.05
M Race/Ethnicity W1	-.01/-.12/-.17*	-.08/-.21**/-.17*	.07/.05/.05
F Race/Ethnicity W1	-.00/-.15$^{+/}$-.25**	-.13*/-.30***/-.24**	.16**/.19*/.15^{+}
Number of Children in the Home W1	-.04/-.03/-.11	-.09/.01/-.05	.00/.07/.23**
Care Outside the Home W1	.01/-.05/-.06	.04/.11/.04	-.03/.12/.09
Care Outside the Home W2	-.00/-.08/-.08	.07/-.02/.13^{+}	-.02/.06/-.03

W2 and W3 expressive language coefficients separated by / .
AVA = Automatic Vocalization Assessment Score; VP = Vocal Productivity Score
Ethnicity "White" = 0 "Non-white" = 1; Care Outside the Home "Primary care only in the home" = 0 "Has primary care outside the home" = 1
$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$; $^{+}p \leq .10$

Table 11.

Correlations between Mothers' and Fathers' Depression and Children's Expressive Language

	Child Vocalizations W2/W3	AVA W2/W3	VP W2/W3
M Depression W1	-.05/-.07	-.12/-.13^{+}	.11/-.07
M Depression W2	-.10/-.08	-.17*/-.07	.01/.01
M Depression W3	-.12/-.06	-.13^{+}/-.07	.01/-.08
F Depression W1	-.06/-.02	-.14^{+}/-.10	-.08/-.03
F Depression W2	-.02/-.05	-.02/-.06	-.06/-.04
F Depression W3	-.08/-.02	-.15^{+}/-.15^{+}	-.04/-.12

W2 and W3 expressive language coefficients separated by / .
AVA = Automatic Vocalization Assessment Score; VP = Vocal Productivity Score
$^{*}p \leq .05$; $^{+}p \leq .10$

Table 12.

Correlations between Mothers' and Fathers' Depression and Parent-Child Interactions

	M Depression W1/W2/W3	F Depression W1/W2/W3
M Acceptance/Warmth W1	-.04/-.07/-.10^{+}	-.11*/-.13*/-.14*
M Acceptance/Warmth W2	-.06/-.07/-.02	.03/-.01/-.04
M Acceptance/Warmth W3	.05/.03/.02	-.01/-.03/.04
F Acceptance/Warmth W1	.07/.05/.04	-.03/-.04/-.02
F Acceptance/Warmth W2	-.07/-.03/-.03	.07/-.01/.11
F Acceptance/Warmth W3	-.10/-.07/.07	-.08/.04/-.06
M Supportiveness W1	-.06/-.05/-.04	-.04/-.08/-.04
M Supportiveness W2	-.16*/-.11^{+}/-.02	-.08/-.07/-.06
M Supportiveness W3	-.11/-.08/.00	-.08/-.06/-.04
F Supportiveness W1	-.03/-.04/-.02	.02/-.09/-.02
F Supportiveness W2	-.17*/-.05/-.02	.01/-.02/.04
F Supportiveness W3	-.19*/-.16*/-.14^{+}	-.12/-.14^{+}/-.14^{+}
M Intrusiveness/restrictiveness W1	-.01/.05/.05	.01/.03/-.03
M Intrusiveness/restrictiveness W2	.03/-.03/-.04	.07/-.13^{+}/-.09
M Intrusiveness/restrictiveness W3	.07/-.07/-.02	-.03/-.04/.02
F Intrusiveness/restrictiveness W1	.06/.05/.02	.07/.13*/.07
F Intrusiveness/restrictiveness W2	-.06/-.06/-.02	-.07/-.10/-.03
F Intrusiveness/restrictiveness W3	-.13/-.14^{+}/-.06	-.07/-.07/-.04

W1, W2, and W3 mothers' and fathers' depression coefficients separated by / .
AVA = Automatic Vocalization Assessment Score; VP = Vocal Productivity Score
$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$; $^{+}p \leq .10$

Table 13.

Correlations between Mothers' and Fathers' Parent-Child Interactions and Children's Expressive Language

	Child Vocalizations W2/W3	AVA W2/W3	VP W2/W3
M Acceptance/Warmth W1	.14*/.06	.02/.11	.12/-.01
M Acceptance/Warmth W2	.06/.20**	.04/.32***	.07/.23**
M Acceptance/Warmth W3	.13+/.13+	.13+/.27***	.11/.14*
F Acceptance/Warmth W1	.10/.02	.04/.01	.04/.04
F Acceptance/Warmth W2	.03/.10	.05/.13	.02/.14+
F Acceptance/Warmth W3	.03/.07	.02/.13	-.01/.05
M Supportiveness W1	.04/.12+	.05/.17*	.02/.13+
M Supportiveness W2	.24***/.24***	.08/.29***	.03/.20**
M Supportiveness W3	.20**/.22**	.05/.26***	-.03/.13+
F Supportiveness W1	-.05/.17*	-.02/.05	-.22*/.12
F Supportiveness W2	.26***/.28***	.17*/.30***	.00/.22**
F Supportiveness W3	.15+/.17*	.20*/.18*	-.01/.09
M Intrusiveness/restrictiveness W1	-.08/-.12	-.04/-.09	-.18*/-.07
M Intrusiveness/restrictiveness W2	-.05/-.07	.02/-.18*	-.10/-.12+
M Intrusiveness/restrictiveness W3	-.06/-.02	.05/-.16*	.08/-.00
F Intrusiveness/restrictiveness W1	-.08/.03	-.09/-.04	.10/-.02
F Intrusiveness/restrictiveness W2	-.05/-.04	-.04/-.02	-.03/-.03
F Intrusiveness/restrictiveness W3	-.12/-.04	-.01/-.13+	.02/-.07

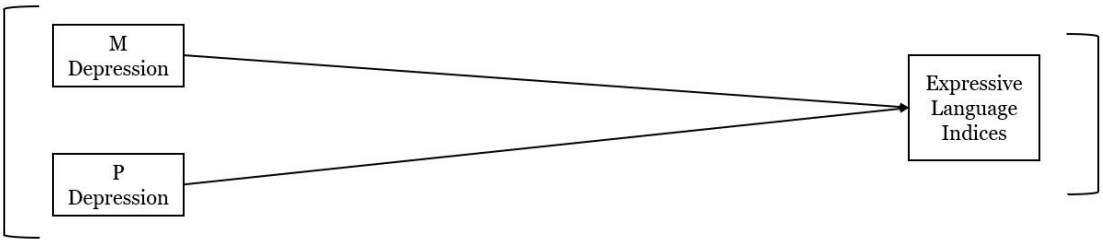
W2 and W3 expressive language coefficients separated by / .
AVA = Automatic Vocalization Assessment Score; VP = Vocal Productivity Score
$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$; $^{+}p \leq .10$

APPENDIX B

FIGURES

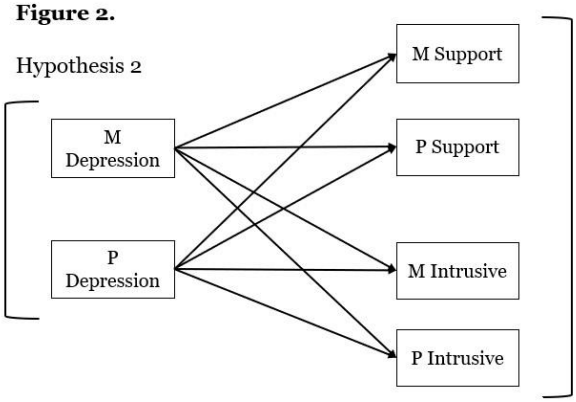
Figure 1.

Hypothesis 1



Note: M = Maternal, P = Paternal; For parsimony, the three separate expressive language indices are not displayed, nor are the covariates or autoregressive paths from study variables.

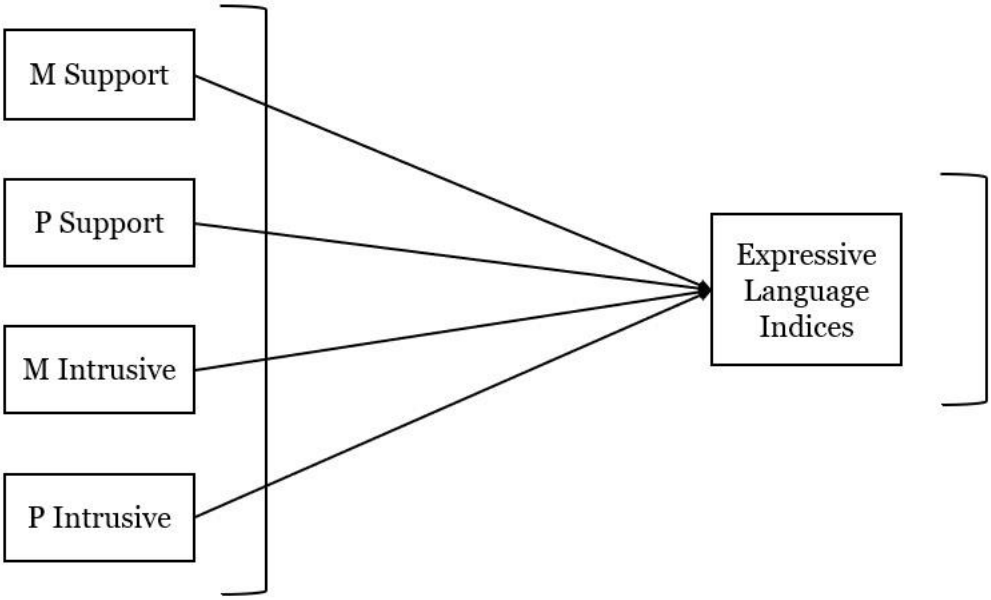
Figure 2.



Note: M = Maternal, P = Paternal; For parsimony, the covariates or autoregressive paths from study variables are not displayed.

Figure 3.

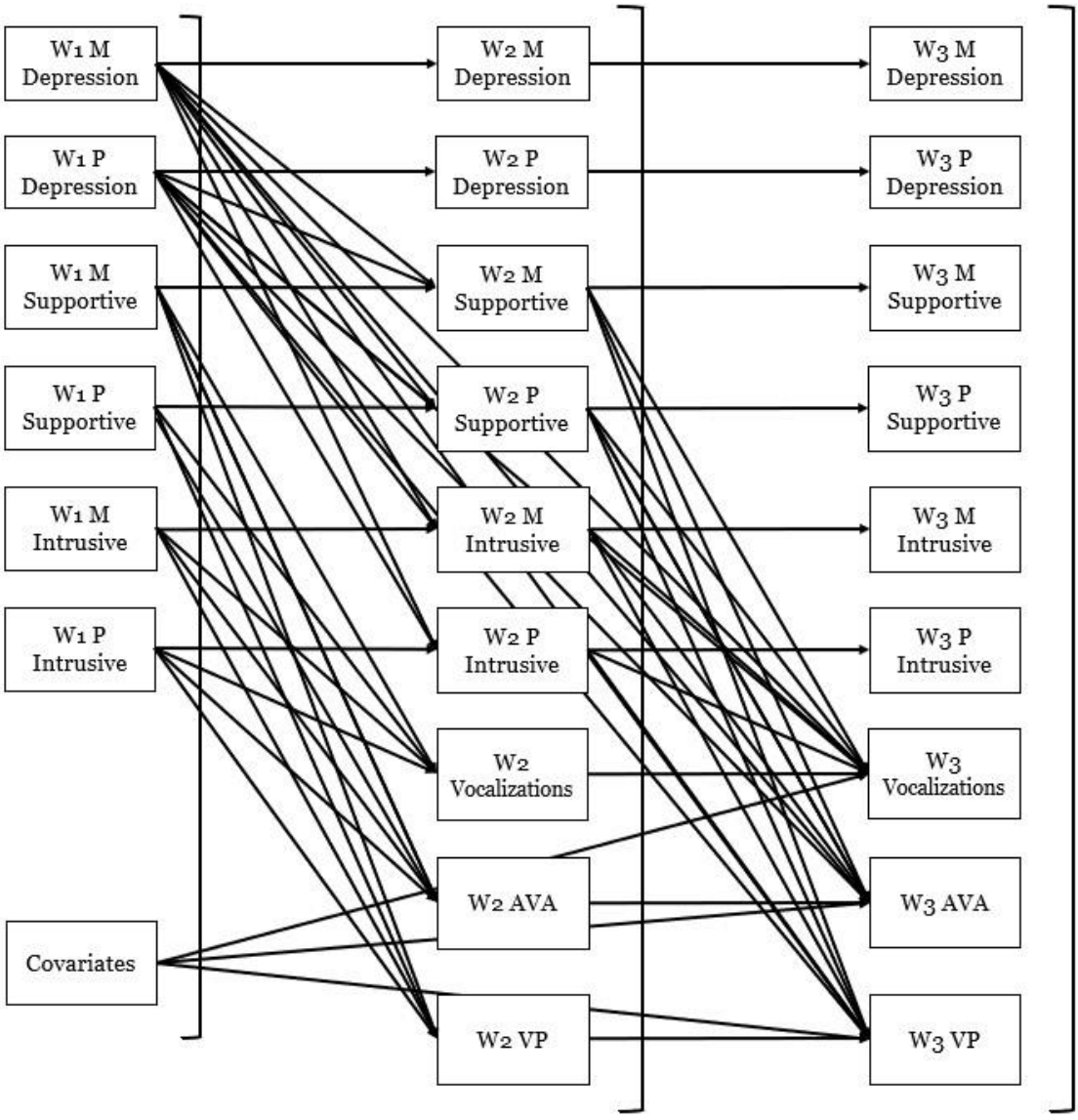
Hypothesis 3



Note. M = Maternal, P = Paternal; For parsimony, the three separate expressive language indices are not displayed, nor are the covariates or autoregressive paths from study variables.

Figure 4.

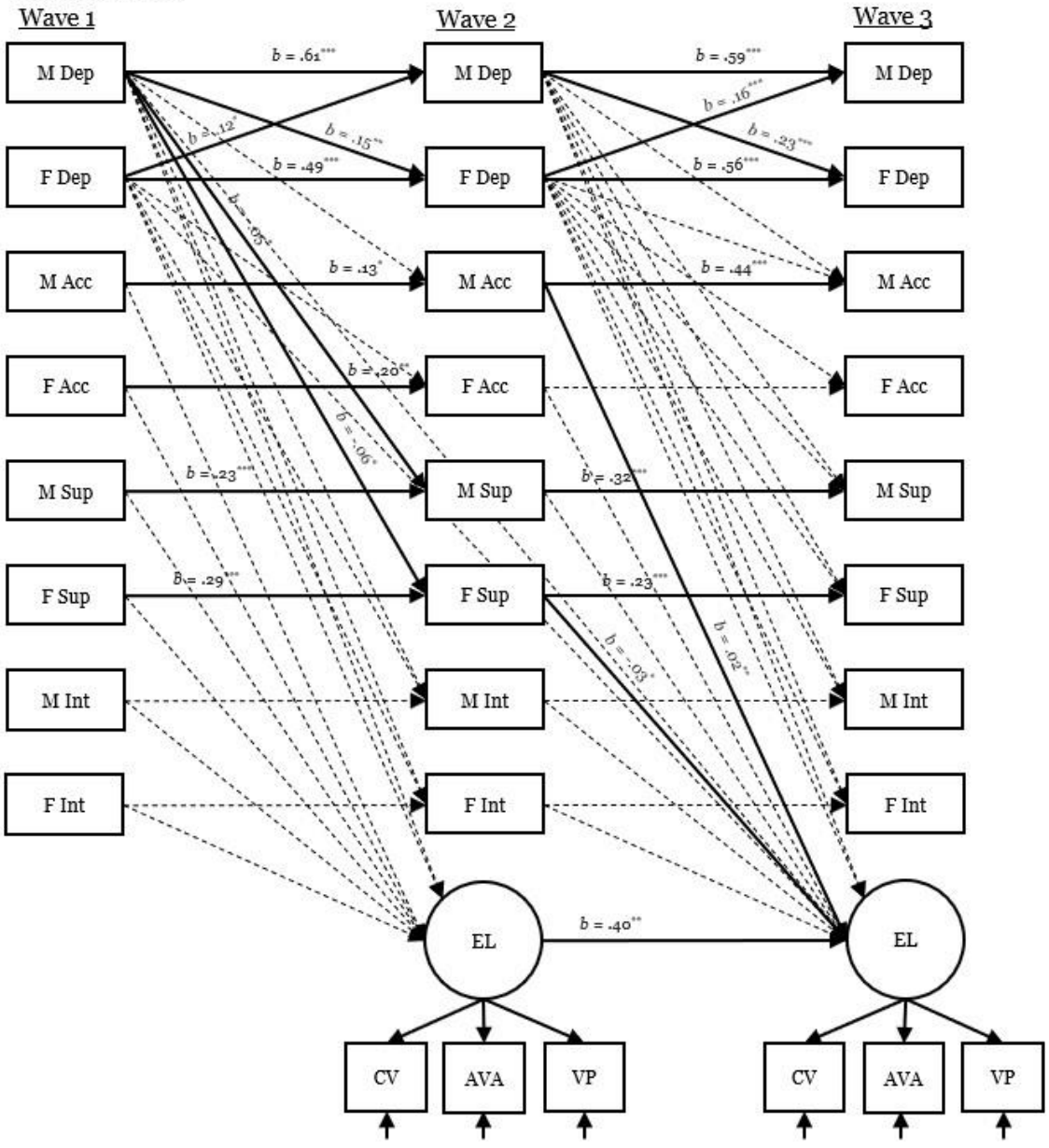
Mediation Model



Note. W1 = Wave 1; W2 = Wave 2; W3 = Wave 3; M = Maternal, P = Paternal; Supportive = Supportiveness; Intrusive = Intrusiveness; AVA = Automatic Vocalizations Assessment; VP = Vocal Productivity Score. Individual covariance paths between exogenous variables and between the errors of endogenous variables are not displayed for parsimony.
Covariates include: household income, maternal and paternal education, the number of children in the home, and caregiver ethnicity.

Figure 5.

Longitudinal relations between mothers' and fathers' depression, parenting practices and children's expressive language.



Note. W1 = Wave 1; W2 = Wave 2; W3 = Wave 3; M = Mothers', F = Fathers'; Dep = Depression; Acc = Acceptance/warmth; Sup = Supportiveness; Int = Intrusiveness/restrictiveness; Outcare = Care outside of the home; EL = Expressive Language; CV = Child Vocalizations; AVA = Automatic Vocalizations Assessment; VP = Vocal Productivity Score; # children = Number of children in the home.

Covariances between exogenous variables and between the residuals of endogenous variables are not displayed for figure clarity.

Covariates regressed on study variables (significant pathways are bolded):
-*M Dep W1* on household income, M education, outcare
-*M Dep W2* on household income
-*M Acc W1* on **household income** (b = .07; p = .03), M education, **M ethnicity** (b = -.68; p = .001)
-*M Acc W2* on household income, M education, M ethnicity, F ethnicity, # children
-*F Acc W1* on F education; *F Acc W3* on M Ethnicity, **F Ethnicity** (b = -.90; p = .04)
-*M Sup W1* on household income, **M education** (b = .50; p < .001), F education, M ethnicity, F ethnicity, outcare
-*M Sup W2* on household income, M education, M ethnicity, **F ethnicity** (b = -.66; p = .03), **# children** (b = -.19; p = .05)
-*M Sup W3* on household income, M education, **F education** (b = .22; p = .05), M ethnicity, F ethnicity, **# children** (b = -.15; p = .02)
-*F Sup W1* on **M education** (b = .35; p = .003), F ethnicity
-*F Sup W2* on household income, **M education** (b = .37; p = .01), M ethnicity, **F ethnicity** (b = -.84; p = .02)
-*F Sup W3* on household income, M education, F education, M ethnicity, F ethnicity
-*M Int W1* on household income, **M education** (b = -.23; p < .001), **F education** (b = -13; p = .05), M ethnicity; *M Int W2* on household income, **M education** (b = -.17; p = .02)
-*M Int W3* on **household income** (b = -.05; p = .05), M education, F education
-*F Int W1* on household income, M education, F education
-*F Int W2* on F ethnicity
-*F Int W3* on # children
-*EL W2* on household income, M education, M ethnicity, **# children** (b = -.03; p = .02)
-*EL W3* on household income, M education, **M ethnicity** (b =-.13; p = .007), F ethnicity, # children

$^{***}p \leq .001$; $^{**}p \leq .01$; $^{*}p \leq .05$