LANGUAGE DEVELOPMENT IN CONTEXT: INFLUENCES OF PERINATAL RISK AND ENVIRONMENTAL CHARACTERISTICS ON OUTCOMES AT 14 TO 36 MONTHS

By

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ABSTRACT

LANGUAGE DEVELOPMENT IN CONTEXT: INFLUENCES OF PERINATAL RISK AND ENVIRONMENTAL CHARACTERISTICS ON OUTCOMES AT 14 TO 36 MONTHS

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Research has emphasized the importance of the social context for understanding early language development. However, the extant literature lacks a single multivariate model that concurrently examines influences of the home environment, the dynamics of mother-child interaction (e.g., joint attention, negativity), maternal characteristics (e.g., education, mental health) and child risk factors (e.g., perinatal risk) on longitudinal language and cognitive outcomes during infancy.

Using data from the Early Head Start Research and Evaluation Project (EHSRE), collected at ages 14, 24, and 36 months, I hypothesized that (a) infants develop language abilities in the context of adult-mediated interactions, (b) child cognition facilitates language development, (c) the presence of environmental risk factors in the home and perinatal risk due to prematurity have negative impacts on language development, which are mediated by the mothers' mental health and education, and d) the relationships in the 14-month time period will be predictive of language outcomes at 24 and 36 months.

The EHSRE observed children and their parents at 17 sites across the U.S; I used a subset of the EHSRE sample (N = 2,245) comprising children who were native English speakers. The families were from middle to lower SES backgrounds with an almost even distribution among boys (N=1,141) and girls (N=1,104). To test my hypotheses I used Structural Equation

Modeling (SEM) via a multistep model-building approach. My 14-month model identified direct and indirect effects of perinatal risk, child cognition, joint attention, negative mother-child interaction, maternal mental health, and home environment on language outcomes. Furthermore, measures at 14 months successfully predicted language outcomes at 24 and 36 months. Thus, the direct and indirect influences of the home environment, mother-child interaction, as well as maternal characteristics and child risk factors at 14 months were highly predictive of language development outcomes at 14 months, and at time points extending into the preschool years.

The findings suggest the need for early interventions involving high-risk infants and their families, as child, maternal and environmental risk factors at the first year of life are strongly predictive of outcomes into the preschool years.

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Introduction

Overview

The purpose of the present study is to examine the role of various family and child influences on child language development in a national longitudinal sample of low-income children attending Head Start programs throughout the United States. In the United States, 41% of children live in low-income families with 19% below the federal poverty level. Family poverty and perinatal risk tend to be highly associated, with babies from poorer families having higher perinatal risk. These low income children are being reared in adverse circumstances that are contextually embedded and include high levels of family stress and family struggles. These children are at high risk for delays in language development, and consequently, at risk for academic difficulties. By examining how social and environmental factors predict individual differences in language-learning outcomes in a high-risk population, we might better understand which subgroups to target in early intervention.

Statement of the Problem

There is considerable research documenting how parenting behavior, maternal mental health, and the home environment impact language development, and a separate body of research showing impacts of perinatal risk on language development. However, no existing research examines how influences of parenting behavior, maternal mental health and home environment on language development differ for children with varying levels of perinatal risk.

Organization of the Remainder of the Study

In what follows, I will first review the literature on contextual factors of language development and on the role of maternal education, home environment, maternal mental health, perinatal risk, joint attention and maternal negativity on child language and cognitive outcomes.

After presenting the relevant literature, I will provide a summary of my research questions at the end of Chapter 2. Chapter 3 contains the methodology and procedures employed in the current study. The results of the study will then be presented in Chapter 4. Finally, Chapter 5 includes a summary of the findings of the study based on my specific research questions, theoretical and practical implications derived from the present research, and a discussion addressing my findings, limitations of the present research, and suggestions for future studies.

CHAPTER 2

Review of Related Literature

Contextual Frameworks

Bronfenbrenner's (1979, 1994) ecological model of child development suggested that all human interactions are context driven, and that these process-driven interactions are both proximal (e.g., the bi-directional relationship between the child and the home or school) as well as embedded in multiple distal processes (e.g., the parent's workplace, the media, and their more indirect relationships to the child's development) that interact and influence developmental outcomes. He called these processes systems, and emphasized that understanding children's development within an ecological framework involves a close examination of these multiple interacting systems (e.g., home, parenting, neighborhood characteristics, socioeconomic status (SES), cultural practices). According to this framework, the genetic predisposition of the child may or may not be actualized based on the types of environmental triggers that produce the transformation of genotypes to phenotypes. For example, social policies and programs, education systems, and political agendas might serve as catalysts that help individuals actualize unrealized capacities that are innately possessed but require the appropriate environmental conditions in order to be manifest (see Bronfenbrenner & Ceci, 1994). Bronfenbrenner's ecological framework provides a viewing lens of language development within the social context.

Vygotsky (1978) viewed adult guidance as an essential factor in child language and cognitive development (Luria, 1976; Vygotsky, 1978; Wertsch, 1985). Piaget (1926) and others (e.g., Werner & Kaplan, 1963) viewed the internalization of social activity as a mechanism of development, but it was Vygotsky and Luria who elaborated this theme and identified the shared problem-solving activity of child and adult as defining the primary framework for cognitive growth (see also Rogoff, 1987, 1990, 1993 as cited in Barocas, Seifer, Sameroff, Andrews & Croft, 1991). Vygotsky (1978) called the difference between what a child can do with adult help and what he or she can do without guidance the "zone of proximal development" (ZPD). This concept described how individual intellectual development originates in social interaction. Vygotsky maintained that the child follows the adult's example and gradually develops the ability to do certain tasks without help or assistance. He suggested that a basis for prediction of a child's future independent performance is found in the child's current performance with adult guidance (Vygotsky, 1978, 1986). Vygotsky’s sociocultural approach provides another framework in which the role of home and family factors in the development of language skills central to higher order intellectual functioning may be examined.

More recently, Racine and Carpendale (2007) have argued that the mother-child interactions are socio-emotional, context-driven and embedded in shared forms of activity such as the development of competence in joint attention. Racine and Carpendale emphasize that shared practices, such as imitation and joint attention, emerge as the child engages with others in socio-emotional contexts and provide a foundation for the development of language skills. This recent context-driven approach serves as a reframing paradigm for the current study, which examines multiple mother-child interactions, such as joint attention and parent-child negativity, and how these directly or indirectly influence the development of child language.

Biological and Environmental Risk in Relation to Child Language

With regard to risk as it relates to the development of language, we can draw from both biological and environmental conceptualizations. Generally, risk in language development has been operationalized in terms of a medical model that describes perinatal impediments such as prematurity and low birth weight as primary contributors to later language deficits. The problem with this medical model as identified by many developmental psychologists is that many children who are labeled “at risk” show no signs of negative or abnormal outcomes and demonstrate functional language skills, while other children have difficulties and lag behind normal levels. In an effort to explain this phenomenon, a number of studies (Furstenberg, Cook, Eccles, Elder & Sameroff, 1999; Sameroff, Seifer & Zax, 1982; Werner & Smith, 1989, 1992 as cited in Jewkes, 2004) have shifted their focus on an environmental model of risk that describes the influence of varying contextual factors on children’s development through different ages and outcomes. A common perspective in these studies is that they attempt to account for the complexities of the contexts in which children develop. The transactional model of child development developed by Sameroff and Chandler (1975) provides a solution to the problem of having negative developmental outcomes in children who did not have an onset of biological damage at birth. According to the transactional model of development, the teleological aspect of any developmental milestone is a function of the “transaction” between the three interacting and transforming constructs of mother/caretaker, environment and child. To predict an outcome, both the child’s individual characteristics and the characteristics of the environment must be accounted for (see Sameroff & Mackenzie, 2003). The study of environmental risk factors in language, cognitive and social development benefits from the simultaneous examination of multiple contextual risk factors. A child's social and intellectual competence is related to a group of factors that, in addition to biological factors, include the socioeconomic status (SES) of the family, stressful life events within a family, family size, and parental mental-health status. As the number of risk factors increases, children's intellectual and social performance decreases

(Barocas et al, 1991). Sameroff and Chandler (1987) and others (Cichetti & Schneider-Rosen, 1984) have argued that the developmental transactional model is the best way to study children at risk. In this framework, developmental risk factors are mediated by the adult caregiving context in early childhood. According to Sameroff and his colleagues (1998) and others interested in understanding the relationship between risk factors and development (Cicchetti & Cohen, 1995), the nature of risk factors is additive or cumulative, as well as interactive, and probabilistic rather than deterministic. The Rochester Longitudinal study (Sameroff, Bartko, A. Baldwin, C. Baldwin & Seifer, 1998) examined the role of risk factors on poor child outcomes in parents with mental illnesses. A single risk factor did not contribute to a negative outcome, but poorer developmental outcomes were reported as the number of risk factors increased (Sameroff et al., 1998). Another interesting observation was that children from a low socioeconomic background with parents with a minimal education fared more poorly than children from more advantageous backgrounds, even if the parents of those children had a mental illness. Thus, social context is particularly important and may have an effect on preexisting biological risk factors such as perinatal risk.

Guided by Bronfenbrenner’s, Vygotsky's and Sameroff’s perspectives, I developed a model in which the connection between perinatal risk, environmental risk in the home, and child attention and cognition could be evaluated with regards to the mediating influences of parental characteristics (parental mental health and parental negativity) and low-income infants’ language development. This model hypothesizes that (a) there are direct and indirect relationships between maternal education, home environment, maternal mental health, perinatal risk, maternal negativity, joint attention, child cognition and language outcomes, and b) these relationships at the first year of life remain predictive of language outcomes in later years. My review of the literature below focuses on factors to be tested in the present study.

Associations among Maternal Education, Home Environment and Child Language

With regards to research on the effects of the home on language development, Elardo and colleagues (1977) documented that enriched home environments were linked to higher language skills at different early childhood time periods (Elardo, Bradley & Caldwell, 1977). Murray and Yingling (2000) have shown that securely attached children from enriched homes have higher scores on measures of receptive vocabulary (Murray & Yingling, 2000). One of the more comprehensive models of preschool language development is presented by Jewkes (2004). More recently, Jewkes (2004) employed SEM to test the effect of the home environment on preschool language development. Jewkes (2004) demonstrated that there were direct and indirect relationships between the home environment, family income, marital status, ethnicity, maternal education and children's language development. The present study builds on existing SEM models such as Jewkes' model (2004) but incorporates a larger, low-income sample that accounts for influences of joint attention, perinatal risk and mother-child interactions on language outcomes. Using SEM as the main analytic technique, Bornstein and his colleagues (1989; 1998a; 1998b) have shown that child language outcomes are directly and indirectly influenced by maternal attitudes toward parenting, maternal personality, maternal knowledge of child development, and maternal vocabulary and verbal intelligence. In Japan, another study has shown that parent education and age at childbirth impact child developmental milestones (Lung, Shu, Chiang, Chen & Lin, 2009).

Maternal Mental Health in Relation to Child Language

In addition to effects of maternal education and the home environment on child language outcomes, there is also evidence of a relationship between maternal depression and child language development. The NICHD study (1999) reported that children of depressed mothers received less language input and consequently scored lower on measures of expressive and receptive vocabulary skills than did children of non-depressed mothers. Furthermore, maternal depression has been associated with poorer quality caregiving, especially in lower socioeconomic populations, and is predictive of poorer language outcomes (Stein, Malmberg, Sylva, Barnes & Leach, 2008). In addition, depressive symptoms have been associated with less frequent parent-to-child reading and poorer child expressive vocabulary (Paulson, Keefe, Leiferman, 2009). In another study, maternal mental health, along with age at time of birth and maternal education, had direct effects on children's development, evaluated at 6 to 18 months (Lung, Shu, Chiang and Lin, 2008).

Relationships among Perinatal Risk and Child Language Outcomes

In terms of perinatal risk, Guarini et al. (2009) showed that preterm birth continues to affect language development through the preschool years and beyond, highlighting continuity between pre- and peri-natal life and subsequent development. It is also documented that premature and low birth weight infants are at risk for language delays that may be part of a global deficit that impacts many areas of cognitive functioning and results in lower intelligence, poor academic performance and social isolation (Ortiz-Mantilla, Choudhury, Leevers, & Benasich, 2008; Potter, 2010). In addition, Marlow and colleagues (2005) have shown that for extremely preterm children, cognitive and neurologic impairment is common at school age (Marlow, Wolke, Bracewell, & Samara, 2005). Unfortunately, there is paucity of research that integrates the influences of maternal behavior and mental health, home environment, and perinatal risk (i.e., preterm birth and low birth weight) on child language outcomes, albeit evidence that shows relationships among these individual factors.

Although the above studies emphasize the importance of the social context for understanding the origin of later language development, we currently lack a single multivariate model that examines influences of multiple aspects of the home environment including maternal education and mental health characteristics, as well as child risk factors like perinatal risk on longitudinal language outcomes. In addition, the small, middle class samples in some of these studies present limitations in attempts to generalize the findings to at-risk populations.

The Role of Joint Attention in Child Language Outcomes

Carpenter, Nagell and Tomasello (1998) have emphasized the role of the mother in scaffolding the development of joint attention, as well as the relationship between joint attentional engagement and the child's comprehension and production of language. The acquisition of language is grounded in the development of shared forms of activity such as joint attention, which are naturally embedded in socio-emotional dynamics between mother and child (Farrant, Murray & Fletcher, 2011). Studies have found substantial variation in joint attention between mother-child interactions within low-income samples, which may account for variation in children's cognitive and language abilities (Dickinson & Tabors, 2001; Pan, Rowe, Singer & Snow, 2005; Rowe, Pan & Ayoub, 2005; Weizman & Snow, 2001). An example of this is the study of Tamis-LeMonda and her colleagues (2001) that showed that maternal responsiveness and joint attention during play predicted the timing of children's achievement of basic language milestones (Tamis-LeMonda et al., 2001). In another relevant study, Landry and her colleagues (2000) used a small low-income sample to determine the extent to which mother-child dynamics influence children's later social and cognitive independence. The results indicated that the ability of the mother to maintain the child's interest predicted increases in their child's competencies, which supported later social and cognitive independence. More recently, Farrant and colleagues (2011) investigated the relationships between socio-emotional engagement, joint attention, imitation, and language skill by establishing a model of these relationships in typically developing children and then testing that model in children with language impairments. Joint attention, socio-emotional engagement, imitation and language skill were all significantly related.

Structural Equation Modeling and Early Language Development

In the last two decades, significant methodological advances have been made in research studies of early experience and language development using structural equation modeling (SEM). A key feature of SEM is that it can draw connections between observed/measured variables and non-observed/latent variables that are more hypothetical in nature. SEM represents the structure of the relationships among these variables, which can be both exploratory and theoretically driven. SEM is a combination of statistical techniques similar to regression and path analysis, and models mathematical relationships that are theory driven and tested for their goodness of fit to the data.

Research Goals

The main goal of the present investigation, as guided by Jewkes' (2004) SEM model of preschool language development, is to test and specify direct and indirect influences of children's home environments, maternal education, maternal mental health and behavior, child characteristics on language abilities during infancy, and to understand how perinatal risk shapes this process among a national longitudinal sample of low-income families receiving services through the Head Start network. Secondly, but just as importantly, the goal of the present study is to predict whether the relationships present at the first year of life continue to exist in later years.

Research Questions

The following research questions are of interest: a) Are there direct or indirect relationships between, maternal education, home environment, maternal mental health, perinatal risk, joint attention, maternal negativity and child cognition and language outcomes? b) How can we further our understanding of language development by including all of these aspects in one model? c) And most importantly, do these relationships at the first year of life remain predictive of language outcomes in later years?

SEM features latent variables, which are constructs that are not observed such as "parental negativity" and "parental mental health," and are inferred from observed variables or the measures of the model. The analysis of this study was conducted using the AMOS 18.0 statistical software, which is one of a number of SEM software currently available. Usually, SEM is conducted when latent variables are derived from multiple indicators in a model and when two variables are indirectly related via a third mediator variable (Baron & Kenny, 1986). SEM is an appropriate analytic tool for this study, since it allows the use of multiple constructs, defined by multiple indicators, to be tested simultaneously in a single model. This increases the validity of the findings and allows for a more comprehensive view of language development during infancy. Using other methods of analysis would require several separate analyses and could result in less clear conclusions. In addition, SEM takes measurement error into account by including measurement error variables for each of the observed variables, which makes conclusions about relationships between constructs more reliable. The three data collection points for this study are 14 months, 24 months and 36 months. The large sample size of EHSRE (N= 3,001 children) allowed inclusion of numerous relevant contextual variables in one model, and the longitudinal nature of the study allowed me to draw conclusions about perinatal risk, experience gained through environmental exposure, and language development over the first three years of life.

CHAPTER 3

Methodology

Data and Sample

This longitudinal investigation employed the dataset of the Early Head Start Research and Evaluation Project (EHSRE). Approximately 3,000 children, their parents, and teachers in 17 sites across the U.S. participated in the study. Because I was interested in predicting language outcomes from infancy into later years, I used a sub-sample for this study (N = 2,263) comprising children who were native English speakers. For models at 24 and 36 months, smaller sub-samples comprising children with language outcomes, at 24 and 36 months respectively, were used. The families were from lower-to-middle to lower SES backgrounds with an almost even distribution among boys (N=1,141) and girls (N=1,104), not reported (N=18). See Table 1 for a detailed summary of the demographic characteristics of the sample.

Procedure

In an effort to observe interactions and obtain information regarding the sample's developmental outcomes, day care and home visits were conducted when the children were 14, 24 and 36 months old.

Measures

The EHSRE dataset includes assessments of children's language, cognitive, socioemotional, and physical development; parent and teacher interviews and questionnaires; and videotapes of maternal-child interactions. The related measures of interest are briefly described below; additionally, we describe how these measures were used to construct the latent variables used in the SEM.

The Home Observation for the Measurement of the Environment (HOME). The HOME survey (Caldwell & Bradley, 1984) measures the quality of stimulation and support available to a child in the home environment. The focus is on the child as the active learner and participant in events and interactions involving physical objects, as well as emotional and verbal stimulation within family surroundings. The Infant/Toddler (IT) HOME is designed for use between birth and age three. It comprises 45 items divided into six subscales: 1) Parental Responsivity, 2) Acceptance of child, 3) Organization of the Environment, 4) Learning Materials, 5) Parental Involvement, and 6) Variety in Experience. Each home environment aspect measured in these subscales includes both observed and self-report items. For example, HOME Support of Language and Learning/Learning and Literacy Stimulation is a 13-item subscale including both observed and self-report items about the availability of toys and reading materials, parent-child verbal and literacy interaction, and parental encouragement of learning in several domains. It measures the breadth and quality of the mother's speech and verbal responses to the child during the home visit, as rated by the interviewer; whether the parent encourages the child to learn shapes, colors, numbers, and the alphabet; the presence of books, toys, and games accessible to the child; and whether the parent reads to the child several times per week. Items are obtained by a combination of parent report and interviewer observation. The maximum potential score is 13. An example of items is, "the child has at least 10 children's books" and "parent answers child's questions or requests verbally." The IT version of the HOME was used at 14 months to predict language development outcomes at 14, 24 and 36 months. The latent variable "Home" was measured by the following subscales: Language and Cognitive Stimulation, Verbal and Social Skill and Emotional Response.

The Center for Epidemiological Studies-Depression Inventory (CES-D). The CES-D (Radloff, 1977) measures symptoms of depression using a 20-item scale. It does not indicate a diagnosis of clinical depression, but it does discriminate between depressed patients and others. Symptoms include poor appetite, restlessness, feelings of loneliness, sadness, and lack of energy. Respondents were asked the number of days in the past week they had a particular symptom. The CES-D administered at 14-months was used as a predictor in the model.

The Parenting Stress Index-Short Form (PSI-SF). The PSI-SF **(**Abidin, 1995) measures the degree of stress in parent-child relationships stemming from three possible sources: the child's temperament, the possibility that the parent is depressed, and negative reinforcement of parent-child interactions. The two subscales included in the PSI-SF are Parent-Child Dysfunctional Interaction and Parental Distress. Parent-Child Dysfunctional Interaction measures the parent's assumption that the child does not comply with the parent's expectations. The parent may feel that the child is abusing or rejecting or taking advantage of the parent, or the parent may feel disappointed in or alienated from the child. Parental Distress measures the level of distress that the parent is experiencing in his or her parental role as a result of personal circumstances, self-esteem regarding parental competence, depression and lack of social support. Responses were coded on a 5-point scale ranging from "Strongly agree" to "Strongly disagree." Examples of items include "Most of the time you feel that your child does not like you and does not want to be close to you" and "You feel trapped by your responsibilities as a parent."
The latent variable "Maternal Mental Health" was measured by the CES-D Total Score and PSI-SF.

Maternal education. Mothers selected their highest educational attainment by selecting one of three possible choices: attended some high school, obtained a high school degree/GED, obtained a degree higher than high school or GED diploma. Maternal education was an observed variable.

Gestational Age. Children's perinatal risk was measured by gestational length. Children who were born prematurely were considered to be at risk. Gestational age was an observed variable.

Three-bag Assessment. The 3-bag experiment involves a semi-structured play procedure where the parent and child are given three bags of interesting toys and asked to play with the toys in sequence. The semi-structured play task was videotaped, and child and parent behaviors were coded by child development researchers according to strict protocols. Scores were assessed on a seven-point scale, "1" indicating a very low incidence of the behavior and "7" indicating a very high incidence of the behavior. This assessment was adapted for this evaluation from the Three Box coding scales used in the NICHD Study of Early Child Care (NICHD Early Child Care Research Network, 1999). The 14 month scales were based on the "Early Head Start 14-month Child-Parent Interaction Rating Scales for the Three Bag Assessment" (Ware, Brady, O'Brien, and Berlin, 1998), the NICHD Study of Early Child Care 14-, 24-, and 36-month ratings of Parent-Child Interaction, and the "Manual for Coding Freeplay - Parenting Styles from the Newark Observational Study of the Teenage Parent Demonstration" (Brooks-Gunn et al., 1992). These measures compiled two latent variables: "Negative Interaction and "Joint Attention." Negative Interaction was measured by Parent Negative Regard of the Child, Parent Intrusiveness, and Child Negativity toward Parent. Joint Attention was measured by Child Sustained Attention and Child Engagement of Parent.

Bayley Scales of Infant Development-Second Edition. The Bayley Scales of Infant Development (BSID; Bayley, 1993) measure mental and motor development in infants from one to 42 months of age. The BSID are used to describe the current developmental functioning of infants and to assist in diagnosis and treatment planning for infants with developmental delays or disabilities. The test is intended to measure a child's level of development in three domains: cognitive, motor, and behavioral. The Mental Development Index (MDI) measures the cognitive, language, and personal-social development of children under age 3 ½ (Bayley, 1993). The Bayley MDI was an observed variable at 14 months. The Bayley Language Factor Score was used as one measure of the latent variable “Child Language” at 24 months. The Bayley two-factor reasoning scale was used as one measure of the latent variable “Child Language” at 36 months.

MacArthur-Bates Child Development Inventories (CDI). The CDI (Fenson, Dale, Resnick, Thal, Bates, Hartung, Pethick & Reilly, 1993) is a standardized parent reporting system used to assess children’s lexical growth. The CDI comes in two scales: the infant scale (covering the period from 8 to 16 months) and the toddler scale (from 16 to 30 months). The infant scale looks at comprehension, word production, and aspects of symbolic and communicative gesture use. The toddler scale examines word production and the early phases of grammar. The CDI requires parents or caretakers to report on their children’s progress through parent-child observations. For the infant scale, during these observation sessions the parents/caretakers match words comprehended and spontaneously produced by the children in separate columns. For the toddler scale, the parents/caretakers match the number of words repeatedly produced by the children with those on the CDI scale.

The Peabody Picture Vocabulary Test-Third Edition (PPVT-III). The PPVT-III (Dunn & Dunn, 1997) is an untimed intelligence test that measures the child’s receptive language skills, verbal ability, and scholastic aptitude. The test is given verbally and takes about

20-30 minutes. The examiner presents four pictures at a time to the child and then the child is asked to point to the picture that matches a word spoken aloud. The PPVT-III was normed for ages 2-90 years. The items administered depend on the respondent's chronological age.

Latent Variable for Child Language. I used different measures at each age for the latent variable "Child Language'. At 14 months, it consisted of the MacArthur CDI Early Gestures, Vocabulary Production and Vocabulary Comprehension measures. At 24 months, it comprised the CDI Vocabulary Comprehension and Production measures along with the Bayley Language Factor Score measures. At 36 months, it comprised the PPVT total score along with the Bayley two-factor reasoning score.

CHAPTER 4

Results

Data Transformation and Analysis Plan

I first conducted Shapiro-Wilk tests of normality on all frequency scores. Next, I performed square root transformations on all of the relevant frequency scores in order to adhere to normality assumptions in structural equation modeling. In order to address the research questions I have listed above, a preliminary path analysis was conducted to identify whether there was a good fit for the structural aspects of the model, which included only the latent variables, and any observed variables that were not used in creating a latent variable. Secondly, the statistical technique of structural equation modeling (SEM) was used in order to test and identify the direct and indirect influences of home environment, maternal mental health, maternal education, perinatal risk, joint attention as well as negative interaction and child cognition on children's language outcomes. The order of presentation is as follows:

First, I provide descriptive statistics regarding the demographic variables in the study, as well as the indicator variables included in my model and how I used them to develop the constructs of interest. Second, I describe my data analytic approach including the use of the measurement model that tested the adequacy of the constructs used in the structural models and results of the model building approach. Third, I describe how I accounted for missing data and a template for goodness of fit estimates in structural equation modeling. Fourth, I describe my 14 month model, including how the 14 month model fit the boys and girls sample separately. Fifth, I describe how the 14 month model predicted 24 month outcomes. Sixth, I describe how the 14 month model predicted 36 month outcomes. Lastly, I provide a summary of goodness of fit estimates for all three time periods (i.e., 14, 24 and 36 months) and list relevant covariation, direct, and indirect effects for all the listed models.

Descriptive statistics for demographic variables are shown in Table 1. The children in this study were 50% male and 49% female. The median income was $12,981 with 95% of the families reporting incomes below $22,930. Only 25.5% of the mothers reported an education level above 12th grade. The children were 45.6% White, 42.7% African America, and 7.8% Hispanic. The majority of the children were born on time, with only 12% of the sample born prematurely.

Table 1.

Descriptive Statistics for Demographic Variables

Variable Name	14 mo Sample (N = 2263) N (%)	24 mo Sample (N = 1599) N (%)	36 mo Sample (N = 1258) N (%)
Maternal education			
Below 12th grade	932 (41.2)	615 (38.5)	494 (39.3)
12th grade	718 (31.7)	511 (32.0)	408 (32.4)
More than 12th grade	576 (25.5)	448 (28.0)	334 (26.6)
No report/missing	37 (1.6)	25 (1.6)	22 (1.7)
Child Gender			
Male	1141 (50.4)	810 (50.7)	618 (49.1)
Female	1104 (48.8)	789 (49.3)	640 (50.9)
No report/missing	18 (0.8)	0 (0.0)	0 (0.0)
Race			
White	1031 (45.6)	760 (47.5)	612 (45.6)
African American	966 (42.7)	651 (40.7)	966 (42.7)
Hispanic	176 (7.8)	122 (7.6)	176 (7.8)
Other	84 (3.7)	63 (3.9)	84 (3.7)
No report/missing	6 (0.3)	3 (0.2)	3 (0.2)
Gestational Length			
> 2 months early	38 (1.7)	28 (1.8)	38 (1.7)
2 mo to 3 wk early	230 (10.2)	173 (10.8)	230 (10.2)
About on time	1596 (70.5)	1172 (73.3)	1596 (70.5)
No report/missing	369 (16.3)	201 (12.6)	369 (16.3)

Means and standard deviations for the variables included in the structural equation models at 14, 24, and 36 months are shown in Table 2. The mean CES-D score of 13.51 was below the cut-off (> 16), which indicates that the majority of the mothers did not display symptoms of depression. Approximately 30% of the mothers in the sample were depressed at 14 months. The mean Bayley MDI score was 98.27, which is in the average range according to Bayley MDI descriptive classifications. The three-bag task yielded high scores for child attention and child engagement of parent, as well as high scores for child negativity toward parent, parental intrusiveness, and parent negative regard toward the child, with higher scores indicating greater display of the behavior. These high scores indicate that there were many instances of both positive (child attention and child engagement of parent) and negative (child negativity toward parent, parental intrusiveness, and parent negative regard toward the child) mother-child interactions. Although no cut-off is specified in the HOME manual, higher total HOME scores indicate a more enriched home environment. The mean PPVT score was 83.35, which is in the moderately low range according to the PPVT-III classification system.

Table 2.

Descriptive Statistics for Variables in SEM

Age of Assessment	Variable Name	Mean (sd)	N
14 months	CDI early gestures	14.33 (2.22)	1611
	CDI vocabulary comprehension	48.67 (19.16)	1674
	CDI vocabulary production	12.79 (12.66)	1623
	Bayley MDI	98.27 (11.05)	1447
	3-bag child attention	4.99 (1.03)	1503
	3-bag child engagement of parent	3.92 (1.12)	1503
	3-bag child negativity toward parent	2.08 (1.12)	1503
	3-bag parental intrusiveness	2.45 (1.25)	1503
	3-bag parental negative regard	1.48 (0.83)	1503
	CES-Depression scale	13.51 (9.78)	1769
	Parental distress scale	26.84 (9.27)	1788
	HOME-emotional response	5.94 (1.52)	1629
	HOME-language and cognitive stimulation	10.15 (1.51)	1775
24 months	CDI vocabulary production	55.70 (22.39)	1599
	CDI sentence completion	8.78 (8.26)	1527
	Bayley language factor score	7.91 (3.26)	1368
36 months	Bayley reasoning factor score	5.76 (3.15)	1266
	PPVT score	83.35 (15.46)	1258

Model building was guided by my specific hypotheses to determine the most appropriate model to account for influences of maternal education, home environment, perinatal risk, maternal mental health and negativity towards the child, joint attention, child cognition and preschool language development. Prior to data analyses, variables were examined for normality of distribution using PASW 18. The non-normality of distribution for home environment and play tasks was improved through the use of log transformations. To systematically test my hypotheses I conducted a multistep model building approach. I used AMOS 18 to test the adequacy of the measurement model and the fit of the structural models.

Missing Data

The presence of missing data can occur for a wide variety of reasons that are beyond the researcher's control. Two examples suggested by Kline (1998) include a) the case where a questionnaire is excessively long and the researcher decides to administer only a subset of items to each of several different subsamples, and b) a relatively inexpensive measure is administered to the entire sample, whereas another more expensive test is administered to a smaller set of randomly selected sample (Byrne, 2010). Due to high attrition rates in this high-risk sample, the issue of missing data had to be addressed prior to data analysis. Missing data analyses have improved dramatically in recent years and a number of sophisticated options are now available in statistical software packages (Enders, 2013). To address the issue of missing data AMOS uses the maximum likelihood estimation and I used the convergence of multiple indices to evaluate how the model fits the data. AMOS adapts a direct approach to handling missing data based on maximum likelihood (ML). As described by Enders (2013), ML estimation offers many key advantages over other approaches such as imputation and listwise or pairwise deletion. ML estimates are consistent, efficient, unbiased, and capable of yielding standard error estimates.

Model Goodness of Fit

The chi-square test provides a comparison of the proposed model to the saturated model that fits the data perfectly. A non-significant chi-square indicates that the model fits the data well. In large, complex problems (i.e., problems in which there are many variables and degrees of freedom), the observed chi-square will nearly always be statistically significant, even when there is a reasonably good fit to the data. The chi-square test is strongly influenced by sample size. A poor fit based on a small sample size may result in a non-significant chi-square, whereas a good fit based on a large sample size will result in a significant chi-square. Thus, most applications of confirmatory factor analysis require a subjective evaluation of whether or not a statistically significant chi-square is small enough to constitute an adequate fit. It has been suggested that a chi-square two or three times as large as the degrees of freedom is acceptable (Carmines & McIver, 1981), but the fit is considered better the closer the chi-square value is to the degrees of freedom for a model (Thacker, Fields & Tetrick, 1989). Because the chi-square test is affected by the number of parameter estimates, the Root Mean Square Error of Approximation (RMSEA), and the Comparative Fit Index (CFI) were examined. A RMSEA (Root Mean Square Error of Approximation) value of less than or equal to .05 indicates a good model fit. There is adequate fit if RMSEA is less than or equal to .08. Hu and Bentler (1999) have suggested RMSEA < .06 as the cutoff for a good model fit. A CFI (Comparative Fit Index), close to 1 indicates a very good model fit. The CFI should be equal to or greater than .90 to accept the model. Unlike the chi-square test, the CFI is independent of sample size, which provided a good reason to evaluate it as a goodness-of-fit index.

Table 3 provides a summary of the correlations among all the variables of interest. There were 462 comparisons. As expected, most of the variables were significantly correlated, even with the Bonferoni adjustment, due to the large sample size.

Table 3.
Correlations Among Predictor Variables and Language Measures

	14m HOME Language and Cognitive Stimulation	14m HOME Verbal and Social Skill	14m HOME Emotional Response	14m Parental Distress Scale	14m: CES Depression Score	Maternal Education	Gestation Length
Child Gender	-0.006 (1775)	-0.010 (1664)	0.028 (1629)	-0.028 (1788)	-0.020 (1769)	-0.029 (2209)	0.034 (1894)
14m HOME Language and Cognitive Stimulation		0.216* (1650)	0.273* (1615)	-0.174* (1772)	-0.168* (1757)	0.211* (1745)	0.018 (1534)
14m HOME Verbal and Social Skill			0.567* (1625)	-0.076 (1658)	-0.054 (1642)	0.157* (1638)	-0.021 (1443)
14m HOME Emotional Response				-0.139* (1623)	-0.128* (1607)	0.204* (1604)	0.016 (1416)
14m Parental Distress Scale					0.519* (1766)	-0.140* (1758)	-0.037 (1544)
14m: CES Depression Score						-0.144* (1740)	-0.019 (1528)
Maternal Education							-0.020 (1861)
Gestation Length							

	14m 3-bag Parent Intrusiveness	14m 3-bag Child Negativity	14m 3-bag Parent Negative Regard	14m 3-bag Child Engagement with Parent	14m 3-bag Child Sustained Attention	14m Bayley Mental Development Score	14m CDI Vocabulary Comprehen sion
Child Gender	0.054 (1503)	-0.046 (1503)	-0.044 (1503)	0.116* (1503)	0.070 (1503)	0.108* (1447)	0.090 (1674)
14m HOME Language and Cognitive Stimulation	-0.154* (1475)	-0.068 (1475)	-0.121* (1475)	0.100 (1475)	0.088 (1475)	0.129* (1415)	0.167* (1665)
14m HOME Verbal and Social Skill	-0.104* (1454)	-0.075 (1454)	-0.178* (1454)	0.138* (1454)	0.110* (1454)	0.155* (1393)	0.047 (1555)
14m HOME Emotional Response	-0.137* (1447)	-0.107* (1447)	-0.183* (1447)	0.174* (1447)	0.174* (1447)	0.248* (1388)	0.108* (1524)
14m Parental Distress Scale	0.085 (1482)	0.069 (1482)	0.065 (1482)	-0.089 (1482)	-0.119* (1482)	-0.051 (1423)	-0.079 (1670)
14m: CES Depression Score	0.129* (1467)	0.076 (1467)	0.061 (1467)	-0.028 (1467)	-0.094 (1467)	-0.074 (1408)	-0.025 (1661)
Maternal Education	-0.169* (1477)	-0.131* (1477)	-0.157* (1477)	0.094 (1477)	0.087 (1477)	0.064 (1426)	0.005 (1645)
Gestation Length	-0.062 (1308)	-0.025 (1308)	-0.064 (1308)	0.077 (1308)	0.098 (1308)	0.173* (1257)	0.089 (1455)

	14m 3-bag Parent Intrusiveness	14m 3-bag Child Negativity	14m 3-bag Parent Negative Regard	14m 3-bag Child Engagement with Parent	14m 3-bag Child Sustained Attention	14m Bayley Mental Development Score	14m CDI Vocabulary Comprehen sion
14m 3-bag Parent Intrusiveness		0.659* (1503)	0.483* (1503)	-0.199* (1503)	-0.337* (1503)	-0.114* (1388)	-0.026 (1396)
14m 3-bag Child Negativity			0.406** (1503)	-0.228* (1503)	-0.373* (1503)	-0.096 (1388)	-0.003 (1396)
14m 3-bag Parent Negative Regard				-0.191* (1503)	-0.307* (1503)	-0.108* (1388)	-0.026 (1396)
14m 3-bag Child Engagement with Parent					0.379* (1503)	0.189* (1388)	0.087 (1396)
14m 3-bag Child Sustained Attention						0.237* (1388)	0.122* (1396)
14m Bayley Mental Development Score							0.138* (1336)
14m CDI Vocabulary Comprehension							

	14m CDI Vocabulary Production	14m CDI Gesture Production	24m CDI Vocabulary Production	24m CDI Sentence Completion	24m Bayley Language Factor Score	36m PPVT Receptive Vocabulary	36m Bayley Verbal Reasoning Score
Child Gender	0.065 (1623)	0.140* (1611)	0.125* (1599)	0.118* (1527)	0.095 (1368)	0.099 (1258)	0.124* -1266
14m HOME Language and Cognitive Stimulation	0.125* (1615)	0.176* (1600)	0.189* (1445)	0.176* (1383)	0.204* (1250)	0.227* (1126)	0.237* -1131
14m HOME Verbal and Social Skill	0.054 (1511)	0.086 (1494)	0.061 (1351)	0.099 (1293)	0.160* (1199)	0.181* (1084)	0.183* (1086)
14m HOME Emotional Response	0.112* (1481)	0.153 (1462)	0.125* (1331)	0.154* (1274)	0.169* (1187)	0.253* (1066)	0.253* -1067
14m Parental Distress Scale	-0.049 (1620)	-0.097* (1607)	-0.118* (1455)	-0.097 (1393)	-0.087 (1260)	-0.132* (1136)	-0.112 (1141)
14m: CES Depression Score	0.014 (1610)	-0.017 (1593)	-0.057 (1442)	-0.024 (1383)	-0.092 (1250)	-0.082 (1121)	-0.112 (1127)
Maternal Education	-0.017 (1594)	-0.053 (1587)	0.059 (1574)	0.084 (1502)	0.126* (1346)	0.237* (1236)	0.230* (1244)
Gestation Length	0.084 (1409)	0.167* (1381)	0.106* (1398)	0.107* (1338)	0.112 (1194)	0.093 (1084)	0.078 (1082)

	14m CDI Vocabulary Production	14m CDI Gesture Production	24m CDI Vocabulary Production	24m CDI Sentence Completion	24m Bayley Language Factor Score	36m PPVT Receptive Vocabulary	36m Bayley Verbal Reasoning Score
14m 3-bag Parent Intrusiveness	-0.024 (1352)	-0.054 (1328)	-0.090 (1242)	-0.090 (1183)	-0.136* (1099)	-0.175* (1002)	-0.198* (1004)
14m 3-bag Child Negativity	-0.017 (1352)	0.000 (1328)	-0.071 (1242)	-0.041 (1183)	-0.106 (1099)	-0.146* (1002)	-0.151* (1004)
14m 3-bag Parent Negative Regard	-0.042 (1352)	-0.038 (1328)	-0.078 (1242)	-0.095 (1183)	-0.115 (1099)	-0.140* (1002)	-0.120 (1004)
14m 3-bag Child Engagement with Parent	0.121* (1352)	0.142* (1328)	0.173* (1242)	0.140* (1183)	0.212* (1099)	0.209* (1002)	0.178* (1004)
14m 3-bag Child Sustained Attention	0.127* (1352)	0.188* (1328)	0.178* (1242)	0.161* (1183)	0.197* (1099)	0.248* (1002)	0.225** (1004)
14m Bayley Mental Development Score	0.167* (1296)	0.206* (1290)	0.327* (1186)	0.238* (1126)	0.367* (1061)	0.269* (971)	0.311 (969)
14m CDI Vocabulary Comprehension	0.523* (1620)	0.471* (1513)	0.396* (1368)	0.263* (1314)	0.165* (1178)	0.171* (1068)	0.184* (1068)
14m CDI Vocabulary Production		0.390* (1466)	0.373* (1328)	0.301* (1278)	0.227* (1146)	0.146* (1042)	0.136* (1042)

	14m CDI Vocabulary Production	14m CDI Gesture Production	24m CDI Vocabulary Production	24m CDI Sentence Completion	24m Bayley Language Factor Score	36m PPVT Receptive Vocabulary	36m Bayley Verbal Reasoning Score
14m CDI Gesture Production			0.360* (1316)	0.236* (1261)	0.217* (1138)	0.161* (1038)	0.167* (1047)
24m CDI Vocabulary Production				0.614* (1508)	0.526* (1306)	0.309* (1079)	0.386* (1080)
24m CDI Sentence Completion					0.473* (1243)	0.281* (1027)	.365** (1024)
24m Bayley Language Factor Score						0.412* (994)	0.451* (995)
36m PPVT Receptive Vocabulary							0.589* (1170)

* p < .01

Measurement model

I first considered the measurement model that defines the constructs in terms of the indicator variables but does not restrict how the variables may be related. If the measurement model provided a good fit to the data then additional restrictions were applied that tested the relationships between constructs and compared to the preceding model. At each stage, I compared competing models and tested the chi-square change to determine if a reduced model decreased the adequacy of fit. This approach allowed me to increase the efficiency and power for testing hypotheses in the full model. I hypothesized a 5-factor model to be confirmed in the measurement portion of the model. The final sample size was 2263 and included only children whose primary language at home was English. The Comparative Fit Index (CFI) = .83, and the Root Mean Square Error of Approximation (RMSEA) = .06. Those values indicated an adequate fit between the model and the observed data.

In each of the models tested, the latent variable “Home” was measured by the following subscales: Language and Cognitive Stimulation, Verbal and Social Skill and Emotional Response. The latent variable “Maternal Mental Health” was measured by the CES-D Total Score and PSI-SF. Maternal education was an observed variable. Perinatal risk as gestational age was an observed variable. The latent variable “Negative Interaction” was measured by the three-bag tasks Parent Negative Regard of the Child, Parent Intrusiveness, and Child Negativity toward Parent. The latent variable “Joint Attention” was measured by the three-bag tasks Child Sustained Attention and Child Engagement of Parent. The Bayley MDI was an observed variable at 14 months. A latent variable of “Child Language” was formed from the measured variables McArthur CDI at 14 months. Woodcock Johnson and Bayley Language Factor Score formed the latent variable “Child Language” at 24 months. Peabody Picture Vocabulary Test and the

Bayley Two-Factor Reasoning Score at 36 months formed “Child Language” at 36 months. Factor loadings are presented in Table 4.

Table 4.

Measurement Model-Factor Loadings

Variable Paths		Estimate
Parent Negativity	Negative Interaction	.547
Parent Intrusiveness	Negative Interaction	.883
Child Negativity	Negative Interaction	.746
Lan & Cog Stimulation	Home Environment	.333
Verb. Social Skill	Home Environment	.662
Emotional Response	Home Environment	.846
Vocab. Compreh.	Child Language	.766
Vocab. Product.	Child Language	.672
Early Gestures	Child Language	.614
CES-D	Mental Health	.701
Parental Distress	Mental Health	.741
Child Engage Parent	Joint Attention	.589
Child Attention	Joint Attention	.644

14 month model

My hypothesized 14 month SEM is described graphically in Figure 1. I used the entire sample (N = 2263) and treated language as a covariate with child cognition, joint attention and negative interaction rather than as an outcome measure. I chose maximum likelihood parameter estimation to treat the issue of missing data. In this first model, I tested whether children's language skills would be influenced by their mother's education, parenting interactions, maternal mental health, joint attention, cognitive skills, home environment and perinatal risk at the 14 month data collection point. The question of whether these influences were direct or indirect was examined. In examining the 14 month model, I did not hypothesize a causal relationship between child cognition and child language, and negative parental interaction and child language, therefore, I allowed the constructs to be correlated. Model trimming included dropping the non-significant total HOME score from the model and including only the subscales Language and Cognitive Stimulation, Verbal/Social skills, and Emotional Response. In addition, birth weight was not significant and was dropped from the model. The Parental Detachment scale was dropped from the initial construct of negative interaction due to non-significance. This improved the overall model fit. Estimation of the hypothesized model resulted in an overall good fit to the data with a chi-square = 456.29, RMSEA = .046 and CFI = .92. 14 month model fit indices suggest a good match between the model and the data. Standardized parameter estimates for statistically significant paths are provided in Figure 1.

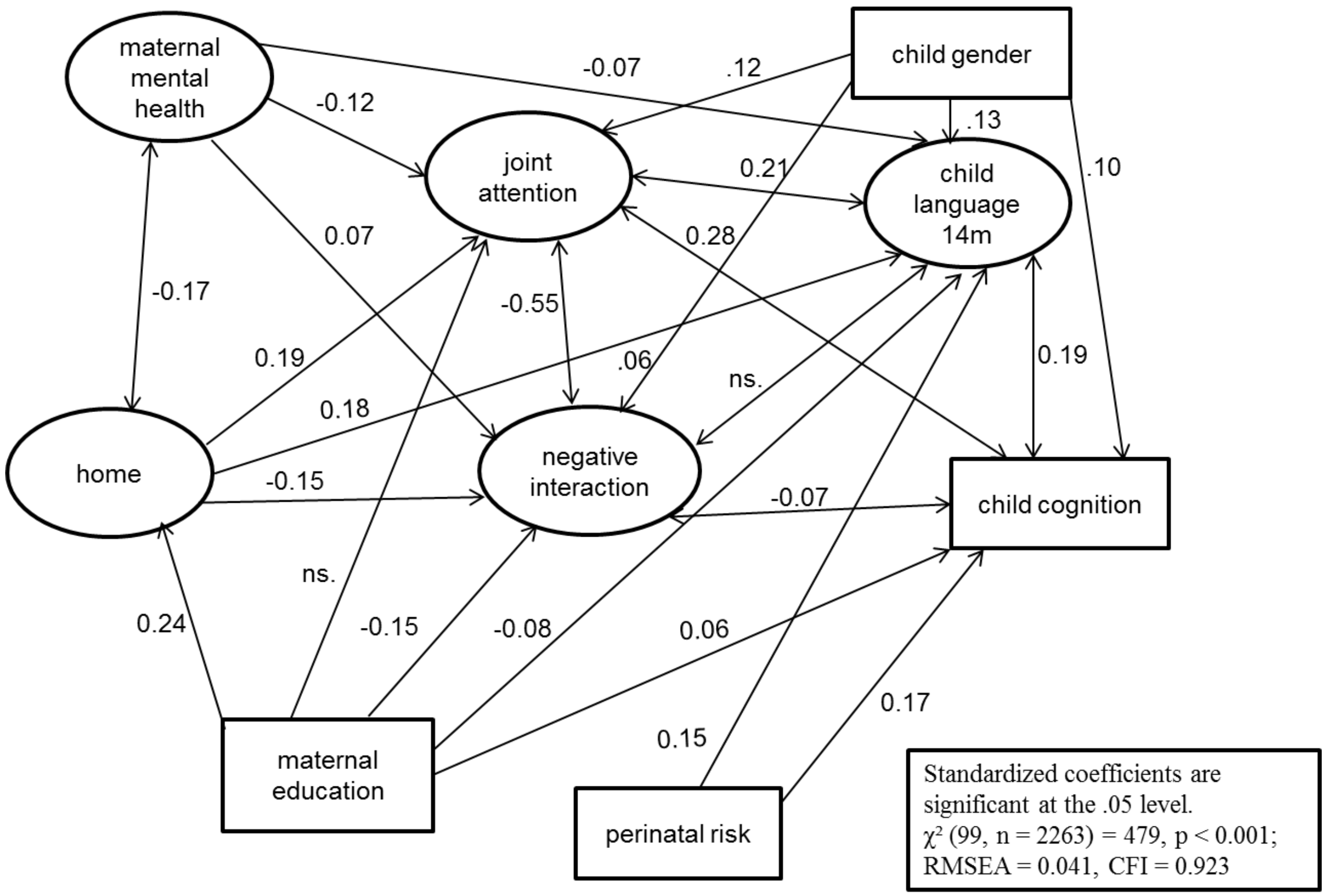

Figure 1. Estimated relations among child, maternal and home characteristics at 14 months RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index

For all paths unstandardized and standardized estimates are provided in Table 4. Standardized regression weights values reflect the extent to which the measure/construct at the head of the arrow would increase, given an increase of one standard deviation on the measure/construct at the tail of the arrow. For an increase of one standard deviation on the HOME, a child in this sample would show an increase of .175 standard deviations in Child Language. The 14 month model explains 60% of the variance in children's home environments as measured by the HOME subscales, 53% of the variance in children's language as measured by the CDI, 67% of the variance in joint attention as measured by the three-bag task and 71% of the variance in negative parent-child interaction as measured by the three-bag task. Unstandardized regression weights were then examined. If there was theoretical reason for a known relationship between constructs/measures, the nonsignificant path was kept in the model. I did not conduct post-hoc modifications because of the goodness of fit of the data to the model. I then tested whether my 14-month model was good at predicting language outcomes for boys and girls separately and consecutively at 24 and 36 months.

Table 5.

Unstandardized and standardized coefficients for the 14 month model (N = 1674)

Predictor Variable	Outcome Variable	Unstandardized Coefficient	Standardized Coefficient	p value
Home	Child Language	28.227	0.177	0.001
Home	Joint Attention	1.195	0.192	0.001
Home	Negative Interaction	-0.269	-0.149	0.001
Maternal Education	Child Cognition	0.876	0.064	0.013
Maternal Education	Child Language	-1.389	-0.078	0.007
Maternal Education	Home	0.027	0.242	0.001
Maternal Education	Joint Attention	0.049	0.070	0.042
Maternal Education	Negative Interaction	-0.031	-0.153	0.001
Maternal Mental Health	Child Language	-0.174	-0.070	0.027
Maternal Mental Health	Joint Attention	-0.012	-0.122	0.001
Maternal Mental Health	Negative Interaction	0.002	0.070	0.030
Perinatal Risk	Child Cognition	13.023	0.174	0.001
Perinatal Risk	Child Language	14.349	0.147	0.001
Child Gender	Child Language	3.750	0.130	0.001
Child Gender	Child Cognition	2.299	0.104	0.001
Child Gender	Joint Attention	0.132	0.117	0.001
Child Gender	Negative Interaction	-0.021	-0.064	0.023

Table 6.

Unstandardized covariances and standardized correlations for the 14 month model (N = 1674)

Variable Names		Unstandardized Covariance	Standardized Correlation	p value
Child Cognition	Child Language	28.428	0.191	0.001
Home	Maternal Mental Health	-0.084	-0.167	0.001
Joint Attention	Child Cognition	1.602	0.276	0.001
Joint Attention	Child Language	1.530	0.207	0.001
Joint Attention	Negative Interaction	-0.046	-0.548	0.001
Negative Interaction	Child Cognition	-0.124	-0.073	0.018
Negative Interaction	Child Language	0.057	0.026	0.456

14 month model for boys and girls

There was a strong model fit at 14 months for boys, chi square = 284.12, RMSEA = .045 and CFI = .92, and for girls, chi square = 277.75, RMSEA = .045 and CFI = .919, when the sample was split and looked at separately. Unstandardized and standardized coefficients for boys and girls are shown in Tables 7, 8, 9 and 10. Table 11 describes fit measures for 14 month models for boys and girls. There was a significant improvement in model fit when gender was added in the 14 month model according to the log likelihood test. Language outcomes were, on average, higher for girls than for boys by a value of .103 at $p < .01$.

Table 7.

Unstandardized and Standardized coefficients for the 14 month model for boys only (N = 1141)

Predictor Variable	Outcome Variable	Unstandardized Coefficient	Standardized Coefficient	p value
Home	Child Language	28.971	0.153	0.002
Home	Joint Attention	1.414	0.191	0.001
Home	Negative Interaction	-0.221	-0.106	0.031
Maternal Education	Child Cognition	0.798	0.058	0.114
Maternal Education	Child Language	-1.745	-0.095	0.018
Maternal Education	Home	0.019	0.199	0.001
Maternal Education	Joint Attention	0.017	0.024	0.597
Maternal Education	Negative Interaction	-0.026	-0.128	0.002
Maternal Mental Health	Child Language	-0.355	-0.130	0.002
Maternal Mental Health	Joint Attention	-0.016	-0.151	0.002
Maternal Mental Health	Negative Interaction	0.002	0.067	0.121
Perinatal Risk	Child Cognition	13.402	0.183	0.001
Perinatal Risk	Child Language	20.104	0.207	0.001

Table 8. Unstandardized covariances and standardized correlations for the 14 month model for boys only (N = 1141).

Variable Names		Unstandardized Covariance	Standardized Correlation	p value
Child Cognition	Child Language	39.762	0.252	0.001
Home	Maternal Mental Health	-0.068	-0.162	0.007
Joint Attention	Child Cognition	1.811	0.291	0.001
Joint Attention	Child Language	1.858	0.232	0.001
Joint Attention	Negative Interaction	-0.050	-0.559	0.001
Negative Interaction	Child Cognition	-0.127	-0.071	0.096
Negative Interaction	Child Language	0.063	0.028	0.577

Table 9.

Unstandardized and Standardized coefficients for the 14 month model for girls only (N = 1104).

Predictor Variable	Outcome Variable	Unstandardized Coefficient	Standardized Coefficient	p value
Home	Child Language	27.068	0.196	0.001
Home	Joint Attention	0.884	0.179	0.006
Home	Negative Interaction	-0.316	-0.198	0.001
Maternal Education	Child Cognition	0.987	0.073	0.047
Maternal Education	Child Language	-0.952	-0.055	0.200
Maternal Education	Home	0.036	0.285	0.001
Maternal Education	Joint Attention	0.078	0.124	0.017
Maternal Education	Negative Interaction	-0.037	-0.183	0.001
Maternal Mental Health	Child Language	0.030	0.014	0.774
Maternal Mental Health	Joint Attention	-0.007	-0.092	0.113
Maternal Mental Health	Negative Interaction	0.001	0.049	0.309
Perinatal Risk	Child Cognition	12.210	0.160	0.001
Perinatal Risk	Child Language	7.421	0.075	0.076

Table 10.

Unstandardized covariances and standardized correlations for the 14 month model for girls only (N = 1104)

Variable Names		Unstandardized Covariance	Standardized Correlation	p value
Child Cognition	Child Language	17.264	0.121	0.008
Home	Maternal Mental Health	-0.101	-0.165	0.008
Joint Attention	Child Cognition	1.247	0.248	0.001
Joint Attention	Child Language	1.029	0.159	0.011
Joint Attention	Negative Interaction	-0.038	-0.526	0.001
Negative Interaction	Child Cognition	-0.124	-0.077	0.083
Negative Interaction	Child Language	0.055	0.027	0.597

Table 11.

Fit measures for SEM models at 14 months for boys and girls.

Fit Measure	Boys	Girls	Recommended Value
N	1141	1104	
Chi-square	284.12	277.75	
Degree of Freedom	87	87	
Chi-square/DF	3.27	3.19	
p-value	0.0001	0.0001	≤ 0.05
CFI	0.920	0.919	≥ 0.90
RMSEA	0.045	0.045	≤ 0.05

14 to 24 month model

My hypothesized 14-24 month SEM is described graphically in Figure 2. I performed a SEM analysis based on data from the EHSRE of 1599 children and their caregivers with the AMOS 18 statistical package. For the purposes of the study, the sample was selected based on two criteria: The children and their caretakers had to be English speakers and the sample was filtered to include only cases with language outcomes. I chose maximum likelihood parameter estimation to treat the issue of missing data. In this model, I used the 14 month model to predict whether the established relationships at 14 months would be predictive of language outcomes at 24 months. Specifically, I tested whether children's language skills at 24 months would be influenced by their mother's education, parenting interactions and maternal mental health, joint attention, cognitive skills, home environment and perinatal risk measured at 14 months. The question of whether these influences were direct or indirect was examined. In examining the 14 to 24 month model, I did not hypothesize a causal relationship between child cognition and joint attention, joint attention and negative parental interaction, and maternal mental health and home, therefore, I allowed the constructs to be correlated. Estimation of the hypothesized model resulted in an overall good fit to the data with a chi-square = 440.69, RMSEA = .046 and CFI = .925. Standardized parameter estimates are provided in Figure 2. The 24 month model explains 72% of the variance in children's home environments as measured by the HOME subscales, 21% of the variance in children's language as measured by the CDI and the Bayley Language Factor Score, 82% of the variance in joint attention as measured by the three-bag task, 72% of the variance in negative parent-child interaction as measured by the three-bag task and 32% of the variance in child cognition as measured by the Bayley MDI.

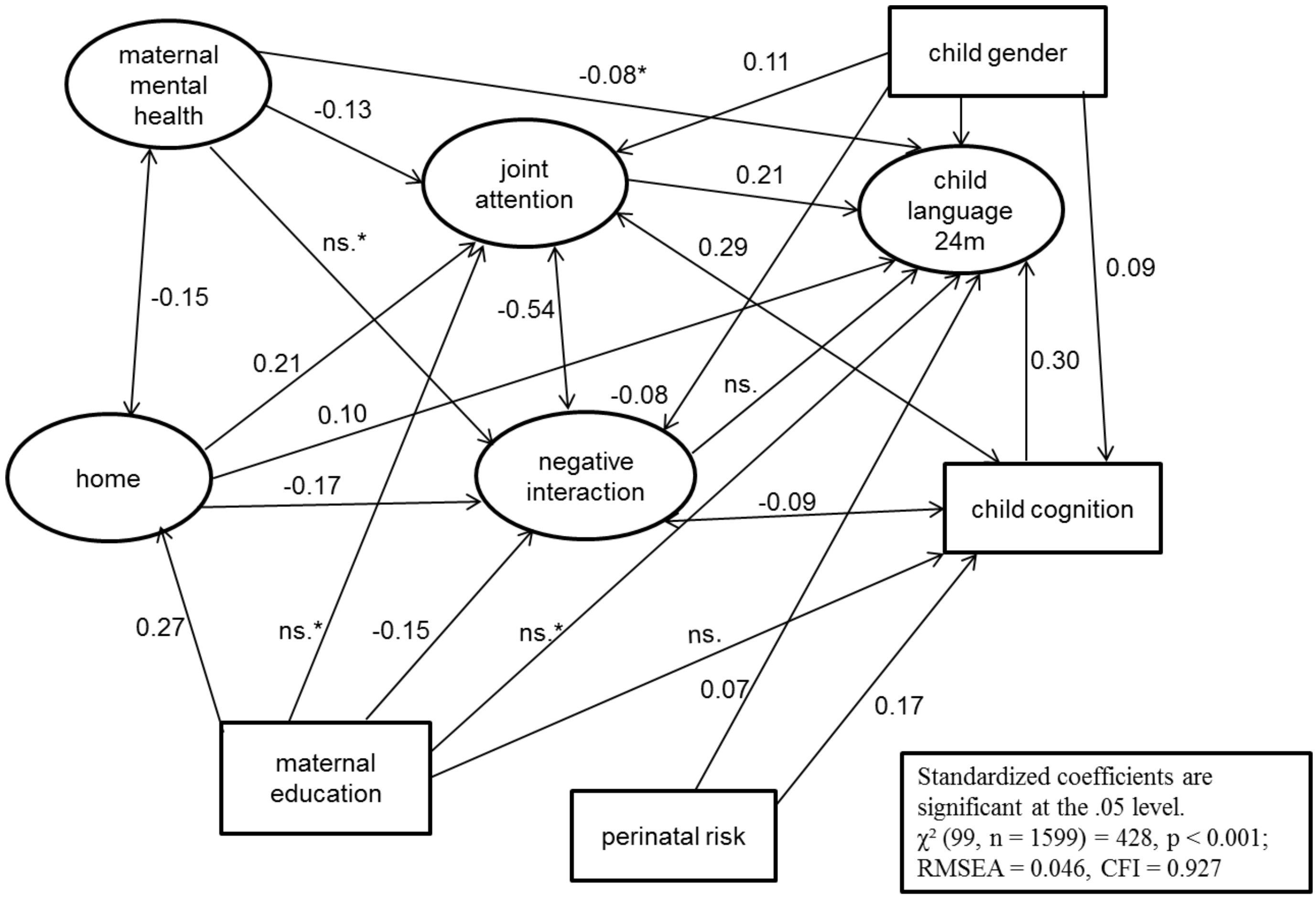

Figure 2. Estimated relations among child, maternal and home characteristics at 14 months used to predict language outcomes at 24 months.
RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index

Unstandardized and standardized parameter estimates are provided in Table 11. Unstandardized regression weights were then examined. If there was theoretical reason for a known relationship between constructs/measures, the nonsignificant path was kept in the model. I did not conduct post-hoc modifications because of the goodness of fit of the data to the model.

Table 12.
Unstandardized and Standardized coefficients for the 14 to 24 month model (N = 1599)

Predictor Variable	Outcome Variable	Unstandardized Coefficient	Standardized Coefficient	p value
Child Cognition	Child Language	0.497	0.300	0.001
Home	Child Language	21.293	0.104	0.007
Home	Joint Attention	1.380	0.212	0.001
Home	Negative Interaction	-0.303	-0.173	0.001
Joint Attention	Child Language	6.460	0.205	0.001
Maternal Education	Child Cognition	0.695	0.052	0.067
Maternal Education	Child Language	0.865	0.039	0.180
Maternal Education	Home	0.029	0.268	0.001
Maternal Education	Joint Attention	0.050	0.071	0.066
Maternal Education	Negative Interaction	-0.028	-0.148	0.001
Maternal Mental Health	Child Language	-0.250	-0.076	0.019
Maternal Mental Health	Joint Attention	-0.013	-0.128	0.002
Maternal Mental Health	Negative Interaction	0.002	0.059	0.091
Negative Interaction	Child Language	9.801	0.084	0.090
Perinatal Risk	Child Cognition	12.421	0.169	0.001
Perinatal Risk	Child Language	8.448	0.069	0.016
Child Gender	Child Language	3.605	0.100	0.001
Child Gender	Child Cognition	2.011	0.092	0.001
Child Gender	Joint Attention	0.130	0.114	0.002
Child Gender	Negative Interaction	-0.024	-0.076	0.013

Unstandardized and standardized correlations for the 14 to 24 month model are provided in Table 13.

Table 13.

Unstandardized covariances and standardized correlations for the 14 to 24 month model (N = 1599)

Variable Names		Unstandardized Covariance	Standardized Correlation	p value
Home	Maternal Mental Health	-0.071	-0.151	0.002
Joint Attention	Child Cognition	1.666	0.285	0.001
Joint Attention	Negative Interaction	-0.044	-0.542	0.001
Negative Interaction	Child Cognition	-0.125	-0.079	0.020

I then tested whether the 14-month model was good at predicting language outcomes at 36 months.

14 to 36 month model

My hypothesized 14 to 36 month SEM is described graphically in Figure 3. I performed a SEM analysis based on data from the EHSRE of 1258 children and their caregivers with the AMOS 18 statistical package. For the purposes of the study, the sample was selected based on two criteria: The children and their caretakers had to be English speakers and the sample was filtered to include only cases with language outcomes. I chose maximum likelihood parameter estimation to treat the issue of missing data. In this model, I tested whether children's language skills at 36 months would be influenced by their mother's education, parenting interactions and maternal mental health, joint attention, cognitive skills, home environment and perinatal risk at

14 months. The question of whether these influences were direct or indirect was examined. In examining the 14 to 36 month model, I did not hypothesize a causal relationship between child cognition and joint attention, joint attention and negative parental interaction, and maternal mental health and home; therefore, I allowed the constructs to be correlated. Estimation of the hypothesized model resulted in an overall good fit to the data with a chi-square = 277.39, RMSEA = .042 and CFI = .939. The 36 month model explains 72% of the variance in children's home environments as measured by the HOME subscales, 21% of the variance in children's language as measured by the PPVT and the Bayley Reasoning Factor Score, 82% of the variance in joint attention as measured by the three-bag task, 72% of the variance in negative parent-child interaction as measured by the three-bag task and 32% of the variance in child cognition as measured by the Bayley MDI. Standardized parameter estimates are provided in Figure 3.

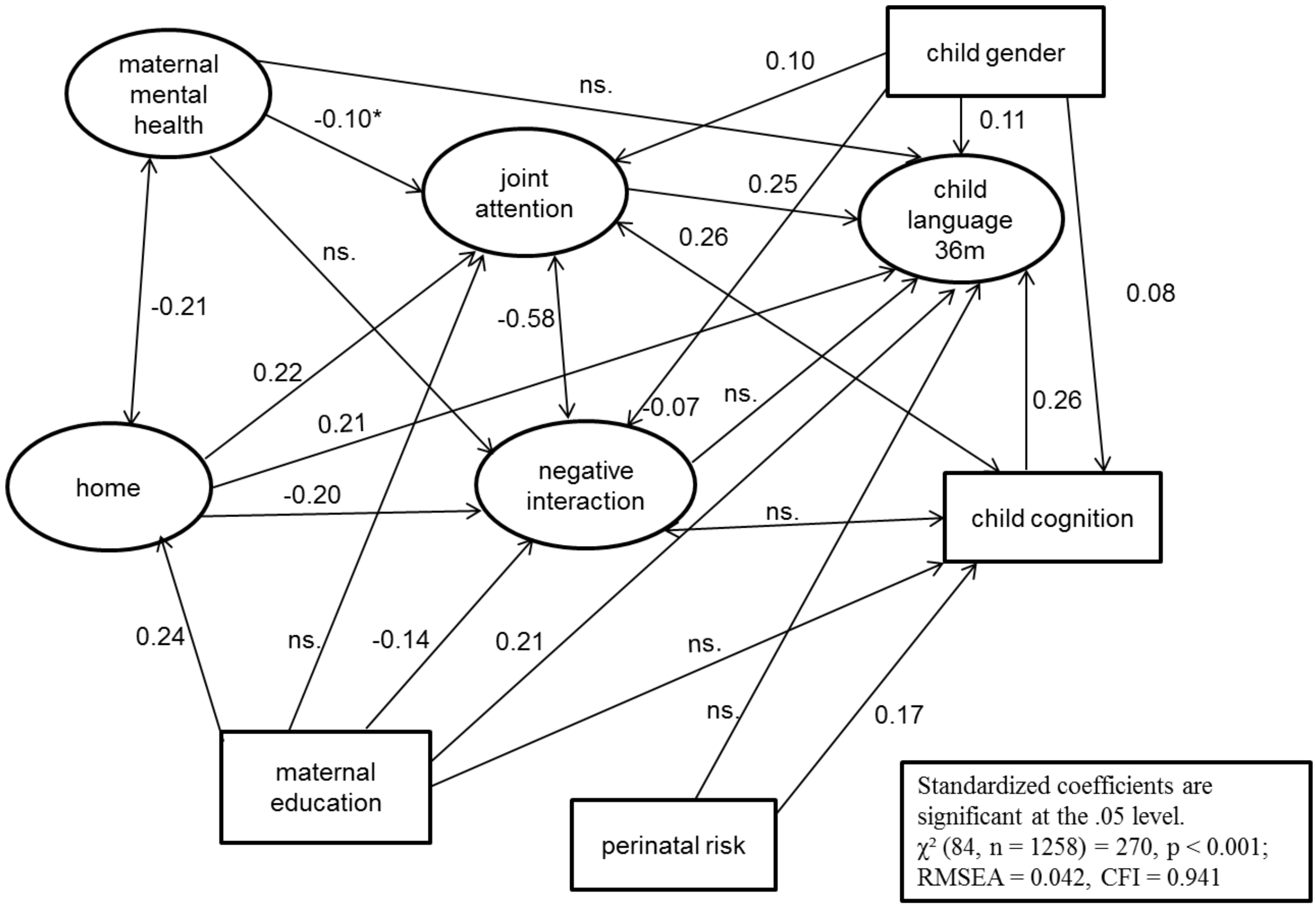

Figure 3. Estimated relations among child, maternal and home characteristics at 14 months used to predict language outcomes at 36 months.
RMSEA = Root Mean Square Error of Approximation; CFI = Comparative Fit Index

Unstandardized and standardized parameter estimates are provided in Table 14. I did not conduct post-hoc modifications because of the goodness of fit of the data to the model.

Table 14.
Unstandardized and Standardized coefficients for the 14 to 36 month model (N = 1258).

Predictor Variable	Outcome Variable	Unstandardized Coefficient	Standardized Coefficient	p value
Child Cognition	Child Language	0.273	0.260	0.001
Home	Child Language	27.476	0.212	0.001
Home	Joint Attention	1.354	0.220	0.001
Home	Negative Interaction	-0.344	-0.201	0.001
Joint Attention	Child Language	5.304	0.253	0.001
Maternal Education	Child Cognition	0.738	0.055	0.080
Maternal Education	Child Language	2.961	0.210	0.001
Maternal Education	Home	0.026	0.242	0.001
Maternal Education	Joint Attention	0.032	0.047	0.258
Maternal Education	Negative Interaction	-0.025	-0.135	0.001
Maternal Mental Health	Child Language	-0.110	-0.057	0.124
Maternal Mental Health	Joint Attention	-0.009	-0.099	0.035
Maternal Mental Health	Negative Interaction	0.001	0.037	0.368
Negative Interaction	Child Language	1.781	0.024	0.688
Perinatal Risk	Child Cognition	12.782	0.169	0.001
Perinatal Risk	Child Language	2.763	0.035	0.279
Child Gender	Child Language	2.335	0.102	0.001
Child Gender	Child Cognition	1.724	0.080	0.011
Child Gender	Joint Attention	0.103	0.095	0.017
Child Gender	Negative Interaction	-0.021	-0.070	0.042

The unstandardized and standardized covariances and correlations for the 14 to 36 month model are shown in Table 15.

Table 15.

Unstandardized covariances and standardized correlations for the 14 to 36 month model (N = 1258)

Variable Names		Unstandardized Covariance	Standardized Correlation	p value
Home	Maternal Mental Health	-0.105	-0.205	0.001
Joint Attention	Child Cognition	1.435	0.259	0.001
Joint Attention	Negative Interaction	-0.043	-0.577	0.001
Negative Interaction	Child Cognition	-0.048	-0.031	0.405

A summary of the fit indices for all models that I employed is presented in Table 16. The 14-36 month model had the smallest chi-square value of 277 along with the highest CFI value of 0.94 and a RMSEA value of 0.042. All of the models tested were a good fit to the data.

Table 16.

Fit measures for SEM models using measures at 14 months to predict language outcomes at 14, 24, and 36 months.

Fit Measure	14-month language	24-month language	36-month language	Recommended Value
N	2263	1599	1258	
Chi-square	478.96	428.85	270.25	
Degree of Freedom	99	99	84	
Chi-square/DF	4.84	4.33	3.22	
p-value	0.0001	0.0001	0.0001	≤ 0.05
CFI	0.923	0.927	0.941	≥ 0.90
RMSEA	0.041	0.046	0.042	≤ 0.05

Using the 14 month model to predict language outcomes at 24 and 36 months

Covariation in all models. Child cognition was correlated with child language. Children with higher MDI scores had more developed language abilities. Home was correlated with maternal mental health. Higher depression and distress scores were associated with poorer home environments. Joint attention was correlated with child cognition, child language and negative interaction. More positive mother-child interactions were positively correlated with higher MDI scores and higher language scores and were negatively associated with interactions that included the child's negativity towards the parent or parental intrusiveness. Negative interactions were negatively correlated with child cognition and child language. Interactions that included parental intrusiveness and children's negative regard toward the parent were associated with poorer MDI and language scores. In the 14-24 and 14-36 month model joint attention was entered as a direct path (rather than as a correlation) to child language because my goal was to test its long term effects on children's language outcomes. Similarly, child cognition was entered as a direct path in the 14-24 and 14-36 month models but was correlated with child language in the 14 month model due to theoretical reasons and prior research reporting that cognition and language are associated early in life.

Direct effects in all models. Maternal mental health was directly related to child language. Depressed and distressed mothers had children with lower language scores. The home environment had a direct influence on child language. More specifically, children from less enriched homes had less well-developed language abilities. At 14 months there was a direct effect between perinatal risk and child language. Children who were born prematurely had poorer language skills. Children born on time had higher language scores. In the 14 to 24 month and 14 to 36 month models, there was not a significant direct relationship between perinatal risk and child language. There was a weak significant direct effect between maternal education and language at 14 months. There was no significant direct link between maternal education and child language in the 14 to 24 month model and there was a strong direct relationship between maternal education and child language in the 14 to 36 month model.

Indirect Effects in all Models. Child language was indirectly related to perinatal risk through child cognition in the 14 to 24 and 14 to 36 month models. Children born prematurely had lower cognitive and in turn lower language scores than children who were born on time. The home environment mediated the relationship between maternal education and negative interaction. Mothers with lower education levels had less supportive home environments and interacted negatively with their children more often. The home environment also mediated the relationship between maternal education and joint attention. Mothers with higher education levels had more supportive home environments and engaged their children in more proactive ways.

Overall, the relationships established in the 14 month model were robust and remained strong in the 24 and 36 month models. The following exceptions apply: Perinatal risk had a strong direct effect on child language at 14 months but became non-significant in later time periods. In later time periods, the relationship between language outcomes and perinatal risk was mediated by child cognition. Maternal education was weakly related to child language at 14 months and had no significance to child language at 24 months but was strongly influencing language outcomes at 36 months.

Direct, Indirect, and Total effects in the 36 month model. Child language was directly explained by joint attention (.253), negative interaction (.024), perinatal risk, maternal education, child cognition (.260) and home environments. The indirect effects of maternal education, home environment (.263) and perinatal risk (.079) strengthened these influences on language with the largest effect being that of maternal education (.297). Overall, families with more enriched home environments, better education levels and with mothers who engaged their children in more positive ways, and with children who were born on time had children who scored better on cognitive and language outcomes.

Table 17.

Standardized direct, indirect and total effects for maternal mental health, maternal education, joint attention, negative interaction, perinatal risk, child cognition and home environment on language outcomes at 36 mo.

Variable	Maternal Mental Health	Maternal Education	Joint Attention	Negative Interaction	Perinatal Risk	Home Environment	Child Cognition	Child Gender
Direct Effect	-.057	.210	.253	.024	.035	.212	.260	.102
Indirect Effect	-.024	.087	-	-	.044	.051	-	.043
Total Effect	-.082	.297	.253	.024	.079	.263	.260	.145

CHAPTER 5

Discussion

The main goal of the present investigation, as guided by Jewkes' (2004) SEM model of preschool language development, was to test and specify direct and indirect influences of perinatal risk, children's home environments, maternal education, maternal mental health and behavior, and child characteristics on preschool language abilities, and to determine whether this constellation of relationships at 14 months continues to be predictive of outcomes at 24 and 36 months among a national longitudinal sample of low-income families attending Head Start. The results of the study provide theoretical and empirical support for the initial hypotheses introduced, and in the following section I will be discussing each of these consecutively.

Summary of Research Questions and Findings

Associations among Maternal Education, Home Environment and Child Language. Interestingly, maternal education had a very small but significant relationship to children's language at 14 months that was not significant at 24 months. This finding suggested that mothers with lower education levels had children with poor language outcomes at 14 months. An interpretation of this finding is that mothers with lower education levels used less language to interact with their children.

The effect of maternal education was not significant in the 24 month model, but re-emerged at the 36 month model as a highly significant direct path. In contrast to the effect of perinatal risk on language that is more robust early on and disappears with time, what this finding seems to suggest is that factors measuring environmental risk such as maternal level of education that have weak or no direct relationship to language early on gain influence later in life. These findings are consistent with Jewkes' (2004) model of language development that demonstrates strong relationships between maternal education, home environment and language in preschool years. The present findings extend the study conducted by Jewkes in a number of ways.

Firstly, the smaller middle class sample in Jewkes's model is contrasted to a much larger low-income sample. Despite these differences, the relationships among the home environment, and maternal education that were confirmed in Jewkes's model were also confirmed in the present study. Secondly, the present study extends Jewkes' model by including the additional constructs that were made available to me through the EHSRE dataset, namely, joint attention, perinatal risk and negative interaction. Lastly, the present model uses 14 month predictors to estimate language outcomes at 24 and 36 months of age.

The findings are also consistent with prior literature on the effects of maternal mental health, along with maternal education on language at 6 and 18 months of age (Lung et al, 2008). In addition, the home environment mediated the relationship between maternal education and language outcomes. More educated mothers provided more supportive home environments and in turn had children with higher language scores. This finding remained consistent across all three time periods.

In addition, the home strongly influenced language outcomes, with children from more supportive homes scoring higher on language measures at 14, 24, and 36 months. The home environment explained 60% of the variance in the 14 month model, 72% of the variance in the 24 month model and 59% of the variance in the 36 month model. This finding is consistent with prior work that links the enriched home to higher language skills at different childhood periods (Bornstein, 1989; 1998a; 1998b; Elardo, Bradley & Caldwell, 1977; Lung, Shu, Chiang, Chen & Lin, 2009; Jewkes, 2004; Murray & Yingling, 2000) but also suggests that a poor home environment has a less desired influence on language outcomes. This finding further emphasizes the need to provide resources and educate families on the role of enriched home environments in child language development.

Maternal Mental Health Influences on Child Language. The present study revealed a direct effect between maternal mental health and children's early vocabulary production and comprehension at 14 and 24 months. Children of more mentally distressed mothers scored lower in early vocabulary production and comprehension measures. By the third year of life the effects of maternal mental health had an indirect effect on language through joint attention and negative interaction. The more mentally distressed mothers were the less they engaged their children, which resulted in children's lower language scores. In addition, if the mothers were mentally distressed they were more likely to regard their children in a negative manner, which also resulted in lower language scores.

There was also a negative association between maternal mental health and home environments. More mentally distressed mothers were less likely to stimulate their children's language, social, and emotional skills in the home. The present findings are consistent with prior studies reporting that children of depressed mothers receive less language input and consequently score lower on measures of expressive and receptive vocabulary skills than did children of non-depressed mothers (NICHD, 1999; Paulson, Keefe, Leiferman, 2009) as well as more recent research documenting strong associations between maternal depression, poorer quality caregiving, and lower language outcomes, especially in lower socioeconomic populations (Stein, Malmberg, Sylva, Barnes & Leach, 2008).

Influences of Perinatal Risk on Child Language. In the present study, the direct path between perinatal risk and child language lost significance over time, but perinatal risk continued to have a steady indirect effect on language through child cognition in all three models we tested. The effects of perinatal risk on language were more robust at 14 months and disappeared by the time the child reached the third year of life. A possible explanation for this finding is that biological risk does not manifest into later developmental difficulties when proper environmental care is provided through positive parenting and enriched home environments. Future research should test this hypothesis in relation to implications for clinical practice and the level of intervention intensity and timing (early or late) in multiple interacting contexts such as the home and the school. Similarly, children whose mothers did not report existing perinatal risk but did not receive adequate parenting support, and who had mothers who were less educated and more mentally disadvantaged reported more negative outcomes despite being at an advantage at birth compared to the perinatal risk population. This finding highlights the importance of the social context in relation to both perinatal and environmental risk. The existence of perinatal risk was related to lower child cognitive abilities, which in turn yielded lower language abilities at 14, 24 and 36 months. This finding is consistent with Guarini et al. (2009) who showed that preterm birth continues to affect language development through the preschool years and beyond, highlighting continuity between pre- and peri-natal life and subsequent development as well as with prior research documenting that premature and low birth weight infants are at risk for language delays that may be part of a global deficit that impacts many areas of cognitive functioning (Ortiz-Mantilla, Choudhury, Leevers, & Benasich, 2008; Potter, 2010).

Relationships among Joint Attention and Child Language Outcomes. Joint attention at 14 months was correlated with child language at 14 and 24 months and had a direct influence on child language at 36 months. This finding suggests that the ability of the mother to maintain and direct the child's attention results in increased child language and cognitive competencies and is consistent with prior literature, which emphasizes the role of the mother in scaffolding the development of joint attention as well as the relationship between joint attentional engagement and the child's comprehension and production of language abilities (Dickinson & Tabors, 2001; Pan, Rowe, Singer & Snow, 2005; Rowe, Pan & Ayoub, 2005; Tamis-LeMonda et al., 2001; Weizman & Snow, 2001). The findings of the present study are also consistent with more recent findings that show relationships among joint attention, socio-emotional engagement, imitation and language skills (Farrant et al, 2011). In the 14 to 36 month model, 75% of the variance in joint attention was explained, 82 % of the variance was explained in the 14 to 24 month model and 67% of the variance in the 14 month model, which further indicates a good model fit to the data.

Additionally, joint attentional interactions were positively correlated with higher MDI scores, higher language scores and negatively associated with interactions that included the child's negativity towards the parent or parental intrusiveness. Negative interaction was negatively correlated with child cognition and child language. Interactions that included parental intrusiveness and children's negative regard toward the parent were associated with poorer MDI and language scores. Future policy interventions should emphasize the importance of frequent positive mother-child interactions and aim to provide all the necessary support to caretakers in order to be engaging and encourage proactive scaffolding.

An interesting finding in this study was that joint attention was were highly correlated with negative interaction, which seems to suggest that negative interaction disrupts the child's sustained attention and engagement of their mother. Negative interaction did not have a significant effect on language score outcomes, but was indirectly impacting language through the measures of joint attention. Future research should attempt to confirm these findings. This finding points to a useful direction in terms of intervention research designs, which emphasize the role of positive mother-child interactions and discuss the negative effects of negative mother-child interactions.

Relationships among Gender and Language Outcomes. In the present study, gender had a significant impact on child language outcomes with girls faring better than boys. The findings are consistent with prior literature that suggests that girls are superior to boys in language and cognitive abilities during early infancy (Hindmarsh, O'Callaghan, Mohay & Rogers, 2000). In a recent study of 750 preschoolers from low income backgrounds, Qi, Kaiser, Milan, McLean, and Feurer (2006) also reported boys scoring significantly lower than girls in language measures. Additionally, in a study conducted by Kaiser, Hancock, Cai, Foster, and Hester (2000) significantly more boys than girls scored below average on language measures. These results indicate the need for future interventions that address boys and girls separately as they may have different needs.

Implications

Theoretical implications. The results of the present study have theoretical implications for context-driven theories of language development. The results are consistent with a number of frameworks that emphasize the need to examine multiple interacting contexts and their influence on the developing child (Bronfenbrenner 1994; Sameroff et al., 1998; Vygotsky, 1978).

This study examined multiple microsystems (such as the home environment) and mesosystems such as the role of maternal mental health and their bi-directional contributions to child language outcomes and confirmed that a comprehensive view of language development can only be gained when examining the complexity of the interacting systems that directly and indirectly affect child language performance (Bronfenbrenner 1994). The present study also illuminates the Vygotskian approach to language.

Vygotsky (1978) viewed adult guidance as an essential factor in child language and cognitive development (Luria, 1976; Vygotsky, 1978; Wertsch, 1985) and emphasized that language development originates in social interaction. In the present study, all interactions were context-driven and guidance and support whether in the context of the home or during a specific mother-child task was positively correlated with children's language scores. The results are also consistent with Racine and Carpendale's (2007) constructivist argument that the acquisition of language is grounded in the development of competence in shared forms of socio-emotional engagement such as joint attention (Farrant, Mayberry & Fletcher, 2011).

The present findings also illuminate Sameroff's transactional model of development, which indicates that any teleological developmental milestone (including language milestones such as vocabulary comprehension and production) is a function of the transactions between the constructs of mother/caretaker, environment and child. Similarly, the concept cumulative risk indicates that as the number of risk factors increase, the outcome performance of the child decreases. In the present study, the presence of multiple risk factors such as perinatal risk, maternal depression and increased levels of stress, maternal low education levels, negative interactions and poor home environments negatively influenced children's language abilities.

Practical Implications. The present findings also have practical implications. They open the possibility of reducing later language deficits through interventions that support positive parent-child interactions as well as interventions that address mental health problems in caregivers. Overall, the findings suggest the need for early interventions involving high-risk infants and their families, as child, maternal and environmental risk factors at the first year of life are strongly predictive of outcomes into the preschool years. Future studies could test the present model prior to and after intervention.

Limitations and Directions for Future Research

The EHSRE study was a rigorous, large-scale, random-assignment evaluation and included an implementation study, an impact study and local research projects. 3,001 children from birth to age 3 were followed. The study included self-enumerated questionnaires, personal interviews, and direct observations. Due to the longitudinal nature of the study and the high risk low-income sample, there were high attrition rates.

Attrition can be a great problem in longitudinal research and can result in non-random sampling (Magnusson, 1990). The full EHSRE sample varied substantially from the analytical sample of the present study, since I only included participants who had language outcome scores and were English speakers. Since I worked with secondary data, the reasons for attrition are unknown but it can be assumed that some participants broke survey and interview appointments for miscellaneous and/or health reasons or that there was refusal of information for selected persons, or that there was unavailability during all time periods due to death and emigration reasons. Unfortunately, the EHSRE codebook fails to state directly which participants that were approached declined to participate. The reasons for missing data are not determinable but can be attributed to high attrition rates that are typical of longitudinal research with high risk samples. Fortunately, the total sample was large enough so that I can still assume that it is representative of the group under study. In addition, working with secondary data meant having to interpret data that was maintained at an extreme level of aggregation.

Data in this collection were constructed by the Mathematica Policy Research (MPR) researchers for use in their analyses. Very few of the original source variables are present in this public-use file. The constructs came from several data sources: Baseline data, which were collected from the Head Start Family Information System (HSFIS) program application and enrollment forms and the MPR Tracking System. I did not differentiate among the different location sites, as well as between the children who attended Head Start and those who belonged in the control group. In addition, there was a mismatch of units of language measures across all three time periods, which is a standard that needs to be met in order to conduct growth curve analysis.

In this study, the majority of children were born on time or about on time. Further research with large perinatal risk samples should test the present findings. Examining environmental influences with regard to language development in perinatal risk samples will allow for a better understanding of how to care for at-risk children with the goal of not only treating but preventing language delays in later years.

In this study, the construct joint attention was measured by the three bag task Child Engagement of Parent and Child Sustained Attention, which means one measure was centered around focused attention and one measure was interaction oriented. I did not have a mother-centered measure for this construct; the measures were more child-centered. Future research should address this limitation by including both child-centered and mother-centered measures of joint attention.

Although this study explained relationships among child and family characteristics, home environment, perinatal risk and language and cognitive outcomes in a low-income sample, there are demographic variables that are missing from the listed models, such as marital status, maternal age, and income. Consequently, I have not accounted for the full picture of all the surrounding contextual and risk factors that are influencing language abilities. Future research should attempt to include more of these demographic variables as an attempt to gain a more thorough understanding of how to target at-risk populations in interventions.

The present study confirmed gender differences among boys and girls. Girls did better than boys on language measures at 14 months and mothers were more likely to engage and sustain girls' attention and more likely to negatively interact with boys. However, it is important to note that the gender effect may be a confounding factor and there may be other variables like perinatal risk and home environment that are impacting these gender associations. At the same time it is equally noteworthy that gender was impacting on both the negative and positive aspects of interaction, which seems to suggest that the effect of gender is very much socially situated.

The present study confirmed relationships identified by Jewkes's model of preschool language development, albeit the differences in sample characteristics (small upper middle/middle class and large low-income class samples), which increases the generalizability of the findings. It is important however to note that the model developed by Jewkes included measures of maternal speech, which is something that the EHSRE dataset did not grant me access to. Future longitudinal research should include measures of maternal speech when testing the present findings, as there is strong literature supporting the claim that growth in vocabulary between a group of children from high SES families and a group of children from mid-SES families was fully explained in terms of differences in maternal speech, with children from mid-SES families scoring lower on language outcomes than children from high SES families (Jewkes, 2004; Hoff, 2003). Future longitudinal research should attempt to confirm the direct and indirect pathways identified in this study.

Additionally, future research should continue to explore whether specific types of parenting behavior (mother's negativity, neglect, etc.) and the home environment have an effect on language development among children with varying levels of perinatal risk. In particular, future research should further investigate whether relationships between parenting behaviors and child characteristics that put the child at risk for later cognitive and language deficits during the first years of life translate into more long lasting deficits that extend well into adolescence in individuals with and without language and cognitive delays.

The results of such research can be applied towards policy-related intervention designs. This process can involve interventions that encourage positive parent-child interactions for high-risk infants and their families, awareness raising, and mental health interventions (for example through cognitive therapy and especially through attention control techniques) for parents. It would also be interesting to investigate how high-risk children respond to positive interventions.

Conclusions

This longitudinal study of low-income children's language development outcomes makes several unique contributions to the literature. First, by examining influences of perinatal risk as well as environmental risk the study advances our understanding of the early language development of low-income, at-risk children. To date, most research that has involved research on preschool language development examines these influences (i.e., perinatal risk, maternal depression) separately rather than trying to understand their relationships in a single multivariate model.

Compared with earlier research on the language development of children the current study incorporated a systematic examination of children's characteristics (including perinatal risk) maternal parenting behavior and interaction with children, mental health, home environment and indicators of socio-economic status such as maternal education. Second, the middle class samples of many studies present limitations for generalizing findings to at-risk populations.

The present study sought to address these limitations of prior research by examining relationships between multiple factors (perinatal risk, child cognition, parent-child interaction, maternal education, maternal mental health, home environment) and language development in a large, longitudinal low-income sample. It is important to understand how these factors influence language outcomes in a high-risk population, since only then might we be better able to address the needs of children in policy intervention. Third, by incorporating a longitudinal approach this study gained valuable information on low-income children's language development during the first three years of life and how these outcomes were dynamically related to the home, maternal mental health, perinatal risk, joint attention and maternal education and negative parenting behavior.

My study confirmed significant relationships among all the variables of interest. These associations emerged as early as 14 months, and remained strong until the children's third year of life. Finally, by using observational data as well as a range of questionnaires and interviews, this study makes a methodological contribution to the investigation of this population's language experiences.

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