

IMPACT OF ADVERSE CHILDHOOD EXPERIENCES ON PARENTING,
CHILDRENS' SOCIAL AND EMOTIONAL AND LANGUAGE OUTCOMES:
THE ROLE OF MATERNAL DEPRESSION AND SOCIAL SUPPORT

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Abstract Study One: In the current study we examine the relationship between mothers' adverse childhood experiences (ACEs) and children's social and emotional development in a sample of low income mothers and their young children ($N = 42$). The effects of maternal depression, social support, and parenting self-efficacy were examined on that relationship. ACE scores were measured retrospectively and depressive symptoms, social support and parenting self-efficacy were assessed when babies were between 3 and 11 months of age ($M = 6.0$). Children's social and emotional development was assessed one year later. Results indicated that mothers ACE scores predicted children's social and emotional problems one year later. However, parenting self-efficacy was found to fully mediate that relationship. Maternal depression mediated this relationship at a 90% confidence level. These findings suggest that one way mothers' early adversity affects their children's development is through its effects on maternal mental health and parenting confidence.

Abstract Study Two: In the current study, the quantitative (adult word count, child vocalizations) and qualitative (conversational turns, child vocal productivity) environments of young children were assessed. Specifically, the relationship between the quality of the home language environment, positive parenting behaviors, and mother's depressive symptoms were examined in a sample of low income young children ($N = 26$) (M age = 18 months). Language Enhancement Analysis software (LENA) was used to measure language environments using full day recordings collected in the child's natural environment. Parent-child interactions were assessed using standardized observational tasks for positive parenting behaviors, encouragement, affection, responsiveness and teaching. Mother's depressive symptoms were assessed when children were on average six-months old. Results indicate that observed maternal teaching behaviors predicted the qualitative features of the language environment while maternal depressive symptoms significantly predicted lower child vocal productivity scores.

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CHAPTER I

STUDY ONE

Introduction

The relationship between adverse childhood experiences (ACEs) and negative physical and mental health outcomes is well established (Dube, Felitti, Dong, Giles & Anda, 2003; Edwards, Felitti, Holden & Anda, 2003). Researchers conducting the original ACEs study, were interested in the effects of childhood abuse, neglect, and household dysfunction on long-term outcomes. In a sample of over 17,000 adults, childhood abuse, neglect, and household dysfunction were retrospectively assessed and a significant and cumulative relationship was found between ACEs and subsequent illnesses, disease, disability and early mortality (Anda et al., 2006; Chapman et al., 2004). Data from the original ACEs study indicates that approximately two-thirds of the more than 17,000 participants reported having at least one ACE and most of the ACEs reported co-occurred with one or more additional ACE. Since the original ACE study, awareness of the long-term effects of experiencing childhood abuse and neglect has increased, leading to studies that have replicated and expanded on these findings. For example, prolonged exposure to adversity in childhood has also been linked to changes in the structure and function of the developing brain as well as biological impairments of the body's stress response

system, leading to cognitive impairments, difficulty regulating emotion, and poor health outcomes (Dube et al., 2003). A model proposed by Felitti and colleagues (1998) theorizes that adverse experiences in early childhood cause neurobiological deficits in development, leading to social, emotional, and cognitive impairment, and the subsequent adoption of risky health behaviors, mental and physical health problems, disease, disability, and early mortality (Felitti et al., 1998).

Neurobiological and epidemiological evidence suggest that exposure to cumulative adversity early in life has the potential to affect decision making, memory, reactivity to stress, cognitive development and physical and mental health, all of which have the potential to negatively impact subsequent parenting attitudes and behaviors. This unified, multidisciplinary perspective is important as researchers seek to better understand the impact of ACEs on development and how to prevent first generation and intergenerational exposure. While interest in ACEs has grown exponentially over the past decade, much less is known about how ACEs impact parenting and subsequent child development. Of interest in the proposed study is the relationship between mother's ACE scores and their children's social and emotional development. We hypothesize that the same dose response rate will be present between maternal ACEs and negative child social and emotional problems as is found with ACEs and negative health outcomes.

ACEs, Parenting, and Maternal Depression

ACEs can affect parent-child interactions in a variety of ways. Parents who have experienced traumatic events in childhood such as physical or sexual abuse are more likely to experience physical and mental illness, exhibit lower levels of social functioning, and increased reactivity to stress, affecting the ability to engage in positive parenting behaviors (Bailey, DeOliveira, Wolfe, Evans, & Hartwick, 2012; Lomanowska, Boivin, Hertzman & Fleming, 2017). These findings are in line with neurobiological research indicating a relationship between ACEs, mental health outcomes, and the disruption of the body's stress response system which has been linked to over responding in stressful situations and poor decision-making (Anda et al., 2006; Chapman et al., 2004). While this evidence supports the negative association between specific types of abuse and subsequent parenting behaviors, examining this issue from an ACEs perspective has the potential to provide valuable insight on the cumulative effects of abuse, neglect, and household dysfunction. ACEs research has led to an enhanced understanding of the profound impact experiencing early adversity has on mental and physical health, disease, and mortality (Felitti et al., 1998). Employing this same framework to research focused on early adversity, parenting, and child outcomes is an important next step.

The intergenerational risk of ACEs on parenting may increase for mothers experiencing depression. Similar to experiencing childhood abuse or neglect, maternal depression has been linked to parent-child interactions that are less sensitive, encouraging, and responsive (Murray, Fiori-Cowley, Hooper & Cooper, 1996). In addition to being less positive in nature, increased negativity, hostility and disengagement have also been found to be correlated with maternal

depression (Dixon et al., 2005; Pears & Capaldi, 2001). Researchers conducting a meta-analysis of maternal depression and parenting behaviors examined results from forty-six observational studies found increases in both negative and disengaged behavior from depressed mothers. Moreover, this association was the most robust for mothers from low socioeconomic status posing an additional risk for the sample population in the proposed study (Lovejoy, Graczyk, O'Hare & Neuman, 2000).

Poverty, Maternal Depression, and Child Social and Emotional Development

Mothers living in poverty are at increased risk for parenting difficulties due to the increased stress associated with financial hardships, lack of access to resources, neighborhood risk, single parent status, chaotic households, social isolation, and lack of social support (Balaki et al., 2007, Evans, 2004; Brooks-Gunn & Duncan, 1994). Recent research has shown a positive relationship between ACE scores and rates of maternal depression posing additional risk for mothers of low socioeconomic status who have also experienced early trauma (Chapman et al., 2004; McDonnell & Valentino 2016). Researchers interested in the mechanisms underlying economic disadvantage and child social and emotional problems examined this relationship in a sample of over 2,000 at risk families and their young children. Results indicated that maternal depression, disrupted parenting, parenting stress and harsh discipline were each factors that partially explained the risk between poverty and child social and emotional problems (Rijlaarsdam et al., 2013). The existing literature strongly suggests that maternal depression negatively affects the quality of early parenting interactions. Studies have shown depressed

mothers to be less engaged with their infants, less sensitive and warm, and exhibit increased hostility and irritability (Field, 2011). This is of particular importance in the current study as maternal warmth has been shown to buffer the negative health effects associated with low socioeconomic status (Chen, Miller, Kobor & Cole 2001).

For children who are already at risk due to the negative effects of living in poverty, the role of social interactions, particularly those with parents, may be even more influential in their development. Researchers studying the relationship between poverty and maternal depression on child outcomes found significant associations with many negative outcomes in early childhood such as increased negative affect, higher levels of inattention and hyperactivity, internalizing and externalizing behaviors (Field, 1995; Kiernan & Huerta, 2008; Petterson & Albers, 2001). Further, Chronis and colleagues (2007) found maternal depression to be associated with less positive parenting interactions leading to child conduct problems as much as eight years later. However, mother-infant interactions mediated the relationship between negative child outcomes and maternal depression suggesting that programs aimed at improving parent and child interaction may be especially important for mothers facing these cumulative risks (Petterson & Albers, 2001). Children who experience social and emotional problems in early childhood are more likely to experience social rejection and academic difficulties and show increased aggressive behavior (Dodge et al., 2003; Webster-Stratton & Reid, 2004). Without intervention these problems are likely to persist into adolescence leading to further affecting academic success and behavior problems (Cole, Lochman, Terry & Hyman, 1992; Hoglund, Lalonde &

Leadbeater, 2008; Laird, Jordan, Dodge, Pettit & Bates, 2001). Recently, Sun and colleagues (2017) reported that maternal ACEs were associated with children's developmental risk and evidence was found for maternal depression as a possible mediator of that association (Sun, Patel, Rose-Jacobs, Frank, Black & Chilton, 2017). Considering the strong graded relationship between ACE scores and long term negative health behaviors and outcomes, examining the intergenerational relationship between maternal ACEs, depression, and child social and emotional problems is a critical next step.

Social Support

While ACEs and maternal depression pose additional risk factors, social support has the potential to buffer the negative effects of early adversity on parenting and child social and emotional problems. In the current study, social support is conceptualized as the mother's perception of the quality of psychological support received from people in her life. Hashima and Amato (1994) found parent's perceived social support to be negatively associated with punitive parenting behaviors, however the effect was most significant when household income was low, indicating that social support may play a unique role on parenting practices in low income families (Hashima & Amato, 1994). In addition to functioning as a protective factor for mothers, mother's perceived social support has been found to moderate the relationship between maternal depression and child social and emotional problems. Researchers studying the effects of maternal depression, social support and children's behavior problems examined data from the Study of Early Child Care, a large scale, longitudinal study. Study results indicated that the relationship

between children's externalizing behavior and maternal depression significantly differed based on the amount of social support available to the mother. Moreover, researchers found that as maternal depression increased the protective effects of social support decreased (Lee et al., 2006). Social support may positively impact parenting and mental health through an increased number of relationships that provide support, encouragement, advice, and increased access to resources and can reduce the impact of stress (Letourneau, Stewart, Barnfather, 2004; McConnell, Breitzkreuz, & Savage, 2011; Morris et al., 2017).

Parenting Self-Efficacy

In addition to reduced stress, improved parenting, and maternal well-being, social support has been linked to improved self-efficacy (Balaji et al., 2007). Researchers examining the relationship between social support and postnatal depression found a statistically significant relationship between informal (i.e., support from family, friends vs. nurse, hospital etc.) social support and maternal self-efficacy (Leahy-Warren, McCarthy & Corcoran 2012). These results are similar to those reported by Haslam and colleagues (2006) who found that maternal self-efficacy and social support were associated with lower rates of postpartum depression four weeks after giving birth in a sample of two hundred new mothers (Haslam, Pakenham & Smith 2006). The effects of parenting stress associated with low-income status played a less significant role when self-efficacy was high (Raikes & Thompson, 2005). We hypothesize that mother's parenting self-efficacy, or the view they hold of their parenting abilities, will be positively associated with social support and child outcomes, and negatively associated with maternal

depression.

To our knowledge no studies have examined the relationship between ACEs, maternal depression, social support, and parenting self-efficacy concurrently. In addition, few studies have examined the impact of maternal ACEs specifically on their child's social and emotional problems. In response, the proposed study examined the relationship between maternal ACEs and child social and emotional problems and whether maternal depression, social support, and parenting self-efficacy mediated this relationship. Thereby adding to a gap in the current literature on the relationship between ACEs, maternal depression, and child social and emotional problems, and the role social support and parenting self-efficacy may play in that relationship. ACEs, maternal depression, social support, and parenting self-efficacy were assessed when babies were approximately six months of age and were used to predict child social and emotional problems (i.e., internalizing and externalizing behaviors, maladaptive behaviors and behaviors associated with dysregulation) one year later. The longitudinal design of the current study has the potential to offer unique insight into the relationship between ACEs and child social and emotional problems. We hypothesized that ACEs would be positively associated with child social and emotional problems as well as maternal depression and negatively associated with social support and parenting self-efficacy. We hypothesized that higher levels of social support would be associated with higher levels of mother's parenting self-efficacy and lower levels of maternal depression. Last, we examined the role of maternal depression, social support and parenting self-efficacy as possible mediators of the relationship between mothers' ACEs and

child social and emotional problems. See Figure 1.

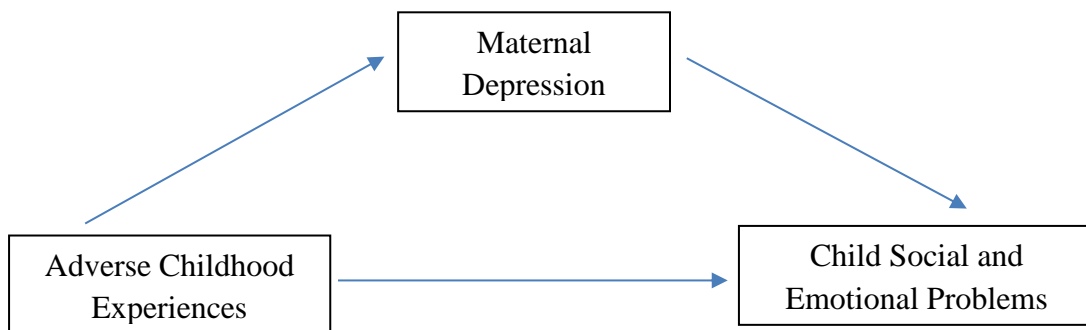


Figure 1. *Hypothesized Regression Model*

Note: In addition to maternal depression, social support, parenting self-efficacy were tested as mediators of the relationship between ACEs and child social and emotional problems.

Method

Participants

Data for the current study comes from participants ($N = 52$) who were part of an ongoing longitudinal study of mothers and infants living in poverty in a large urban city in the Midwest. The overarching goal of this larger study is to understand how babies develop and change over the first three years of life and how mothers influence their baby's development in a low-income sample of mothers and their infants. After receiving university IRB approval research assistants began recruiting participants were from local service agencies and a university hospital's pediatric clinic. Mothers who were at least eighteen years of age and had a baby between six

weeks and four months of age at the time of the baseline assessment were invited to participate in the study. In addition to maternal and child age requirements, mothers also had to be eligible to receive services from Women, Infants, and Children Food and Nutrition Service (WIC), a federally funded food and nutrition program for low income mothers. Both English and Spanish speaking mothers were eligible to participate. Interested participants completed a parent interest form, providing contact information for follow up calls and scheduling. In addition to informing mothers about the study, they were also told about a parenting program, *Legacy for Children*TM. This program is designed for new mothers and their babies, beginning prenatally or at six weeks of age (Perou et al., 2012). In the current study the program was set to begin when babies were approximately six weeks old. Mothers met weekly for parenting groups, and every other week the groups included the mother and their baby. The program is three years in duration and groups meet for three ten-week sessions per year, with six to eight week breaks in between. Mothers who were interested in participating were informed of the group meeting time and location and were invited to join if the meeting time worked with their schedule. Mothers who were no longer interested in participating or who could not participate due to meeting time or work conflicts were invited to participate in the study only condition. The survey was the same for those who participated in the parenting program and those that did not. The only difference between the assessments was the inclusion of survey questions related to the parenting program as part of a larger implementation study. Analysis controlled for *Legacy* ($N = 21$) participation. Only English-speaking mothers were included in the current study.

Procedure

Trained research assistants called interested participants and scheduled a time for them to come to the university to explain the study, answer questions, and obtain informed consent. The assessment consisted of a videotaped play interaction with the mother and baby and a computer administered survey and lasted approximately 2 hours. The survey portion of the assessment asked questions about mother's early adverse experiences, positive early experiences, substance abuse, parenting attitudes and beliefs, social support, neighborhood characteristics, mental health and relationships. In addition, parents were asked to report on their child's social, emotional and cognitive development. The videotaped portion of the assessment was usually completed first, however, the needs of the mother and baby always came first and that order was changed if the baby was sleeping, fussy, needed to be fed, etc. Participants were compensated \$40.00 for their participation at each wave of the survey. Demographic information, ACEs, and parenting measures came from the second wave of the survey (time one in the current study) when children were three to eleven months old ($M = 6.5$, $SD = 1.5$). Child outcomes measures were collected when children were between nineteen to twenty-one months of age ($M = 17$, $SD = .85$). Mothers ranged in age from nineteen to thirty-nine years of age ($M = 27$, $SD = 5$). Fifty-three percent of the children were male. Forty percent of the mothers were participants in the parenting program. No correlations were found between parenting program participation and any of the study variables. Over half the sample, 63%, was Caucasian, 23% African American, 4% Native American, 2% Asian, and 8% reported more than one race. At time one twenty 23% of mothers

reported never being married, 38% were married, 28% were living together and 11% were separated or divorced. Two percent of the sample had no high school degree, 45% received a high school diploma or high school equivalency certificate or GED (General Education Diploma), 25% reported having some college or vocational/technical school or training program and 28% reported having a college degree. All the families were low-income as established by their eligibility to receive WIC services.

Measures

Adverse Childhood Experiences (ACEs) Questionnaire. The ACEs questionnaire consists of 10 items designed to measure childhood exposure to psychological, physical or sexual abuse, witnessing domestic violence, and household dysfunction. Household dysfunction was defined as living with household members who abused substances, who were mentally ill, had attempted suicide or had been incarcerated (Felitti et al., 1998). For each of the 10 items a score of 1 was given for a “yes” response and 0 for a “no” response, for a total possible score of 10 and a range of 0 – 10. Researchers analyzing the test retest reliability of the ACEs questionnaire and the validity of using self-reported retrospective measures of adverse childhood events, surveyed 658 participants at two-time points, approximately 1 year apart. Analysis for each question, construct (household dysfunction, type of abuse) and the overall ACE score were conducted using kappa coefficients. These coefficients can range from -1 to + 1 with a value of .40 considered poor and a value $\leq .75$ considered excellent (Dube, Williamson, Thompson, Felitti & Anda, 2004; Fleiss, 1981). The weighted kappa coefficient for the overall ACE score was .64.

The kappa coefficient for emotional abuse was .66, .69 for sexual abuse, and .55 for physical abuse. The household dysfunction kappa coefficients were .75 for substance abuse and .77 for witnessing domestic violence (Dube et al., 2004). The Cronbach's alpha in the current study was .86.

Parenting Stress Index (PSI-4) Competence Subscale. The competence scale of the PSI-4 was used to measure mother's self-efficacy. The PSI-4 is a widely used measure to assess parents' perceived stress within the parent-child system. The PSI-4 is written at a fifth-grade reading level and is designed to be used with mothers whose children are one month to twelve years of age (Aibidin, Austin, & Flens, 2013). The competence subscale consists of thirteen items, sample items include "When my child came home from the hospital, *I had doubtful feelings about my ability to handle being a parent*," "*Being a parent is harder than I thought it would be,*" and "*I often have the feeling that I cannot handle things very well*". Item answers range from strongly disagree to strongly agree and scores range from one to five with a range of possible scores of twelve to sixty. Several studies have shown the PSI to be a reliable and valid tool to measure parenting stress. The PSI reports Cronbach's alpha of .95 for the PSI total scale, .90 for the child domain and .93 for the parent domain (Aibidin et al., 2013). In addition, researchers have reported good to excellent internal consistency when used with individuals from diverse backgrounds such as differing socioeconomic status, ethnicity, child age, family structure and language (Abidin, 1983; Abidin, Austin & Flens, 2013; Hutcheson & Black, 1996). This subscale of the parenting stress index includes two questions about the education level of the

mother and the father. These questions were not included in the parenting competence scale in the current study. Original scale reliability with the parent education was low, with a Cronbach's alpha of .42. Theoretically, these questions do not reflect parenting competence, when combined with the low Cronbach's alpha the decision was made to remove these items from the competence subscale. When removed Cronbach's alpha was still low at .45. Two questions in this subscale address how participants see themselves as parents, "*When I think about myself as a parent I believe*", answer options range from "*I can handle anything that happens*", to "*I don't think I handle things very well at all*". "I feel that I am" answer options range from "*very good parent*" to "*not very good at being a parent*". These questions have different answer options than the rest of the scale, when these items were removed from the competence internal consistency increased to .75. Therefore, in the current study the competence scale consists of eight of the thirteen items in the original subscale.

Center for Epidemiologic Studies Depression Scale - Revised (CESD-R). The CESD is a widely used assessment tool to measure depression in the general population (Van Dam, & Earleywine, 2011). The CESD-R is a revised version of this scale was used in the current study. The CESD-R consists of 20 items that ask how often in the last week a participant felt a certain way. Items include, "My appetite was poor", "I could not shake off the blues", "I lost interest in my usual activities", and "I could not focus on the important things". Responses range from "not at all" to "nearly every day for 2 weeks". Each item has a range of scores from 0 to 5. Research has shown the CESD-R to have strong psychometric properties demonstrating internal

consistency, content and construct validity, and reliability (Eaton, Smith, Ybarra, Muntaner & Tien 2004; Van Dam, & Earleywine, 2011). Internal consistency for the current study was high, with a Cronbach's alpha of .92.

Social Provision Scale. The social provision scale was used to assess dimensions of participants social support (Cutrona & Russell, 1987). This scale consists of 24 items asking about how the participants perceived support from people in their lives and is designed to address six dimensions of support, attachment, reliable alliance, guidance, reassurance of worth, social integration, and opportunity for nurturance. All six dimensions are combined to create a total social support score. Sample items include “*There is no one I can turn to for guidance in times of stress*”, “*I have close relationships with people that provide me with a sense of emotional security and well-being*”, and “*There is a trustworthy person I could turn to if I were having problems*”. Item scores range from 1 to 4 and answer responses are strongly disagree, disagree, agree and strongly agree. The social provision scale is a well-established measure that has shown validity and very high internal consistency ranging from .83 to .94 (Mancini & Bliezner, 1992; Roberts, Lepore, & Helgeson, 2006). Internal consistency in the current study was high, with a Cronbach's alpha of .95

Brief Infant-Toddler Social and Emotional Assessment (BITSEA). The BITSEA is screening tool used to assess social and emotional problems and competencies in children 12 months to 36 months of age (Briggs-Gowan, Carter, Irwin, Wachtel & Cicchetti, 2002). It

consists of 42 items and 2 subscales, the Problem scale (31 items) and the Competency scale (11 items). The problem scale looks for internalizing and externalizing behaviors, maladaptive behaviors and behaviors associated with dysregulation. Sample items include, “Gets hurt so often that you can't take your eyes off him or her”, “Seems restless and can't sit still”, “Has less fun than other children”, and “Does not react when hurt”. Answer responses are “*Not True or rarely*”, “*Somewhat True/Sometimes*” and “*Very True/Often*”. This is a standardized, normed referenced measure and several studies have reported high validity and reliability for assessing social and emotional competence and problem behavior (Briggs et al., 2002; Hungerford, Garcia & Bagner, 2015; Karabekiroglu, Briggs-Gowan, Carter, Rodopman-Arman & Akbas, 2010). In the current study, only the Problem scale was included. The BITSEA has also shown high internal consistency with Cronbach's α of .80 to .90 and the problem scale has shown to have excellent test retest reliability with an alpha of .92 (Briggs-Gowan et al., 2002; Briggs-Gowan, Carter, Irwin, Wachtel & Cicchetti, 2004) Internal consistency in the current study was high with a Cronbach's alpha of .70.

Results

Statistical Analysis

Participant data was complete for ACEs, maternal depression, social support, and parenting self-efficacy ($N = 53$). Data for children's social and emotional problems was not available for ten participants ($N = 42$), 12 of those were *Legacy* participants and 30 were non-

Legacy participants. Prior to analysis, scales were computed for study variables and descriptive statistics were derived. Data was assessed for outliers via leverage points. A plot of studentized residuals and unstandardized predicted values indicated there was homoscedasticity and no correlations were greater than .07 and Tolerance values were less than .01, indicating no multicollinearity. Normality was assessed through visual inspection of histograms and normal Q-Q plot of studentized residuals. Maternal depression and ACE scores were marginally positively skewed however it was determined there was not enough skew to require a transformation. Descriptive statistics are presented in Table 1.

Bivariate correlation analysis was computed to test the strength and magnitude of associations between study variables. No association was found between social support and ACEs therefore mediation was not conducted for this variable. [See Table 1.] To test the hypothesized mediation models, Baron and Kenny's (1986) procedure for mediation was used. First, the outcome variable (social and emotional problems) was regressed on the predictor variable (ACES). Next the specific mediator (maternal depression, parenting self-efficacy) was regressed on the predictor variable. Last, the outcome variable (social and emotional problems) was regressed on the predictor variable (ACEs) and the specific mediator (maternal depression, parenting self-efficacy). Indirect effects were computed using bootstrapping and PROCESS 3.0 software (Hayes, 2017).

Correlation and Regression Analysis

Results of bivariate correlational analyses regarding the associations between ACEs, maternal depression, social support, parenting self-efficacy, and children’s social and emotional problems were largely consistent with our hypothesis. See Table 1. However, no significant correlations were found between gender, participant education, *Legacy* participation, and the main study variables, and so they were not controlled for in regression analyses. ACE scores were positively correlated with maternal depression and child social and emotional problems and negatively correlated with parenting self-efficacy. Maternal depression was negatively correlated with social support and parenting self-efficacy and positively correlated with child social and emotional problems. Social support was positively correlated with parenting self-efficacy and negatively correlated with child social and emotional problems. Parenting self-efficacy was negatively correlated with child social and emotional problems.

Table 1. *Statistics and Bivariate Correlations between ACEs and Parent Variables (N = 53) and Children’s Social and Emotional Problems (N =43)*

Variable	Range	<i>M</i>	<i>SD</i>	2	3	4	5	6
1. Legacy participation				-.05	-.03	-.20	-.06	-.10
2. ACEs	0 - 9	3.25	2.96		.33*	-.16	-.37**	.35*
3. Maternal depression	0 - 64	13.75	13.40			-.32*	-.57**	.37*
4. Social support	58 - 96	78.50	11.25				.45**	-.36*
5. Parenting self-efficacy	24 - 45	37.48	4.88					-.44**
6. Child SE	2 - 28	11.30	7.02					

* $p < .05$, ** $p < .01$.

The predictor variable (ACEs) was significantly related to child social and emotional problems. Further the predictor variables were significantly correlated with the mediator

variables (maternal depression, parenting self-efficacy). The association between the predictor variable ACEs and child social and emotional problems was no longer significant when the mediator (parenting self-efficacy) was entered in the regression model (see Figure 2). When ACEs, self-efficacy and child social and emotional problems were entered simultaneously in the regression equation, only parenting self-efficacy remained a significant predictor of child social and emotional problems ($\beta = -.36, t(41) = -2.4, p = .02$). Further the association between the predictor variable (ACEs) and child social and emotional problems was no longer significant when the mediator maternal depression was entered in the model (see Figure 3). When ACEs, maternal depression, and child social and emotional problems were simultaneously entered in the model, ACEs was no longer a significant predictor of child social and emotional problems while maternal depression remained marginally significant remained significant ($\beta = .14, t(41) = 1.82, p = .08$). Thus, there was evidence that parenting self-efficacy and maternal depression each uniquely mediated the relationship between ACEs and children's social and emotional problems.

To test the variance explained by indirect effects of the mediators in the two models, a bootstrapping procedure was used. Results of indirect effects are presented in Table 2. Using PROCESS for SPSS software (Hayes, 2017), bootstrapping estimates of the indirect effect were generated and that distribution was used to approximate the original sampling distribution. This procedure allows indirect effects to be quantified rather than inferred, as is the case with the Sobel test (Hayes, 2009). Unlike the Sobel tests, bootstrapping does not assume a normal distribution of the indirect effect (MacKinnon, Warsi, & Dwyer, 1995; Hayes, 2009).

Unstandardized indirect effects were computed for each of the 5,000 bootstrapped samples, and the 95% confidence interval was computed by determining the indirect effects. Results from bootstrapping analysis indicated parenting self-efficacy fully mediated the relationship between ACEs and child social and emotional problems. See Figure 2. However, maternal depression did not mediate the relationship between ACEs and child social and emotional problems. See Figure 3.

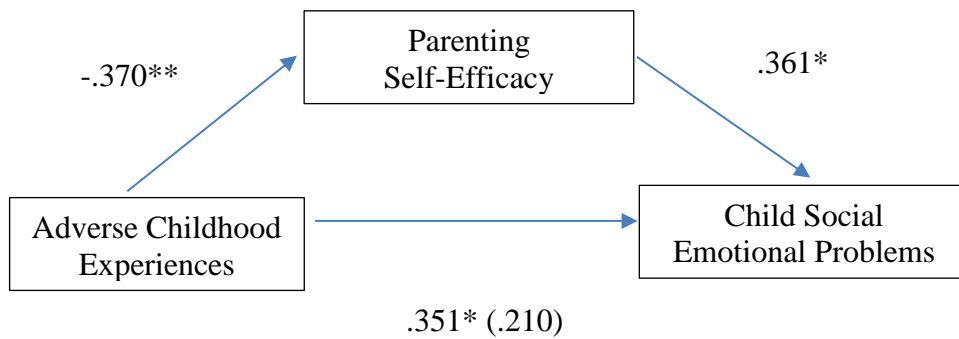


Figure 2. *Standardized Regression Coefficients Illustrating the Path from ACEs to Child Social and Emotional Problems as Mediated by Parenting Self-Efficacy.*

Note: The standardized regression coefficient between ACEs and social and emotional problems controlling for parenting self-efficacy is in parenthesis.

* $p < .05$. ** $p < .01$.

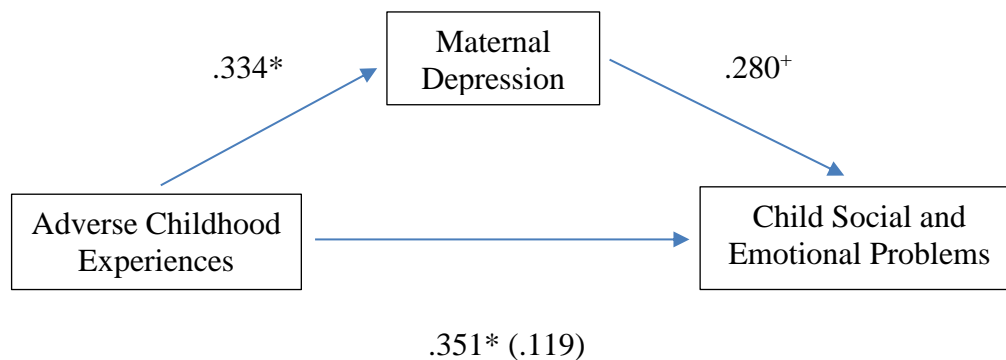


Figure 3. *Standardized Regression Coefficients Illustrating the Path from ACEs to Child Social and Emotional Problems as Mediated by Maternal Depression.*

Note: The standardized regression coefficient between ACEs and social and emotional problems controlling for maternal depression is in parenthesis.

⁺p < .10. *p < .05.

Results from bootstrapping analysis are presented in Table 3. Results indicated indirect effects were significant for model one where parenting self-efficacy mediated the relationship between ACEs and child social and emotional problems. The bootstrapped unstandardized indirect effect for ACEs, parenting self-efficacy was significant $B = .342$, 95% CI [.010, .886]. Thus, the indirect effect was statistically significant. However, the bootstrapped indirect effect was not significant for ACEs, maternal depression, and child social and emotional problems $B = .097$, 95% CI [-.008, 2.10], indicating mediation did not occur for this model. This could be due to the small sample size. Because maternal depression was marginally significant when ACEs, maternal depression, and child social and emotional problems were simultaneously entered in the model ($\beta = .14$, $t(41) = 1.82$, $p = .08$) bootstrapping analysis was conducted with a 90% confidence interval. Results from this analysis indicated that the indirect effect was significant $B = .097$, 90% CI [.001, 2.10]. Therefore, a trend towards significance is present for the mediating

effect of maternal depression on the relationship between ACEs and child social and emotional problems.

Table 2. (*N* = 42) *Mediation Effects of Parenting Self-Efficacy on the Relationship between ACEs and Child Social and Emotional Problems (Model 1) and Maternal Depression on ACEs and Child Social and Emotional Problems (Model 2).*

	<i>B</i>	95% CI	
		Lower	Upper
Model 1			
Parenting Efficacy			
Total	.853	.134	1.571
Direct	.512	-.228	1.250
Indirect (mediation)	.342	.010	.886
Model 2			
Depression			
Total	.185	.040	.330
Direct	.088	-.084	.259
Indirect (mediation)	.097	-.008	.210

Note. Results are based on 5,000 bootstrapped estimates

Discussion

The goal of the current study was to examine the relationship between mothers' ACE scores and children's social and emotional problems and to explore the role of maternal depression, social support, and parenting self-efficacy on that relationship in a sample of low-income mothers. As hypothesized, mothers' self-reported ACE scores were related to their parenting efficacy, depressive symptoms, and their perceptions of their child's social and emotional problems. Results from mediation analysis suggest that mothers with a history of ACEs are less confident in their parenting abilities and this has a negative effect on their

children's social and emotional development. Mediation analysis also indicates that mother's ACE scores tend to increase depression, and in turn, their children's adjustment. While social support could not be tested as a mediator, social support and parenting self-efficacy were highly correlated with one another suggesting that mothers with higher levels of social support have more confidence in their parenting abilities.

In the broader contextual view, study results suggest that improving parent's confidence in their parenting abilities can potentially buffer the deleterious effects of ACEs on child social and emotional problems. Our results are in line with the recent work of McDonnell and Valentino (2016) who found a significant association between ACEs and prenatal depression, and postnatal depression and six-month infant social and emotional problems. As awareness of the deleterious effects of ACEs on later life outcomes has increased, so have prevention efforts aimed at preventing intergenerational transmission (Shonkoff, 2012). Morris and colleagues (2017) recently proposed a model suggesting that parenting programs designed to support nurturing parenting can potentially reduce the intergenerational risks of early adversity and poverty by increasing parents social support and improving parent and child interactions. Results from the current study support this proposed model, although we did not find program differences for mothers who were part of the parenting program, likely due to the small sample size. While social support in the current study did not indirectly mediate this intergenerational risk, social support and parenting self-efficacy were highly correlated suggesting that social support increases parents' confidence in their ability to parent thereby improving child social and

emotional problems. Moreover, while participation in *Legacy* was not correlated with children's social and emotional problems, this could be because social and emotional problems were assessed too early in the program to see appreciable differences. In randomized control trials of the *Legacy* intervention, significant results were not seen until year two (Kaminski et al., 2013).

Strengths, Limitations, and Future Directions

To our knowledge, no studies have examined ACEs, maternal depression, parenting self-efficacy, social support, and children's social and emotional problems in a short-term longitudinal study. Further, the current study goes beyond a model of risk to examine the possible explanatory mechanisms of social support and parenting self-efficacy. A limitation of the current study is that all data are mother's self-report however, the data are longitudinal, indicating that mother's perception of their social support, parenting self-efficacy, and depressive symptoms are all related to their perceptions of their child's subsequent problem behavior. Moreover, parent's self-report using the BITSEA has been shown to be a reliable and valid tool for identifying children's social and emotional problems ((Briggs et al., 2002; Hungerford, Garcia & Bagner, 2015). The BITSEA Problem score has also shown high sensitivity (80% - 96.2%) and specificity (75%–90%) when compared to clinical scores on the Child Behavior Checklist (CBCL) a widely used diagnostic tool for assessing problem behaviors (Briggs-McGowan et al., 2013). Regardless of whether a child's social and emotional problems are within a clinical range, mother's perception of their child's behavior is important, and can affect the quality of their interactions. The measures used to assess mothers perceived social support

(SPS), parenting self-efficacy (PSI), and mother's depressive symptoms (CESD-R), have been shown to be reliable and valid measures (Abidin et al., 2013; Mancini & Bliezner, 1992; Roberts, Lepore, & Helgeson, 2006; Van Dam, & Earleywine, 2011). Further, mothers are the most qualified to report on their own perceptions, thoughts, and feelings surrounding social support and parenting self-efficacy. While data are collected at only two-time points, ACEs are measured retrospectively and can be viewed as a strength or a limitation; however, this is a widespread practice for assessing adverse childhood experiences (Dube et al., 2004; Hardt & Rutter, 2004). While maternal depression, social support, and parenting self-efficacy are thought to affect children's social and emotional development through positive parenting interactions, no measure directly assessing parenting interactions was included in this study and is an additional limitation. Including an observational measure of parent and child interactions in future analyses may help to more fully elucidate the pathways between ACEs, depression, social support, parenting self-efficacy and child outcomes. Due to a relatively sample size, more complex multivariate models could not be examined, however, replicating these results with a larger sample size may provide additional support for these findings.

An important next step is to more fully elucidate the ways in which social support and parenting self-efficacy impact the negative effects of ACEs and depression on child outcomes to increase the effectiveness of prevention and intervention efforts. Rates of postnatal depression for low-income mothers are high, with 55% of infants being cared for by a mother experiencing depressive symptoms (Golden et al., 2011; Vericker et al., 2010). Depression is treatable,

however, research on the effectiveness of treatments in this vulnerable population is limited (National Research Council, 2009). Home visiting programs aimed at improving outcomes for low-income mothers and children have shown mixed results for mothers who are also experiencing depression (Duggan, Cassidy, Burrell & Tandon, 2009; Johnson, Reid et al., 2018; Olds et al., 2007). It possible that modifications need to be made for successful implementation of these programs. Increased training and support for interventionists on the identification of depressive symptoms and how to effectively support mothers experiencing depression, may improve the effectiveness of service delivery (Golden et al., 2011). Interventions aimed at improving parent-child interactions and increasing parent's social support can improve outcomes for at risk families as well (Morris et al., 2017). For mothers experiencing depressive symptoms, social support may play a critical role in improving parenting self-efficacy and parent-child interactions (Carter, Garrity-Rokous, Chazan-Cohen, Little & Briggs-Gowan, 2001; Silver, Heneghan, Bauman & Stein 2006). The *Legacy for Children*TM intervention was designed to improve parenting self-efficacy and social support for low-income mothers and has shown promising results related to children's developmental outcomes (Kaminski et al., 2013). However, the intervention is three years in length, requiring a considerable time commitment for families making it difficult to scale up, although efforts are underway (Morris et al., 2017). Programs for low-income families embedded within a medical home or early childhood center may be a more effective way to bring interventions to scale as they meet families where they are, in a setting that is familiar, and where trusting relationships may already exist. Centering

Pregnancy and Centering Parenting are group based models of healthcare designed to support mothers during their pregnancy and through the first two years of their child's life. The overall goal of Centering is improving the health and well-being of mothers and children (Mital, 2001). Group sessions are part of regular prenatal and well child visits, with emphasis placed on the health, education, and support while strengthening the relationship between the provider and patient. Facilitated group discussions are intended to empower mothers and increase social support (Centering Healthcare Institute, 2018; Mittal, 2011). Similar to home visiting programs, successful program implementation and maintaining maternal engagement may be more difficult with mothers experiencing depressive symptoms. Because these programs are implemented within a medical home, screening and treatment can be simplified potentially reducing barriers for mothers. Researchers studying the implementation of Centering Parenting found higher scores for mother's social support and self-efficacy (Jones et al., 2018). Increasing awareness of the vital role of parents' self-confidence in their parenting abilities and the unique role social support plays in improving outcomes for at risk families is a critical next step. An additional next step is finding ways to effectively and consistently implement interventions in community care and to address the economic disparities that exist in accessing quality mental health care (Garland, Lebensohn-Chialvo, Hall & Cameron, 2017).

Conclusion

Experiencing abuse, neglect, or household dysfunction in childhood leads to an increased risk of social, emotional, and physical health problems. Coupled with the deleterious effects

associated with living in poverty, mothers are at increased risk for experiencing depression, lack of social support, and holding a negative view of their parenting abilities. Almost half of the 41% of children living in poverty in the United States are younger than three (Koball & Jiang, 2018). Intervening early for families who are at increased risk due to socioeconomic disparities is crucial (Shonkoff, Boyce, McEwen, 2009). Our study findings suggest that this can be done by increasing awareness of the intergenerational risks associated with ACEs and supporting both research and evidence based interventions aimed at reducing risk and improving outcomes for families and young children.

CHAPTER II

STUDY TWO

Introduction

A child's early language environment is predictive of their cognitive development, educational outcomes, and future economic opportunities (Hoff, 2013; Leffel & Suskind, 2013). The negative effects of a diminished language environment emerge early. The number of words a child hears by the age of thirty-six months is highly correlated with language development and later academic success (Hart & Risley, 1995). Moreover, differences in vocabulary and processing speed have been shown to emerge as early as eighteen months (Fernald & Marchman, 2013). Children living in poverty have heard approximately thirty million fewer words by the age of three than their peers from higher socioeconomic backgrounds (Hart & Risley, 1995). In addition to hearing fewer words, they hear more negative and directive language that subsequently discourages conversation. This gap in language development continues to widen and is associated with smaller vocabularies and weaker reading skills in third grade (Hart & Risley, 1995; Suskind et al., 2016). This is critical because children who have not achieved reading proficiency by third grade are more likely to experience academic difficulties, behavior

problems, and are less likely to graduate high school and more likely to experience economic difficulties later in life. Males and minority children living in poverty are at even greater risk, with approximately eighty-five percent of this population failing to reach reading proficiency by third grade (Fiester, 2010). In addition to being at risk for lower quality language environments, low-income children three years and under are at increased risk for having a mother with depressive symptoms. Over half of children living in low-income families have a mother who is experiencing depressive symptoms (Schmit, Golden & Beardslee, 2014; Vericker, Macomber & Golden, 2010) compounding the risk for delayed language development. With over thirteen million children living in poverty in the United States (Children's Defense Fund, 2017), closing this gap in early language development is of critical importance.

Quantity versus Quality and Young Children's Language Acquisition

The seminal work of Hart and Risley (1995) led to what is known as the thirty-million-word gap. In their landmark study, 42 families from different socioeconomic backgrounds with children seven-to nine-months of age were followed until the children turned three. Researchers recorded and transcribed everything heard in the home for one hour a month. After analyzing the 1,300 recordings they found significant disparities existed in the language environments of young children. Children living in low-income homes heard approximately thirty million words fewer words than children from higher socioeconomic backgrounds. In addition to hearing fewer words, they heard more discouragements and prohibitions. Differences in the language environment at age three predicted third grade academic performance for the 29 children that participated in the follow up study (Hart & Risley, 2003). While the work of Hart and Risley (1995) established that the quantity of words children hear is important, more recent research

suggests that the quality, responsiveness, and complexity of the child's language environment is equally, if not more important (Hirsh-Pasek et al., 2013; Hoff, 2006).

More recently, researchers interested in young children's language development have found that the quantity of input is significant in predicting young children's language development. However, this relationship between quantity of words was partially mediated by the number of conversational turns between the parent and child (Zimmerman et al., 2009) suggesting qualitative features of language input also play an important role in children's language acquisition (Rowe, 2018). Further evidence to support the importance of qualitative features of the language environment on children's development comes from longitudinal research spanning a decade. Researchers found that conversational turns measured when children were one to three years old predicted working memory and cognitive development ten years later. The magnitude of this effect size was strong and was not found for the number of words the child heard (Gilkerson, 2017). Perhaps the most recent evidence of the influence of the qualitative features on children's language development comes from a study examining the home language environments of young children using Language Environment Analysis System (LENA) recording devices and data from functional magnetic resonance imaging (fMRI). fMRI scans of children four to six years of age were conducted during a language processing task. Adult word counts and conversational turns were negatively correlated with SES, however, only conversational turns predicted children's language processing over and above SES. Further, results from scans showed greater activation of the area of the brain associated with language processing, Broca's area, for children who experienced more conversational turns, even when controlling for SES, cognitive ability, adult word count, and child vocalizations. Taken together, activation of Broca's area and conversational turns accounted for 23% of the variance between

SES and children's language ability (Romeo et al., 2018). These results are the first to show neurobiological evidence of the significant role the qualitative features of the home language environment play in young children's language development.

Parenting Interactions, Maternal Depression, and Language Quality

It is well established that parent's quantitative and qualitative input on a child's language environment is influenced by the social interactions between the parent and child. Sensitive and responsive parenting interactions have been shown to positively impact language quality (Landry, Smith, Swank, 2006; Leigh, Nievar & Nathans, 2011; Tamis-LeMonda & Briggs, 2002) while interactions that are harsh, controlling, or punitive are more likely to be directive in nature and reduce opportunities for conversation (Hart & Risley, 1995; McLeod & Shanahan, 1993). Moreover, mothers experiencing depressive symptoms are more likely to have difficulty responding to their child's needs and maintaining engagement, and display negative emotionality (Feldman et al., 2009), irritability, and hostility all of which can lead to fewer and disrupted caregiving interactions (Lovejoy, Graczyk, O'Hare & Neuman, 2000). Researchers conducting a longitudinal study examining the relationship between maternal depression, caregiving quality, and young children's language outcomes found that depression was associated with caregiving quality but not independently with children's language, and these effects were stronger for lower income dyads (Stein et al., 2008). These results suggest that maternal depression plays a role in children's language acquisition through the quality of parent-child interactions and is especially influential for low-income families. Very young children may be even more susceptible to the effects of depression, and negative interactions as they are more reliant on their caregiver to initiate and maintain interactions.

Alternatively, some evidence suggests language quality may be more influential than sensitive parenting. In a sample of low-income families, researchers found that the quality of communication during a 15-minute play task when children were 24 months was a better predictor of children's expressive language development one year later than the quantity of words or sensitive parenting (Hirsh-Pasek et al., 2015). Focusing on global parenting constructs such as sensitive parenting, which has been operationalized in many ways, may obscure other aspects of parenting that uniquely affect the quality of the language environment (Kathy Hirsh-Pasek et al., 2015). In response, the current study examined four domains of parenting behavior, encouragement, responsiveness, affection, and teaching. These parenting behaviors were assessed using the Parenting Interactions with Children: Checklist of Observations Linked to Outcomes (PICCOLO). This measure was developed specifically for observations of parenting interactions with young children in diverse populations.

Much of the research assessing the quality and quantity of language during parent-child interactions have been done in a lab setting during a relatively brief structured or semi-structured play task and may not accurately reflect the quality of language interactions in the home. In the current study, the quantity and quality of young children's language environments were assessed using full day recordings of the home language environment LENA digital recording devices. In addition, the current study examined relationships between maternal depression, positive parenting, and quantitative and qualitative features of the home language environments in a sample of low-income mothers and their young children living in an urban city in the Midwest. Home language environment quantity was assessed via adult word counts and child vocalizations and quality was assessed via conversational turns. Children's vocal productivity scores and the amount of time spent watching television and using electronics were also included as measures

of the home language environment. To our knowledge no studies to date have used LENA recording devices to assess home language environments in conjunction with observations of parent-child interactions, and maternal depression.

Study Goals and Hypothesis

The first goal of the current study was to delineate differences in children's language environments within a sample of low-income mothers and their young children. We hypothesized that language environment measures would on average be low when compared to LENA national normative data. A second goal was to examine the relationship between positive parenting behaviors, maternal depression, and young children's language environments. We hypothesized that maternal depression and less positive parenting behaviors would be associated with lower adult word counts, conversational turns, child vocalizations, and children's vocal productivity scores.

Methods

Participant Recruitment and Demographics

Participants in the current study ($N = 29$) were part of an ongoing longitudinal study of mothers and infants living in poverty in a large urban city in the Midwest. The overarching goal of this larger study was to understand how babies develop and change over the first three years of life and how mothers influence their baby's development. After receiving university IRB approval research assistants began recruiting participants from local service agencies and a university hospital's pediatric clinic. Mothers who were at least eighteen years of age and had a baby who would be between six weeks and four months of age at the time of the baseline assessment were invited to participate in the study. Mothers also had to be eligible to receive

services from Women, Infants, and Children Food and Nutrition Service (WIC), a federally funded food and nutrition program for low-income mothers. Both English and Spanish speaking mothers were eligible to participate. In addition to informing mothers about the study, they were also told about a parenting program, *Legacy for Children*TM. This program is designed for new mothers and their babies, beginning prenatally or at six weeks of age (Perou et al., 2012). In the current study the program was set to begin when babies were approximately six weeks old. Mothers participating in the parenting program met weekly for parenting groups and every other week the groups include the mother and their baby. The program is three years in duration and groups meet for three ten-week sessions per year, with six to eight week breaks in between. Mothers who were interested in participating were informed of the group meeting time and location and were invited to join if the meeting time worked with their schedule. Mothers who were no longer interested in participating or who could not participate due to meeting time or work conflicts were invited to participate in the study only. Mothers who were interested in participating in the study or the parenting program were asked to complete a parent interest form, providing contact information for follow up calls and scheduling. Research assistants called interested participants and scheduled a time for them to come to the university to explain the study, answer questions, and obtain informed consent. The survey was the same whether parents participated in the parenting program or the study only. The only difference between the assessments was the inclusion of survey questions related to the parenting program as part of a larger implementation study. In the current study four of the 26 mothers participated in the *Legacy for Children*TM program.

The baseline assessment was conducted when babies were between four and eight months old ($M = 6.03$, $SD = 1.02$). The assessment consisted of a videotaped play interaction with the

mother and baby and a computer administered survey and lasted approximately 2 hours. The survey portion of the assessment asked basic demographic questions and about mothers' mental health and social relationships. The videotaped portion of the assessment was usually completed first, however, the needs of the mother and baby always came first and that order was changed if the baby was sleeping, fussy, needed to be fed, etc. In the current study parent-child observations took place when children were between 15 and 19 months of age. Participants were compensated \$40.00 for their participation at each wave of the survey.

A home language component was added to the study when children were approximately eighteen months of age. After receiving IRB approval, research assistants began recruiting for the home language environment study. Research assistants explained the study to mothers during a regularly scheduled assessment and informed consent was obtained for interested participants during this time. At the completion of the survey mothers were given the recording device and instructions and recording days were chosen. Participants who would not be returning for a regularly scheduled assessment for several months and had a child eighteen - months or older were contacted by a research assistant to inform them of the study. This was done only for participants who indicated they would like to be contacted for future studies on their original consent form. Only English-speaking mothers were included in the current study. There were approximately 45 eligible participants and we were able to make contact with 36 of them. Of those 36 participants, 29 chose to participate. We lost contact with one participant and the device was never returned. Two participants did not record the required minimum of ten hours therefore the data could not be analyzed, leaving us with a total of 26 participants, four of those were *Legacy* participants and 22 were non-*Legacy* participants. Mothers ranged in age from 19 to 39 years of age ($M = 28.43$, $SD = 6.22$). Children ranged in age from 18 to 28 months ($M =$

23.56, $SD = 2.75$) and 67% were boys. Over half of the sample, 53%, was Caucasian, 26% African American, 4% Native American, and 8% reported more than one race. Most mothers, 73%, reported being married or living with their partner, 17% reported never being married, 7% were separated, and 3% were divorced. Education levels varied with 40% of mothers having received their high school diploma or GED, 27% had attended some college or attended a career training program, and 33% had received a college degree.

Procedure

Mothers were asked to record for one full day beginning when their child first woke up in the morning. During nap time, bath time, and bed time mothers were asked to leave the recorder on but to remove the vest holding the recorder so that conversation and vocalizations could still be recorded. Participants were asked to not turn off or pause the device to minimize any potential recording errors such as pausing the recording and forgetting to turn it back on. At bedtime the device was left on and allowed to turn itself off automatically after sixteen hours. This ensured that all participants met the minimum ten-hour continuous recording time required for the LENA software to analyze the data. Participants were compensated \$40.00 when the LENA devices were returned.

Measures

Center for Epidemiological Studies Depression Scale – Revised (CESD-R). The CESD-R is a revised scale of the CESD and is a widely used assessment tool to measure depression in the general population (Van Dam, & Earleywine, 2011). The CESD-R consists of 20 items that ask how often an individual felt a certain way in the last week. Items include, “My appetite was poor”, “I could not shake off the blues”, “I lost interest in my usual activities”, and “I could not

focus on the important things”. Responses range from “not at all” to “nearly every day for 2 weeks”. Each item has a range of scores from 0 to 5, with a total possible range of 0 to 100. Research has shown the CESD-R to be a reliable and valid measurement of depression, demonstrating high internal consistency and validity (Eaton, Smith, Ybarra, Muntaner & Tien, 2004; Van Dam & Earleywine, 2011). Internal consistency for the current study was high, with a Cronbach’s alpha of .92.

Parenting Interactions with Children: Checklist of Observations Linked to Outcomes (PICCOLO). Parenting behaviors were assessed using the PICCOLO parenting interactions checklist. This assessment tool was developed to measure developmentally supportive parenting behaviors during parent-child interactions. It is a strength-based coding system designed to look specifically for parent behaviors known to positively impact the social and emotional, cognitive, and language development of young children (Roggman, Cook, Innocenti, Norman, & Christiansen, 2013). To create the PICCOLO coding system, researchers used video recordings from the Early Headstart Research and Evaluation Project, researchers analyzed over 4, 500 observations between parents and children 10 to 47 months old. The reliability and validity of 89 parenting behaviors was assessed and the 29 most valid and reliable items were included in the checklist. The PICCOLO measures four domains of parenting behavior; affection, responsiveness, encouragement, and teaching. Affection includes behaviors that are warm, positive, affectionate, or physically close. Sample items include “*speaks in a warm tone of voice,*” *is physically close to the child,*” and “*shows emotional warmth*”. Responsive behaviors include items that reflect responding to the child’s cues, needs, emotions, words or interests, and positively responding to the child’s behaviors. Sample items include, “pays attention to what the child is doing,” “Follows what child is trying to do,” and “looks at child when child talks or

makes sounds.” Encouragement includes items that look for actively supporting the child’s exploration, effort, skills, initiative, curiosity, creativity, and play and teaching includes behaviors that elicit shared conversation and play, cognitive stimulation, explanations, and questions. Sample items include, “*supports child in making choices,*” *supports child in doing things on his or her own,*” and “*verbally encourages child’s efforts.*” There are a total of 29 items and each item has a range of zero to two. A score of zero indicates that the behavior is “absent”, a score of 1 indicates the behavior is “barely” present, and a score of 2 indicates that a behavior is “clearly” present (Roggman et al., 2013) Total possible scores range from 0 to 58.

The PICCOLO measure has been shown to be reliable and valid across diverse ethnic groups and with children 10 to 47 months of age (Roggman et al., 2013). Psychometric properties for the reliability and validity of this measure are well established. (Roggman et al., 2013). Cronbach’s α value of .78 for affection, .75 for responsiveness, .77 for encouragement and .80 for teaching and a value of .91 for the total PICCOLO score indicating strong internal consistency and scale reliability. Confirmatory factor analysis showed moderate to high construct validity for each of the four domains (Roggman et al., 2013; Matsunaga, 2010). Additional evidence of construct validity associated with child development outcomes was established by examining correlations between PICCOLO scores and scores from other well established observational techniques. Observational techniques measuring the same constructs as the PICCOLO and coded using the same videotaped interactions found statistically significant correlations across ethnic groups and child age (Roggman et al., 2013). Research also indicates good predictive validity for this measure with PICCOLO scores being found to be significantly correlated with child social and emotional, cognitive and language outcomes at age two, three, and five (Roggman et al., 2013).

In the current study, videos were coded by trained research assistants and a reliability coder scored every other video. Research assistants met bi-weekly to assess reliability during the coding process. Inter-rater reliability in the current study was high between the primary coder and the reliability coder with correlations of $r = .84^{**}$ for affection, $r = .87^{**}$ for responsiveness, $r = .96^{**}$ for encouragement, and $r = .94^{**}$ for teaching.

Language Environment Analysis System (LENA). The home language environment was measured using digital language recording devices. LENA devices are designed to measure the natural language environment from the perspective of the child. The recording devices are small and lightweight and fit into the front pocket of a vest that was specially designed to maximize recording quality (Xu, Yapanel & Gray, 2009). The device records every utterance between the parent or adult (within 6 feet of the device) and child, including babbles and coos as well as background noise, overlapping speech, and television and electronics (Gilkerson & Richards, 2008). Data from the recordings are then uploaded and analyzed by software specifically designed to process live recordings of the language environment. Once the data are analyzed, the software generates measures of the home language environment that include adult word counts, conversational turns, child vocalizations, a vocal productivity score (defined below), and a measure of the audio environment. LENA normative data were developed using data collected as part of an ongoing longitudinal study of the language environments of children two months to 48 months of age. Norms were established using data from over 32,000 hours of speech recordings collected from 2,000 families. (Gilkerson & Richards, 2008). The sample was selected to be representative of the United States population with respect to mother's level of education. Over 300 participants provided monthly full day recordings. Children's language was also assessed by speech language pathologists using standardized speech and language

assessments. The normative database contains over 32,000 hours of speech collected in a natural language setting (Gilkerson & Richards, 2008). The automated LENA recording system cuts out the need for time consuming transcription and utilizes speech samples from full day recordings and has been shown to be a reliable and valid tool to measure the child's language environment (Xu, Yapanel & Gray, 2009).

The adult word count is defined as the number of adult words the child heard during the recording time. Conversational turns are the number of back and forth exchanges between the child and adult. A turn is defined as any time an adult speaks and the child responds or the child speaks and the adult responds. Child vocalizations are defined as the number of vocalizations made by the child during the recording time. Vocalizations are distinguished from non-speech sounds such as crying or laughter (Xu, Yapanel & Gray, 2009). The vocal productivity measure assesses children's vocal output. This measure is created by analyzing the length of child vocalizations in canonical syllables or consonant/vowel pairs. (Oller et al., 2000). This is different from previous work measuring early language development as it utilizes canonical syllables that are turn contingent, meaning only canonical syllables during conversational turns are analyzed. This allows for a distinction to be made between interactive talk and self-talk (Du, Xu, Richards, Hannon & Gilkerson 2017). The audio environment measured the amount of time the child spent using television or electronics.

Results

Statistical Analysis

Descriptive statistics were calculated for study variables. Pearson correlation analysis was conducted to look for relationships between participant demographics, language variables,

parenting behaviors, and maternal depression. One-tailed Pearson correlations were used due to the small sample size and because of the directional nature of study hypothesis. Data were assessed for normality by Shapiro-Wilk's test. Significance ($p < .05$) was found only for maternal depression which was positively skewed. A square root transformation was performed for maternal depression and the new variable was included in the analysis. The overall pattern of significance held, therefore the decision was made to proceed with the untransformed maternal depression variable. Data were examined for outliers by visual examination of boxplots. One significant outlier was found for maternal depression. One participant was found to be a significant outlier for both child vocalizations and conversational turns. Correlation analyses was conducted with and without the identified outliers and the overall pattern of significance held. Therefore, the decision was made to include the outliers in the analysis. In the LENA Natural Language Study adult word count did not significantly vary by age while conversational turns and child vocalizations did. Due to this difference, researchers computed LENA norms for conversational turns and child vocalizations based on the age of the child in months. Therefore, while descriptive statistics for actual word counts are reported below, percentiles, means, and standard deviations are reported for conversational turns and child vocalizations. The normative data for the full range of ages of the children in this study (18 to 28 months) is available in the appendix.

Descriptive Statistics

The range of scores, means, and standard deviations, are presented in Table 1. LENA normative percentiles are also included in this table. The average adult word count for this sample fell in the 35th percentile with the average number of adult words spoken being 10,253 ($SD = 3,471$) and was lower than the average of 12, 297 ($SD = 6,642$) words in the LENA

normative database. Conversational turns for this sample were low, with the average in the 18th percentile ($M = 18.77$, $SD = 19.18$). Child vocalizations were in the 29th percentile ($M = 29.77$, $SD = 25.04$). Normative data for vocal productivity has not yet been published, however the software does calculate percentiles. Vocal productivity scores were in the 41st percentile ($M = 41.92$, $SD = 28.95$). Maternal depression scores ranged from 0 to 64 with an average of 16 ($M = 15.54$, $SD = 14.80$).

Table 3. *Range of Scores, Means, Standard Deviations of Language and Parenting Variables and LENA Normative Percentiles (N = 26)*

Variable	Actual Word Counts			LENA Normative Percentiles		
	Range	<i>M</i>	<i>SD</i>	Range	<i>M</i>	<i>SD</i>
Adult Word Count	4,453 – 17,093	10,253	3,470	1 - 87	35.00	26.74
Child Vocalizations	242 - 3473	1,487	718	1 - 90	29.77	25.04
Conversational Turns	50 - 655	255	142	1 - 70	18.77	19.18
Vocal Productivity	49 - 129	95	17	1 - 98	41.92	28.95
Maternal Depression	0 - 64	15.54	14.80			
Responsiveness	5 - 14	11.12	2.67			
Affection	8 - 14	11.31	1.64			
Encouragement	3 - 14	9.54	2.89			
Teaching	2 - 10	6.65	2.26			

Language, Parenting Behaviors, and Demographics

Correlations between study variables are presented in Table 2. No significant correlations were found between marital status, race, child gender, mother's age, child age, Legacy participation, and study variables. Mother's level of education was positively associated with observed teaching behaviors. Significant associations were found between adult word count and child vocalizations, conversational turns, and vocal productivity scores. Adult word counts were found to be significantly associated with observed responsiveness, encouragement, and teaching. While conversational turns were only found to be significantly associated with encouragement. Child vocalizations were marginally correlated with observed teaching behaviors and child vocal productivity scores. These results support the hypothesis that positive parenting behaviors were associated with higher adult word counts. Contrary to our hypothesis adult word counts were not associated with maternal depression, however, conversational turns were significantly and negatively associated with maternal depression and marginally negatively associated with child vocalizations and vocal productivity.

Table 4: *Bivariate Correlations between Language Variables, Parenting Behaviors and Maternal Depression (N = 26)*

Variable	2	3	4	5	6	7	8	9	10
1. Adult Word Count	.32 ⁺	.02	-.25	.35*	.26	.43*	.39*	-.19	-.07
2. Conversational Turns		.62**	.27 ⁺	.22	.17	.34*	.24	-.33*	-.30 ⁺
3. Child Vocalizations			.66**	.16	.14	.14	.27 ⁺	-.30 ⁺	-.20
4. Vocal Productivity				.09	.06	.09	.23 ⁺	-.53**	.17
5. Responsiveness					.83**	.80**	.56**	-.01	.22
6. Affection						.63**	.46**	-.10	.16
7. Encouragement							.50**	-.03	.20
8. Teaching								.24	.40*
9. Maternal Depression									-.01
10. Participant Education									

Regression analysis was conducted for each parenting variable (responsiveness, encouragement, affection, teaching, and maternal depression) predicting language variables, while controlling for mother's education level. See Table 3. After controlling for maternal education, only teaching behaviors remained a significant predictor of adult word counts. Observed teaching behaviors also significantly predicted conversational turns and marginally predicted child vocalizations. Encouraging behaviors also significantly predicted conversational turns and were a marginally significant predictor of adult word counts. Maternal depression significantly predicted children's vocal productivity scores and marginally predicted conversational turns.

Table 5. *Summary of Multiple Regression Analyses for Parenting Behaviors Controlling for Maternal Education (N = 26)*

Variable	<i>B</i>	<i>SE B</i>	β	R^2	<i>F</i>
Adult Word Count					
Responsiveness	504.011 ⁺	264.813	.387 ⁺	.146	1.876
Encouragement	552.022*	233.027	.457*	.207	2.876 ⁺
Affection	597.676	440.767	.282	.082	.980
Teaching	830.918*	323.676	.538*	.234	3.367*
Maternal Depression	45.085	49.951	.903	.041	.465
Child Vocalizations					
Responsiveness	61.124	56.360	.228	.088	1.066
Encouragement	43.655	52.016	.175	.069	.820
Affection	86.306	91.030	.198	.077	.921
Teaching	151.126*	67.380	.475*	.218	3.072 ⁺
Maternal Depression	-16.915	9.644	-.344 ⁺	.157	2.055
Conversational Turns					
Responsiveness	17.228	10.562	.324	.186	2.518
Encouragement	19.434*	9.337	.393*	.238	3.435*
Affection	21.358	17.366	.247	.147	1.889
Teaching	30.826*	12.855	.488*	.277	4.212*
Maternal Depression	-3.620	1.835	-.371	.225	3.194 ⁺
Vocal Productivity					
Responsiveness	-.670	1.634	-.094	.035	.379
Encouragement	-.223	1.338	-.037	.028	.307
Affection	.305	2.515	.157	.028	.300
Teaching	2.303	1.855	.298	.094	1.085
Maternal Depression	-8.081*	.2895	-.514	.539*	4.296*

Discussion

The goal of the current study was to examine and delineate differences in the home language environments of young children living in poverty using full day recordings collected in the child's natural environment. Overall, scores on home language environment variables were low in this sample. This is consistent with the findings of Hart and Risley (1995) and others who found a negative association between socioeconomic status and the home language environment (Gilkerson & Richards, 2008; Hart & Risley, 1995; Leffel & Suskind, 2013). Mothers with

lower levels of education also reported experiencing more depressive symptoms. Vocal productivity scores, child vocalizations, and back and forth interactions were all lower for children whose mothers reported depressive symptoms approximately one year earlier but contrary to expectations, maternal depressive symptoms did not predict less adult talk. However, depression was assessed when children were between four and eight months of age and adult word counts were measured when children were approximately 2 years of age, therefore adult word counts would not likely be affected if mothers were not currently experiencing depressive symptoms. This is in line with results from Stein and colleagues (2008) who found maternal depression in the first year of year of life to predict poorer language outcomes at ten months but not 36 months of age (Stein et al., 2008). Studies have shown that child directed speech, social interactions, shared attention, and maintained engagement all affect young children's language development (Hollich et al., 2000; Kuhl, Tsao & Liu, 2003; Roseberry, Hirsh-Pasek & Golinkoff 2009). Taken in this context, results suggest that mother's maternal depressive symptoms in the first year of life may have long-term negative impacts on children's language learning abilities.

Results from regression analyses indicated that of the four parenting behaviors observed (responsiveness, encouragement, affection, and teaching) teaching behaviors were the most consistent predictor of language outcomes. This supports previous research indicating that the qualitative features of the home language environment may be more significant than quantitative features (Romeo et al., 2018; Gilkerson, 2017; Hirsh-Pasek et al., 2015). For example, a significant relationship found between brain development and conversational turns, but was not found for adult word count or child vocalizations (Romeo et al., 2018). Similarly, findings that the quality of the home language environment predict children's language ability 10 years later were strongest for conversational turns. Moreover, significant associations were found between

conversational turns, working memory, and cognitive development that were not found for adult word count or child vocalizations (Wilkerson, 2017).

It is well established that the amount of talk matters and the quantity of verbal input has been associated with children's language growth, language speed, and processing abilities (Huttenlocher, Haight, Bryk, Seltzer & Lyons;1991; Rowe, 2018; Weisleder & Fernald, 2013). However, when young children interact with their parents or caregivers through back and forth interactions, the linguistic and interactional components of the language environment are likely to be more complex (Huttenlocher, Waterfall, Vasilyeva, Vevea, Hedges; 2010; Rowe, 2018; Weizman & Snow, 2001). In addition, research indicates that infants pay more attention to child-directed speech than adult-directed speech. Infant-directed speech is typically slower, less complex, higher in frequency and have exaggerated intonation (Fernald, 1992; Grieser & Kuhl, 1998; Hollich et al., 2000; Liu, Tsao, & Kuhl, 2007). Moreover, infant's perception of speech has been shown to predict later language development (Tsao, Liu, Kuhl; 2004). Therefore, infants and very young children who experience more conversational turns are also likely to experience more infant-directed speech, leading to improved language abilities. In the current study mothers' encouraging behaviors predicted conversational turns and marginally predicted adult word counts indicating that encouraging interaction between young children and their mothers lead to more adult talk and conversational turns. This is in line with previous research indicating a positive relationship between positive parenting behavior and increased adult-child conversation (Tamis-Lemonda, 2002; Roggman et al., 2013).

After controlling for mother's education level only teaching behavior remained a significant predictor of adult word count, child vocalizations and conversational turns, indicating that teaching behaviors play a unique role in the quality of the home language environment.

Observed teaching behaviors included providing explanations, labeling objects or actions, talking about characteristics of objects, making suggestions to extend an activity the child is engaged in, asking questions repeats or expands words or sounds, asking for information and doing activities in a sequence, and engaging in pretend play. These findings are in line with those of other studies where teaching behaviors have been found to be associated with joint attention, shared play, and increased explanations and conversations (Fuligin & Brooks-Gunn, 2013; Roggman et al., 2013; Holich et al., 2000; Roggman, Langlois & Hubbs-Tait, 1987). These findings suggest that teaching behaviors uniquely predict more adult talk, and child vocalizations. Educating parents about the important role they play as their child's first teacher is an important next step. The Talking is Teaching Campaign is aiming to do just that by educating parents about brain development over the first three years of life and the important role parents play in supporting that development through simple everyday actions such as talking, reading, and singing (Too Small to Fail, 2016). Many parents do not feel that their role is to teach their child, this is especially true with bilingual families (Lewis, 2016). Providing parents with the knowledge about the important role they play in addition to arming them with easily implementable strategies can empower them to engage in more meaningful dialogue with their children. Suskind and colleagues (2015) found that sharing data acquired from LENA recording devices with parents increased the number of conversational turns between the adult and child (Golinkoff et al., in press; Suskind et al., 2015). Using data from LENA recording devices coupled with interventions designed to teach parents specific strategies to increase the quantity and quality of their interactions has the potential to reduce language disparities. In addition, high quality early childhood care has been found to improve children's language outcomes (Golinkoff et al., in press; Yazejian et al., 2017). Increasing access to high quality early childhood care for

low-income families is a critical step in reducing early language disparities. In addition, educating early childhood teachers about the importance of early talk and quality interaction with infants and toddlers has the potential to improve early language outcomes for children in their care.

In our study, children whose mothers reported higher levels of depressive symptoms had significantly lower vocal productivity scores, after controlling for maternal education. Language learning begins in infancy and children whose mothers are experiencing depression may have fewer opportunities to engage with their mothers. These interactions are also likely to be characterized as negative in affect, less responsive, synchronous, and contingent all of which have the potential to limit the child's access to adult words and interactions (Beebe et al., 2008; Cohn & Tronick, 1983). Moreover, infants who experience these types of interaction may begin to limit their own efforts to engage in interactions or respond negatively to them (Cohn & Tronick, 1983). In the current study mother's depressive symptoms predicted children's vocal productivity scores one year later. No significant findings for depression and parenting variables were found. This may be due to the timing of data collection. Maternal depression was assessed when children were on average 6 months old, while parenting interactions were assessed approximately nine months later and mothers may no longer have been experiencing depressive symptoms. These findings have crucial implications for low-income mothers and their children's developmental trajectories. We know that depression can be treated but research on treating depression in low-income populations is lacking (National Research Council, 2009). Moreover, research examining the effects of interventions aimed at improving outcomes for low-income mothers and their children show differing results in their effectiveness for depressed mothers (Duggan, Cassidy, Burrell & Tandon, 2009; Johnson, Reid et al., 2018; Olds et al., 2007).

Identifying and treating depression prenatally and postnatally is critical if we are to reduce the language gap and improve language outcomes for low-income children. Interventions that take place within a medical home such as Healthy Steps and Centering Pregnancy and Centering Parenting, are in a unique position to screen for and treat depression. In addition, the group model of the Centering programs adds a social support component to the intervention similar to the *Legacy for Children*[™] intervention (Kaminski et al., 2013; Minkovitz et al., 2003; Mital, 2011). Increasing social support and parents' confidence in their parenting abilities may work to reduce maternal depression and improve interactions between mothers and their young children thereby improving young children's language outcomes.

While no relationship was found between affection and home language variables this may be due to the items that make up the affection scale. Four of the seven items in that scale, physical proximity, smiling, engagement, and emotional warmth, do not directly contribute to use of language. In addition, the first item "speaks in a warm tone of voice" is to be coded highly for a parent who speaks little but very warmly. No significant findings were found between participation in *Legacy for Children*[™] and study variables. This is likely due to the small sample size and the small number of Legacy participants, only four.

It is important to note the recent criticism of Hart and Risley and the thirty-million-word gap. Sperry and colleagues (2018) reported that when they replicated the Hart and Risley study the evidence for the language gap did not hold. However, they did not include a high SES group in their sample and therefore cannot compare their findings to those of Hart and Ripely. A key component of their argument is that there is variability in the amount of speech low SES children hear. As Golinkoff and colleagues (2018) point out, this is a "finding replicated by every study in the literature. Within-group variability is not inconsistent with between-group differences" (p.

5). We acknowledge that variability is present in all socioeconomic strata, however this does not mean the overall association between socioeconomic status and the quality of the home language environment does not exist. There is clear evidence that a socioeconomic gap exists in children's vocabulary, syntax, language processes, and early language development (Fernald, Marchman & Weisleder, 2013, Levine, Pace, Hirsch-Pasek & Golinkoff, 2018; Rowe, Leech, Cabrera, 2017; Weisleder & Fernald, 2013). Further, neurobiological evidence supporting the word gap is increasing (Hutton et al., 2017; Romeo et al., 2018, Rosen, Sheridan, Sambrook, Meltzoff, McLaughlin, 2018). Sperry and colleagues argue that because Hart and Risley did not include language from multiple caregivers and bystander talk in their analyses that the amount of language low-income children were exposed to was underestimated, however, no evidence suggests that overheard speech helps infants and toddlers learn language (Golinkoff, Hoff, Rowe, Tamis-Lemonda, & Kathy Hirsh-Pasek, in press; Shneidman, Arroyo, Levine, & Goldin-Meadow, 2013; Weisleder & Fernald, 2013). Further, several studies have documented the importance of child directed speech to the language learning process (Golinkoff et al., in press; Hirsh-Pasek et al. 2015; Rowe, Leech, Cabrera, 2017).

Low-income children in the United States are at significantly higher risk of not reaching reading proficiency by third grade. Language skills in Kindergarten are the best predictor of school success in both third and fifth grade (Durham, Farkas, Hammer, Tomblin & Catts, 2007; Pace, Alper, Burchinal, Hirsh-Pasek, & Golinkoff, 2018; Golinkoff et al., in press). Children who do not meet this milestone, are more likely to experience academic and behavior difficulties and are less likely to graduate high school. In addition to experiencing economic difficulties throughout life (Feister, 2010). Language learning begins in infancy and denying the existence of language gap and the importance of child directed speech to language learning is

counterproductive. Resources and efforts should be aimed at educating parents and caregivers about the importance of adult child interactions not denying that a gap exists.

Strengths, Limitations, and Future Directions

It is important to note that the sample size in the current study is small, and replicating this study on a larger scale with a similar homogenous sample is an important next step. Replicating these findings with respect to the negative association found between maternal depression and the quality of the home language environment will add validity to the current findings and allow for the delineation of demographic differences in the home language that we were not able to assess in the current study. Legacy for Children has been shown to positively impact children's developmental trajectories (Kaminski et al., 2013). While we did not find significant differences in the current study, there were not enough Legacy participants to detect group differences. The longitudinal design of the study is a strength and adds to the literature on the qualitative features of the home language environment. Home language quality was measured using full day recordings collected in the child's natural environment, adding to the validity of the current study. The focus on differences within a low-income sample and observational measures of parent and child interactions are also strengths of the current study.

In the broader contextual view, study results have implications for the importance of maternal mental health and early interventions targeting language quality. Ensuring new mothers are screened and treated for depression regularly, especially during the first year of a child's life is particularly important for children's development. Interventions embedded within a medical home such as Centering Parenting (Mital, 2011, and Healthy Steps (Minkovitz et al., 2007) address the well-being of low-income mothers and their infants during established well

child visits. Scaling up interventions that are easy to access and do not increase the burdens of transportation and childcare are an important next step. Interventions aimed at increasing parent's child development knowledge and improving the quality of parent interactions have shown promising results (Leffel & Suskind, 2013; Suskind et al., 2016). Using the parent reports generated by LENA software are a unique way to provide objective information to parents about how much they are talking to their children. Increasing access to these types of interventions can have positive long-term effects on young children's language development.

These findings highlight the need to educate parents and caregivers on the importance of initiating and engaging in conversations with their babies from birth, in addition to increasing awareness of the long-term implications associated with early language environments and children's developmental trajectories. With over thirteen million children living in poverty in the United States (CDF, 2017) focusing efforts on public awareness, parent and caregiver education, and interventions aimed at reducing language disparities is of vital importance. Language disparities when children enter Kindergarten predict outcomes in third and fifth grade as well as future academic success and later economic opportunities (Durham et al., 2007; Golinkoff et al., in press, Suskind et al., 2015). Intervening early and effectively can reduce these early disparities and improve young children's long-term outcomes.

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APPENDIX A

LITERATURE REVIEW

Adverse Childhood Experiences

The Adverse Childhood Experience (ACE) Study is a large-scale study conducted by epidemiological researchers interested in the long-term health outcomes of experiencing childhood abuse and neglect. Researchers collected data from over 17,000 Kaiser Permanente patients receiving regular care in a primary care clinic. They retrospectively assessed exposure to abuse, neglect, and household dysfunction experienced before the age of eighteen. Researchers found a strong dose response relationship between experiencing abuse, trauma, or household dysfunction in childhood and subsequent health behaviors leading to major illnesses, compromised mental states, and early mortality (Anda et al., 2006; Chapman et al., 2004; Dube et al., 2003; Dube et al., 2005; Felitti et al., 1998; Hillis et al., 2004). Study results also indicate that early adverse experiences are relatively common. Two-thirds of the 17, 337 participants reported having at least one ACE and most of the ACEs that were reported co-occurred with one or more additional ACE. Felitti and colleagues (1998) theorize that adverse experiences in early childhood cause neurobiological deficits in development, leading to social, emotional, and cognitive impairment, and the subsequent adoption of risky health behaviors, mental and physical health problems, disease, disability and early mortality (Felitti et al, 1998).

Awareness of the negative effects of early trauma have accompanied scientific advances in the fields of neurobiology, epigenetics, social and developmental science and have led to multidisciplinary efforts to understand the mechanisms and causal pathways that underlie the relationship between ACEs and long-term health outcomes (Shonkoff, 2010). Anda and colleagues (2006) present a conceptual framework that integrates neurobiological research findings with epidemiological research on the negative effects of ACEs. Their findings that a dose response relationship exists between ACE scores and eighteen negative health behaviors and outcomes converges with neurobiological evidence that cumulative exposure to toxic stress impairs multiple parts of the developing brain and various functions associated with them (Anda et al, 2006). Several studies have found smaller hippocampal and amygdala volumes in females with histories of child abuse and post-traumatic stress disorder (Bremner et al., 2011; Pederson et al., 2004; Schmahl, Vermetten, Elzinga, Bremner, 2003; Stein, Koverola, Hanna, Torchia & McClarty, 1997). Reduced volume has also been found in the corpus callosum and prefrontal cortex of females who experienced sexual abuse in childhood (Anderson et al., 2008). Overactive amygdala function is associated with symptoms of post-traumatic stress disorder (PTSD), such as severe reactions to stress, hyperarousal, and inability to control the bodies' response to fear (Ressler, 2010).

In addition, the body's stress system is governed by the hypothalamic pituitary adrenal (HPA) axis and is vulnerable to the effects of childhood abuse and neglect, leaving the system disrupted and unable to effectively regulate the body's response to stressful situations (De Bellis & Thomas 2003). Epidemiological research findings suggest that as ACE scores rise so do rates of smoking, alcohol and drug use, sleep disturbances, obesity, mental health disturbances,

increased perceptions of stress and difficulty regulation anger. Moreover, as ACE scores increased, so did the number of comorbid outcomes which further increases an individual's risk for negative behaviors and health outcomes (Anda et al., 2006). Neurobiological and epidemiological evidence suggest that exposure to cumulative adversity early in life has the potential to affect decision making, memory, reactivity to stress, cognitive development and physical and mental health, all of which have the potential to negatively impact subsequent parenting attitudes and behaviors. This unified, multidisciplinary perspective is important as researchers seek to understand the effect of ACEs and how to prevent first generation and intergenerational exposure. Of interest in the proposed study is how ACEs affect parenting attitudes and behaviors, and how that affects young children's development. I hypothesize that the same dose response rate will be present between ACEs and negative parenting behaviors as is found with ACEs and negative health behaviors and outcomes.

The conceptual framework proposed by Anda and colleagues (2006) illustrates the complex process through which cumulative exposure to early adversity affects the developing brain, neurophysiological stress systems, behavior and health, and lays the foundation for the proposed study (Anda et al., 2006). However, the focus on parenting as a mechanism through which ACEs impacts children's development is rooted in attachment theory. Central to healthy attachments are caregiver interactions that are responsive, nurturing, and sensitive to the needs of the child. These earliest interactions allow strong emotional bonds to be formed between the parent and child that are vital for the development of secure attachment. Securely attached children explore their world with a sense of emotional security and safety that guide children's exploration (Carlson & Sroufe, 1995; Lieberman & Zeanah, 1999). Schore and Schore (2008)

developed a model of modern attachment theory that merges Bowlby's (1977) attachment theory with recent advances in neurobiology (Schore 1998). As previously stated, recent research in neurobiology has contributed greatly to our understanding of the effects of early adverse experiences and trauma on the developing brain and how that impacts subsequent social interactions and relationships. Schore and Shore contend that no theory of development can exclude these advances and that a psychobiological approach is crucial to fully understand the process of attachment. Modern attachment theory recognizes how early attachments affect the biological structures of the developing right brain, which is involved in emotional development, affect, and self-regulation (Schore & Schore, 2008). They argue that attachment theory is a theory of regulation in which relational transactions merge with biologically based mechanisms, stress, and brain development (Schore & Schore, 1998).

In the proposed study I will focus on the intergenerational experiences of the family as well as the relationship between the mother and child. While attachment theory primarily focuses on the bond between the mother and child, family systems theory posits that all members of the family play a role in the functioning of the family, or system (Lewis, Beavers, Gossett, & Phillips, 1976). From a family systems perspective, to fully understand the individual, you must view the family as a whole. Each member of the family plays a reciprocal role in that system, where one member's behavior affects the thoughts and actions of other members. Other relationships within the family, such as marital or sibling relationships may affect the attachment relationship between the mother and child (Bowen 1974; Lewis et al., 1976). When there is dysfunction in the system, as with domestic violence or child abuse, the system is disrupted and individual behaviors adapt and change affecting choices made throughout childhood,

adolescence, and early adulthood; such as education, substance abuse, parenting, mate selection, etc., (Bowen, 1974; Strauss, 1973). This illustrates the multi-generational transmission process that is one of the key propositions of family systems theory. Aspects of each of these theories help to guide the proposed study. I posit that maternal ACE scores lead to disrupted neurodevelopment and neurophysiological responses to stress in parents, leading to fewer positive parent-child interactions, which in turn negatively affects children's social and emotional and language development. I argue that maternal depression and perceived social support may moderate the relationship between maternal ACE scores and negative parenting behaviors, such that depression exacerbates this link while social support plays a protective role and lessens the impact of ACEs.

Parents' Adverse Childhood Experiences (ACEs) and Parenting

Adverse childhood experiences can negatively impact an individual's later parenting abilities. Parents who have experienced traumatic life events such as experiencing physical or sexual abuse in childhood are more likely to experience physical and mental illness, exhibit lower level of social functioning, and increased reactivity affecting the ability to engage in positive parenting behaviors (Bailey, DeOliveira, Wolfe, Evans, & Hartwick, 2012; DeBellis et al., 1999; Lomanowska, Boivin, Hertzman & Fleming, 2017). Furthermore, mothers experiencing physical and sexual abuse have been shown to be more intrusive during interactions with their infants leading to decreased quality of these exchanges (Moehler, Biringen & Poustka, 2007; Marengo, Stefano & Weinberger 2000). In a study of physically and sexually abused mother's researchers found these mothers to have lower rates of self-control as well as greater

propensity towards abusing their own children (Henschel, de Bruin & Möhler, 2014). Moreover, when investigating the impact of childhood maltreatment on parenting, researchers found that mothers who witnessed domestic violence or experienced neglect or emotional maltreatment were more hostile towards their children in observed parenting interactions, and mothers who reported a history of sexual abuse reported less perceived competence as a parent. These results held even after controlling for traumatic events experienced in adulthood (Bailey et al., 2012). Similar results have been reported for women who reported a history of sexual abuse, indicating less positive views of themselves as parents, in addition to reporting higher rates of physical punishment, child neglect, and a lack of emotion regulation during parent-children interactions (Banyard, 1997; Roberts, O'Connor, Dunn, Golding, 2004). These results illustrate the relationship between experiencing early trauma and its' potentially negative impact on parenting. Results from these studies and family systems theory help illustrate this intergenerational transmission of ACEs.

As awareness of ACEs has grown, more recent work on the relationship between parents experience of child abuse and neglect has focused on the ACEs measure specifically, allowing researchers to more fully examine cumulative risk associated with multiple risk factors. Study results provide support for the intergenerational risk of parent's ACEs and child outcomes. Researchers examining the association between parent's ACE scores and children's developmental outcomes at 24 months Results indicated that for each ACE reported by the mother the child's risk of a possible developmental delay increased 18%. Children whose mothers reported 3 or more ACEs were at significant risk for experiencing a developmental delay across multiple domains i.e., communication, gross motor, fine motor, personal-social and

problem solving (Folger et al., 2018). While these results do not elucidate pathways of risk they do indicate a significant relationship between parents ACE scores child outcomes and are similar to the dose-response relationship between ACE scores and adult health outcomes found in the original ACE study. Racine and colleagues (2018) examined mother's ACE scores in relation to children's developmental outcomes at 12 months of age. They reported that maternal ACEs impacted children's developmental outcomes via biological risk during pregnancy and maternal hostility in infancy (Racine, Plamondon, Madigan, McDonald & Tough, 2018). These results suggest that there are both biological and psychosocial mechanisms through which maternal ACEs affect parenting and child outcomes. A retrospective study using data from the National Survey of Child and Adolescent Well-Being study found a positive and graded relationship between experiencing ACEs and internalizing and externalizing behaviors at age six (Clarkson, Freeman 2014). Elucidating the ways in which ACEs impact parenting and child outcomes may be more nuanced than finding a relationship between ACEs and health outcomes, one way that risk may be exacerbated is through depression. The intergenerational risk to parenting from experiencing adversity in childhood may increase for women experiencing depression. Research shows that maternal depression is linked to parent-child interactions that are less sensitive, encouraging and responsive (Murray, Fiori-Cowley, Hooper & Cooper, 1996). In addition to being less positive in nature, increased negativity, hostility and disengagement have also found to be correlated with maternal depression (Dixon et al., 2005; Pears & Capaldi, 2001). Researchers conducting a meta-analysis of maternal depression and parenting behaviors examined results from forty-six parent-child observations and found increases in both negative and disengaged behavior from depressed mothers. Moreover, this association was the most

robust for mothers from low socioeconomic status posing an additional risk for the sample population in the proposed study (Lovejoy, Graczyk, O'Hare & Neuman, 2000).

While maternal depression presents an additional risk factor, social support has the potential to buffer the negative effects of early adversity and parenting. Researchers studying the effects of maternal depression, social support, and children's behavior problems examined data from the Study of Early Child Care, a large scale, longitudinal study. Results indicated that the relationship between children's externalizing behavior and maternal depression significantly differed based on the amount of social support available to the mother. Moreover, researchers found that as maternal depression increased the protective effects of social support decreased (Lee et al., 2006). In addition to the negative association between poverty, maternal depression, and parenting, mothers living in poverty are also at increased risk for parenting difficulties due to the increased stress associated with financial hardships, lack of access to resources, neighborhood risk, single parent status and social isolation (Balaki et al., 2007, Klebanov, Brooks-Gunn & Duncan, 1994; McConnell, Breitzkreuz & Savage, 2011; Morris et al., 2017.). However, social support has been found to buffer the negative effects associated with poverty, depression, and poor parenting practices in some studies. For example, Hashima and Amato (2004) found that social support was negatively associated with less punitive parenting behaviors, however the effect was most significant when household income was low, indicating that social support may play a unique role on parenting practices in low income families (Hashima & Amato, 1994). In line with previous research, the proposed study will look at perceived maternal social support. Specifically, social support as a mediator between ACEs and children's social and emotional outcomes will be examined.

One hypothesis is that social support increases parenting self-efficacy, which can be defined as the view a parent holds about their ability to parent (Jones & Prinz, 2005). Researchers examining the relationship between social support and postnatal depression surveyed approximately four hundred mothers six weeks after they gave birth. Mothers included in the study were first time mothers who did not experience complications during pregnancy or birth, and had single births. Mothers were sent questionnaires to measure maternal self-efficacy, social support, and postnatal depression. A statistically significant relationship was found between informal (i.e., support from family, friends vs. nurse, hospital etc.) social support and maternal self-efficacy. Moreover, a significant negative relationship was found between informal social support and postnatal depression (Leahy-Warren, McCarthy & Corcoran, 2012). These results are similar to results reported by Haslam and colleagues (2006) who found that maternal self-efficacy and social support were associated with lower rates of postpartum depression four weeks after giving birth in a sample of two hundred new mothers (Haslam, Pakenham & Smith 2006). Some evidence exists that self-efficacy itself may serve as protective factor between parent's mental health and difficult child behavior. (Cutrona & Troutman, 1986; Hastings & Brown, 2002; Jones & Prinz, 2005). Furthermore, parenting self-efficacy has been shown to be significantly correlated with parent interactions and children's social and emotional development (Bohlin & Hagekull, 1987; Jones and Prinz, 2005). Of particular interest in the current study is whether parenting self-efficacy mediates the relationship between early abuse and neglect and children's social and emotional outcomes.

Parenting and Child Development

Parenting attitudes and behaviors set the foundation for social and emotional and cognitive development (Deater-Deckard, 2014; Deater-Deckard, Wang, Chen & Bell, 2012; Lomanowska et al., 2017). Parenting that is warm and supportive has been found to protect against the negative effects of adverse childhood experiences (Chen, Miller, Kobor, & Cole, 2011; Morris et al., 2017). It is well documented that secure attachments and caregiver interactions that are warm, encouraging, and nurturing are fundamental to the healthy social, emotional, and cognitive development of children (Gauvain, Perez & Beebe, 2013; Masten & Coatsworth 1998; Paulussen-Hoogeboom, Stams, Hermanns, Peetsma, & van den Wittenboer, 2008; Roskam, Meunier & Steivenart, 2011). Young children who are securely attached and have healthy interactions with their parents or caregivers are more likely to learn to effectively regulate and manage their emotions during exploration, while children who experience disorganized or disrupted attachments are at higher risk for developmental disorders and psychopathology (Bowlby 1977; Gauvain, Beebe & Zhao 2011). In addition, parents who are responsive to the needs of the child and engage in warm and nurturing interactions are more likely to encourage independent thinking, problem solving, and scaffolding, (Gauvain, Perez & Beebe, 2012). However, parents who are unresponsive, harsh, low in warmth, or are overly permissive, are likely to have interactions with their children that are less than optimal for a child's emotional and cognitive development (Amato & Fowler, 2002; Baumrind, 1967; Fletcher, Darling, Steinberg & Dornbusch, 1995). Mother's harsh parenting behaviors have been shown to negatively affect children's ability to regulate their emotion regulation and both are linked to externalizing and internalizing behaviors later in childhood (Deater-Deckard, 1997; Eisenberg, 2001; McKee et al., 2007; Raven, 2003). Young children learn how to regulate their

own emotions through interactions with their parents. Interactions that are harsh, lack in modeling effective problem-solving behaviors provide few, if any, opportunities for children to learn to affectively regulate their own emotions (Eisenberg et al., 2006; Raver 2003). Roggman and colleagues (2009) extensively reviewed the parenting and child development literature and identified eighty-nine parenting behaviors that were positively associated with children's development. They analyzed four thousand five hundred videotaped parent-child interactions from previous studies in a sample of two thousand ethnically diverse low-income families. They identified twenty-nine behaviors that were the most reliable and valid in predicting children's social and emotional and cognitive development. Four domains of parenting were identified; affection, responsiveness, encouragement, and teaching behaviors were identified and will be used in the proposed study to identify positive parenting practices (Roggman et al., 2009). Despite such links, to our knowledge no studies have examined ACEs, parenting, and young children's social and emotional and language development among families living in poverty.

Children's Social and Emotional Development

Young children's social and emotional development is a strong predictor of academic and social success. As children learn strategies to effectively manage their emotional responses they are learning emotion regulation (Morris et al., 2007). Young children who have trouble with emotion regulation are more likely to express negative emotions in problematic ways. Maladaptive emotion regulation is highly correlated with social and emotional difficulties such as internalizing and externalizing behaviors and social relationships. (Eisenberg et al., 2001; Morris, Silk, Steinberg, Myers & Robinson, 2007). The literature on emotion regulation

indicates that children who struggle to manage their emotions are more likely to exhibit behaviors such as aggression, inattention, self-control, anxiety, and irritability and have difficulty successfully engaging in, and maintaining relationships with peers (Eisenberg, et al., 1996). A strong relationship exists between prosocial behavior, acceptance among peers and peer acceptance and academic outcomes (Eisenberg et al., 2001; O'Neil, Welsh, Parke, Wang & Strand 1997; Wentzel & Caldwell, 1997). Furthermore, academic success is associated with future educational opportunities, use of government resources, financial stability and incarceration rates later in life (Hart & Risely, 2003; Leffel & Suskind, 2013; Suskind et al., 2016). Clearly children's successful social and emotional development is of critical importance. For children living in poverty, who are already at risk due to the deleterious effects associated with low socioeconomic status, social and emotional success has the potential to be a significant protective factor. Improving parenting interactions and behaviors associated with successful child development of children living in poverty is an important next step. The proposed study seeks to more fully understand the parenting mechanisms associated with children's social and emotional development in a high-risk sample. The proposed study will use observational data of parent-child interactions at seven-time points over the first two and half years of the child's life adding unique insight to the existing literature

Language Development

Similar to social and emotional development, early language development is highly predictive of later academic and social success. A child's early language environment plays a critical role in their cognitive development, educational outcomes, and economic opportunities

(Hart & Risley, 1995; Hart & Risley 2003; Leffel & Suskind, 2013; Suskind et al., 2016).

Children living in poverty have heard approximately thirty million fewer words by the age of three than their peers from higher socioeconomic backgrounds (Hart & Risley, 1995). In addition to hearing fewer words, these children hear more language that is negative and directive and subsequently discourages conversation. Significant socioeconomic disparities exist in children's home language environments. This gap in language continues to widen and by third grade is linked to smaller vocabularies and weaker reading skills (Hart & Risley, 1995; Hart & Risley, 2003; Suskind et al., 2016). This is critical because children who have not achieved reading proficiency by third grade are more likely to experience academic difficulties, behavior problems, less likely to graduate high school and more likely to experience economic difficulties later in life. Males and minority children living in poverty are at even greater risk, with approximately eighty-five percent of this population failing to reach reading proficiency by third grade (Fiester, 2010). As with social and emotional development harsh parenting behaviors are more likely to be directive in nature and elicit less conversation between parent and child leading to an overall reduction in the number of words the child has access to (Hart & Risley, 1995; Hart & Risley, 2003). Studies show that maternal sensitivity, responsive interactions between parent and child, and negative parenting behaviors all negatively affect children's early language development (Baumwell, Tamis-LeMonda & Bornstein, 1997; Hoff, Laursen, Tardif & Bornstein, 2002; Pungello, Iruka, Dotterer, Mills-Koonce & Reznick, 2009; Tamis-Lemonda & Bornstein, 2002).

The number of words a child hears by the age of 36 months is highly correlated with their IQ and academic success. While the quantity of words children hear is significant, the quality,

responsiveness and complexity of the child's language environment are equally, if not more important (Gilkerson, 2017; Hart & Risley, 2003). Researchers conducting a longitudinal study designed to more fully understand the home language environment of children ages two months to forty-eight months recently reported that conversational turns between parent and child were predictive of working memory and cognitive development ten years later. The magnitude of this effect size was strong and was not found for the number of words the child heard (Gilkerson, 2017). Similar results were found from a cross sectional study of two hundred and seventy-five families with children ages two to forty-eight months measuring the language development of young children. Researchers found that adult word count was significant in predicting toddlers' language acquisition. However, this relationship was partially mediated by the number of conversational turns between the parent and child (Zimmerman et al., 2009). Interest in the importance of early language development coupled with advances in technology led to the development of the Language Environment Analysis System (LENA). As part of this system, small recording devices that fit in the pocket of a specially designed vest are worn by the child. The recording devices pick up every child vocalization (including babbles and cries), all the words spoken to the child, as well as electronics, and background noise. After recording the devices are uploaded and analyzed by the LENA software. Measures of the adult word count, child vocalizations, conversation turns, electronics, and background noise are produced. Despite the importance of early language development, few studies have looked at what effect parenting behaviors and attitudes have on the home language environment using LENA. Furthermore, no studies that we know of have used this technology in combination with longitudinal data assessing maternal depression and observations of parent-child interactions.

APPENDIX B
QUESTIONNAIRES

Participant Demographics

1. What is your gender?	<input type="radio"/> Male <input type="radio"/> Female <input type="radio"/> Other
2. What is your race? Please check all that apply.	<input type="radio"/> White/Caucasian <input type="radio"/> Black/African American <input type="radio"/> American Indian <input type="radio"/> Asian <input type="radio"/> Native Hawaiian/Other Pacific Islander
3. What is your ethnicity?	<input type="radio"/> Hispanic/Latino <input type="radio"/> Non-Hispanic/Latino
4. What is your Date of Birth (MM/DD/YYYY)	
5. What is your baby's gender?	<input type="radio"/> Male <input type="radio"/> Female <input type="radio"/> Other
6. What is the race of your child? Please check all that apply.	<input type="radio"/> White/Caucasian <input type="radio"/> Black/African American <input type="radio"/> American Indian <input type="radio"/> Asian <input type="radio"/> Native Hawaiian/Other Pacific Islander
7. What is your child's ethnicity?	<input type="radio"/> Hispanic/Latino <input type="radio"/> Non-Hispanic/Latino
8. What is your highest level of education completed?	<input type="radio"/> (0) Less than 9th Grade (did not complete middle school) <input type="radio"/> (1) Grade 9-12 (Did not get a high school degree) <input type="radio"/> (2) High School Diploma <input type="radio"/> (3) G. E. D. <input type="radio"/> (4) Some college (no degree) <input type="radio"/> (5) Vo-tech School/training program <input type="radio"/> (6) Associate degree <input type="radio"/> (7) Bachelor's degree <input type="radio"/> (8) Master's Degree (e.g., MA, MS, MSW, MFT etc.) <input type="radio"/> (9) Professional degree (e.g., LLB, LD, MD, DDS) <input type="radio"/> (10) Doctorate degree (e.g., PhD, EdD) <input type="radio"/> (11) Never attended school

Parenting Stress Index (PSI) – Competence Subscale

1. When my child came home from the hospital, I had doubtful feelings about my ability to handle being a parent.	SD	D	NS	A	SA
2. Being a parent is harder than I thought it would be.	SD	D	NS	A	SA
3. I feel capable and on top of things when I am caring for my child.	SD	D	NS	A	SA
4. I can't make decisions without help.	SD	D	NS	A	SA
5. I have had many more problems raising children than I expected.	SD	D	NS	A	SA
6. I enjoy being a parent.	SD	D	NS	A	SA
7. I feel that I am successful most of the time when I try to get my child to do or not do something.	SD	D	NS	A	SA
8. Since I brought my last child home from the hospital, I find that I am not able to take care of this child as well as I thought I could. I need help.	SD	D	NS	A	SA
9. I often have the feeling that I cannot handle things very well.	SD	D	NS	A	SA
10. When I think about myself as a parent I believe (Choose one):	<ul style="list-style-type: none"> a. I can handle anything that happens. b. I can handle most things pretty well. c. Sometimes I have doubts, but find that I handle most things without any problems. d. I have some doubts about being able to handle things. e. I don't think I handle things very well at all. 				
11. I feel that I am (Choose one):	<ul style="list-style-type: none"> a. A very good parent b. A better than average parent c. An average parent d. A person who has some trouble being a parent e. Not very good at being a parent 				

Social Provision Scale (SPS)

	Strongly Disagree	Disagree	Agree	Strongly Agree
1. There are people I can depend on to help me if I really need it.	1	2	3	4
2. I feel that I do not have close personal relationships with other people.	1	2	3	4
3. There is no one I can turn to for guidance in times of stress.	1	2	3	4
4. There are people who depend on me for help.	1	2	3	4
5. There are people who enjoy the same social activities I do.	1	2	3	4
6. Other people do not view me as competent.	1	2	3	4
7. I feel personally responsible for the well-being of another person.	1	2	3	4
8. I feel part of a group of people who share my attitudes and beliefs	1	2	3	4
9. I do not think other people respect my skills and abilities	1	2	3	4
10. If something went wrong, no one would come to my assistance.	1	2	3	4
11. I have close relationships that provide me with a sense of emotional security and well-being.	1	2	3	4
12. There is someone I could talk to about important decisions in my life.	1	2	3	4
13. I have relationships where my competence and skills are recognized.	1	2	3	4
14. There is no one who shares my interests and concerns.	1	2	3	4
15. There is no one who really relies on me for their well-being.	1	2	3	4
16. There is a trustworthy person I could turn to for advice if I were having problems.	1	2	3	4
17. I feel a strong emotional bond with at least one other person.	1	2	3	4
18. There is no one I can depend on for aid if I really need it.	1	2	3	4

19. There is no one I feel comfortable talking about problems with.	1	2	3	4
20. There are people who admire my talents and abilities.	1	2	3	4
21. I lack a feeling of intimacy with another person.	1	2	3	4
22. There is no one who likes to do the things I do.	1	2	3	4
23. There are people I can count on in an emergency.	1	2	3	4
24. No one needs me to care for them	1	2	3	4

Center for Epidemiological Studies Depression Scale Revised (CESD – R)

	Not at all or less than 1 day a week	1 or 2 days last week	3 to 4 days last week	5 to 7 days last week	Nearly every day for 2 weeks
1. My appetite was poor.	0	1	2	3	4
2. I could not shake off the blues.	0	1	2	3	4
3. I had trouble keeping my mind on what I was doing	0	1	2	3	4
4. I felt depressed.	0	1	2	3	4
5. My sleep was restless.	0	1	2	3	4
6. I felt sad.	0	1	2	3	4
7. I could not get going.	0	1	2	3	4
8. Nothing made me happy	0	1	2	3	4
9. I felt like a bad person	0	1	2	3	4
10. I lost interest in my usual activities.	0	1	2	3	4
11. I slept much more than usual.	0	1	2	3	4
12. I felt like I was moving too slowly.	0	1	2	3	4
13. I felt fidgety.	0	1	2	3	4
14. I wished I were dead.	0	1	2	3	4
15. I wanted to hurt myself.	0	1	2	3	4
16. I was tired all the time.	0	1	2	3	4
17. I did not like myself.	0	1	2	3	4
18. I lost a lot of weight without trying.	0	1	2	3	4
19. I had a lot of trouble getting to sleep.	0	1	2	3	4
20. I could not focus on the important things.	0	1	2	3	4

Parenting Interactions with Children: Checklist of Observations Linked to Outcomes – PICCOLO

Score Ratings:	0	Absent	No behavior observed
	1	Barely	Brief, minor, or emerging behavior
	2	Clearly	Definite, strong, or frequent behavior

RESPONSIVENESS					
Responding to child's cues, emotions, words, interests, and behaviors					
#	Parent...	Observation guidelines	Absent	Barely	Clearly
1	Pays attention to what child is doing	Parent looks at and reacts to what child is doing by making comments, showing interest, helping, or otherwise attending to child's actions.	0	1	2
2	Changes pace or activity to meet child's interests or needs	Parent tries a new activity or speeds up or slows down an activity in response to where child looks, what child reaches for, what child says, or emotions child shows	0	1	2
3	Is flexible about child's change of activities or interests	Parent accepts a child's choice of a new activity or toy or show agreeableness about the change or about child playing in unusual ways with or without toys.	0	1	2
4	Follows what child is trying to do	Parent both responds to and gets involved with child's activities.	0	1	2
5	Responds to child's emotions	Parent reacts to child's positive or negative feelings by showing understanding or acceptance, suggesting a solution, reengaging the child, labeling or describing the feeling, showing a similar feeling, or providing sympathy for negative feelings.	0	1	2
6	Looks at child when child talks or makes sounds	When child makes sounds, parent clearly looks at child's face or (if eyes or child's face are not visible) parent's position and head movement face toward child.	0	1	2
7	Replies to child's words or sounds	Parent repeats what child says or sounds child makes, talks about what child says or could by saying, or answers child's questions.	0	1	2
Comments:			Responsiveness Total:		

Parenting Interactions with Children: Checklist of Observations Linked to Outcomes – PICCOLO

Score Ratings:	0	Absent	No behavior observed
	1	Barely	Brief, minor, or emerging behavior
	2	Clearly	Definite, strong, or frequent behavior

AFFECTION					
Warmth, physical closeness, and positive expressions toward child					
#	Parent...	Observation guidelines	Absent	Barely	Clearly
1	Speaks in a warm tone of voice	Parent’s voice is positive in tone and may show enthusiasm or tenderness. A parent who speaks little but very warmly should be coded highly.	0	1	2
2	Smiles at child	Parent directs smiles toward child, but parent and child do not need to be looking at each other when smile occurs. Includes small smiles	0	1	2
3	Praises child	Parent says something positive about child characteristics or about what child is doing. A “thank you” can be coded as praise.	0	1	2
4	Is physically close to child	Parent is within easy arm’s reach of child, comfortably able to soothe or help. Consider context: Expect more closeness for book reading than for playing house.	0	1	2
5	Uses positive expressions with child	Parent says positive things or uses words like “honey”, “kiddo”, or an affectionate nickname. (Note: Emphasis on verbal expressions.)	0	1	2
6	Is engaged in interacting with child	Parent is actively involved together with child, not just with activities or with another adult.	0	1	2
7	Shows emotional warmth	Parent shows enjoyment, fondness, or other positive emotion about child and directed to child. (Note: Includes verbal but emphasis on nonverbal.)	0	1	2
Comments:			Affection Total:		

Parenting Interactions with Children: Checklist of Observations Linked to Outcomes – PICCOLO

Score Ratings:	0	Absent	No behavior observed
	1	Barely	Brief, minor, or emerging behavior
	2	Clearly	Definite, strong, or frequent behavior

ENCOURAGEMENT					
	Active support of exploration, effort, skills, initiative, curiosity, creativity, and play				
#	Parent...	Observation guidelines	Absent	Barely	Clearly
1	Waits for child's response after making a suggestion	Parent pauses after saying something the child could do and waits for child to answer or do something, whether child actually responds or not.	0	1	2
2	Encourages child to handle toys	Parent offers toys or says positive things when child shows obvious interest in toys. (Does not include preventing children from mouthing toys.)	0	1	2
3	Supports child in making choices	Parent allows child to choose activity or toy and gets involved with activity or toy child choose.	0	1	2
4	Supports child in doing things on his or her own	Parent shows enthusiasm for things child tried to do without help, lets child choose how things are done, and lets child try to do things before offering help or suggestions. Parent can be engaged in activities child does "on his/her own".	0	1	2
5	Verbally encourages child's efforts	Parent shows verbal enthusiasm, offers positive comments, or makes suggestions about child's activity.	0	1	2
6	Offers suggestions to help child	Parent gives hints or makes comments to make things easier for child without interfering with child's play.	0	1	2
7	Shows enthusiasm for what child is doing	Parent makes positive statements, claps hands, or shows other clear positive response to what child is doing, including quiet enthusiasm such as patting child, nodding, smiling, or asking child questions about activities.	0	1	2
Comments:			Encouragement Total:		

Parenting Interactions with Children: Checklist of Observations Linked to Outcomes – PICCOLO

Score Ratings:	0	Absent	No behavior observed
	1	Barely	Brief, minor, or emerging behavior
	2	Clearly	Definite, strong, or frequent behavior

TEACHING					
	Shared conversation and play, cognitive stimulation, explanations, and questions				
#	Parent...	Observation guidelines	Absent	Barely	Clearly
1	Explains reasons for something to child	Parent says something that could answer a “why” question, whether child asks a question or not	0	1	2
2	Suggests activities to extend what child is doing	Parent says something child could do to add to what child is already doing but does not interrupt child’s interests, actions, or play.	0	1	2
3	Repeats or expands child’s words or sounds	Parent says the same words or makes the same sounds child makes or repeats what child says while adding something that adds to the idea.	0	1	2
4	Labels objects or actions for child	Parent names what child is doing, playing with, or looking at.	0	1	2
5	Engages in pretend play with child	Parent plays make believe in any way- for example, by “eating” pretend food.	0	1	2
6	Does activities in a sequence of step	Parent demonstrates or describes the order of steps or does an activity in a way that a definite order of steps is clear even if parent does not say exactly what the steps are. Book reading counts only if parent makes the steps explicit by exaggerating or explaining the steps while reading	0	1	2
7	Talks to child about characteristics of objects	Parent uses words or phrases that describe features such as color, shape, texture, movement, function, or other characteristics.	0	1	2
8	Asks child for information	Parent asks any kind of question or says, “tell me”, “show me”, or other command that requires a yes/no response, short answer, or longer answer – whether or not child replies. Does not include questions to direct attention (“See?”) or suggest activities (“Wanna open the bag?”).	0	1	2
Comments:			Teaching Total:		

LENA Normative Data

Conversational Turn Estimates by Month of Age			Child Vocalization Estimates by Month of Age		
Age	<i>M</i>	<i>SD</i>	Age	<i>M</i>	<i>SD</i>
18	391	263	18	1533	894
19	418	254	19	1611	786
20	430	288	20	1738	900
21	433	286	21	1736	887
22	454	318	22	1794	1091
23	445	283	23	1873	1083
24	519	275	24	2152	938
25	498	288	25	2115	982
26	534	290	26	2160	931
27	495	295	27	2052	897
28	514	316	28	2132	1086

APPENDIX C

INSTITUTIONAL REVIEW BOARD APPROVAL FORMS

Oklahoma State University Institutional Review Board

Date: Wednesday, November 15, 2017 Protocol Expires: 11/14/2018
IRB Application No: HE1484
Proposal Title: Legacy for Children Implementation Study

Reviewed and Processed as: Expedited
Continuation

Status Recommended by Reviewer(s) **Approved**

Principal Investigator(s)

Amanda Morris Jennifer Hays-Grudo
1110 Main Hall 233 HS
Tulsa, OK Stillwater, OK 74078

Approvals are valid until the expiration date, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

The reviewer(s) had these comments:

enrollment closed subject still undergoing study procedures. No new changes. No change in risks/benefits. No reportable events. One withdrawal due to non-compliance during data collection. No complaints or new/additional funding.

Signature :



Hugh Crethar, Chair, Institutional Review Board

Wednesday, November 15, 2017
Date

Oklahoma State University Institutional Review Board

Date: Tuesday, January 16, 2018 Protocol Expires: 11/14/2018
IRB Application No: HE1484
Proposal Title: Legacy for Children Implementation Study

Reviewed and Processed as: Expedited
Modification

Status Recommended by Reviewer(s) **Approved**

Principal Investigator(s):

Amanda Morris 1110 Main Hall Tulsa, OK	Jennifer Hays-Grudo 233 HS Stillwater, OK 74078
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The requested modification to this IRB protocol has been approved. Please note that the original expiration date of the protocol has not changed. The IRB office MUST be notified in writing when a project is complete. All approved projects are subject to monitoring by the IRB.

- The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

The reviewer(s) had these comments:

update consent form in order to offer the LENA portion of the assessment to mothers who are eligible based on their child's age.

Signature :



Hugh Crethar, Chair, Institutional Review Board

Tuesday, January 16, 2018
Date

Oklahoma State University Institutional Review Board

Date: Wednesday, November 09, 2016 Protocol Expires: 11/8/2017
IRB Application No: HE1484
Proposal Title: Legacy for Children Implementation Study

Reviewed and Processed as: Expedited
Continuation

Status Recommended by Reviewer(s) **Approved**

Principal Investigator(s)

Amanda Morris Jennifer Hays-Grudo
1110 Main Hall 233 HS
Tulsa, OK Stillwater, OK 74078

Approvals are valid until the expiration date, after which time a request for continuation must be submitted. Any modifications to the research project approved by the IRB must be submitted for approval with the advisor's signature. The IRB office MUST be notified in writing when a project is complete. Approved projects are subject to monitoring by the IRB. Expedited and exempt projects may be reviewed by the full Institutional Review Board.

- The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

The reviewer(s) had these comments:

New subject enrollment still in progress. No new changes. No change in risks/benefits. No reportable events, withdrawals, complaints, or new/additional funding.

Signature :



Hugh Crethar, Chair, Institutional Review Board

Wednesday, November 09, 2016
Date

Oklahoma State University Institutional Review Board

Date: Wednesday, May 06, 2015 Protocol Expires: 12/11/2015

IRB Application No: HE1484

Proposal Title: Legacy for Children Implementation Study

Reviewed and Processed as: Expedited
Modification

Status Recommended by Reviewer(s) **Approved**

Principal Investigator(s):

Amanda Morris
1110 Main Hall
Tulsa, OK

Jennifer Hays-Grudo
233 HS
Stillwater, OK 74078

The requested modification to this IRB protocol has been approved. Please note that the original expiration date of the protocol has not changed. The IRB office **MUST** be notified in writing when a project is complete. All approved projects are subject to monitoring by the IRB.

- ☐ The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

The reviewer(s) had these comments:

Modification to 1) add 90 participants in order to have a community comparison group, 2) start groups post-birth (6 weeks to 4 months), 3) collect Legacy evaluation data at OSU-Tulsa or at Educare, 4) have a total of 6 groups with data collection as outlined in revised application, 5) collect data via paper surveys until OUHSC IRB approval has been obtained and the team can use OUHSC's RedCap software, 6) add surveys, 7) conduct interviews with mothers, 8) include a 10 minute free-play session, 9) add Dr. Lana Beasley as Co-PI, 10) Spanish portion of study to be conducted at OUHSC after OUHSC-IRB approval has been obtained, 11) pay participants

Signature :



Hugh Crethar, Chair, Institutional Review Board

Wednesday, May 06, 2015
Date

Oklahoma State University Institutional Review Board

Date: Friday, December 12, 2014
IRB Application No: HE1484
Proposal Title: Legacy for Children Implementation Study

Reviewed and Processed as: Expedited

Status Recommended by Reviewer(s): Approved Protocol Expires: 12/11/2015

Principal Investigator(s):

Amanda Morris	Jennifer Hays-Grudo
1110 Main Hall	233 HS
Tulsa, OK	Stillwater, OK 74078

The IRB application referenced above has been approved. It is the judgment of the reviewers that the rights and welfare of individuals who may be asked to participate in this study will be respected, and that the research will be conducted in a manner consistent with the IRB requirements as outlined in section 45 CFR 46.

- The final versions of any printed recruitment, consent and assent documents bearing the IRB approval stamp are attached to this letter. These are the versions that must be used during the study.

As Principal Investigator, it is your responsibility to do the following:

1. Conduct this study exactly as it has been approved. Any modifications to the research protocol must be submitted with the appropriate signatures for IRB approval. Protocol modifications requiring approval may include changes to the title, PI advisor, funding status or sponsor, subject population composition or size, recruitment, inclusion/exclusion criteria, research site, research procedures and consent/assent process or forms
2. Submit a request for continuation if the study extends beyond the approval period. This continuation must receive IRB review and approval before the research can continue.
3. Report any adverse events to the IRB Chair promptly. Adverse events are those which are unanticipated and impact the subjects during the course of the research; and
4. Notify the IRB office in writing when your research project is complete.

Please note that approved protocols are subject to monitoring by the IRB and that the IRB office has the authority to inspect research records associated with this protocol at any time. If you have questions about the IRB procedures or need any assistance from the Board, please contact Dawnett Watkins 219 Cordell North (phone: 405-744-5700, dawnett.watkins@okstate.edu).

Sincerely,



Hugh Crethar, Chair
Institutional Review Board

VITA

Amy Treat

Candidate for the Degree of

Doctor of Philosophy

Dissertation: IMPACT OF ADVERSE CHILDHOOD EXPERIENCES ON PARENTING, CHILDREN'S SOCIAL AND EMOTIONAL AND LANGUAGE OUTCOMES: THE ROLE OF MATERNAL DEPRESSION AND SOCIAL SUPPORT

Major Field: Human Development and Family Science

Biographical:

Education:

Completed the requirements for the Doctor of Philosophy in Human Development and Family Science at Oklahoma State University, Stillwater, Oklahoma in July, 2018.

Completed the requirements for the Master of Science in Human Development and Family Science at Oklahoma State University, Stillwater, Oklahoma in 2014.

Completed the requirements for the Bachelor of Science in Early Childhood Education at Northeastern State University, Tahlequah, Oklahoma in 1998.

Experiences:

Research Assistant for Tulsa Children's Project and Project Coordinator for Legacy for Children™ (2014-2018)

Co-instructor of HDFS 3123, Oklahoma State University (Fall, 2017)

Research Assistant for the CAP Family Life Study (2012-2014)

Research Assistant, Department of Human Development and Family Science (2012-2013)

Early Childhood Education Teacher, Tulsa Oklahoma (1998-2011)

Professional Memberships:

International Congress of Infant Studies, Society for Research on Child Development, Zero to Three, World Association for Infant Mental Health