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THE QUANTIFIABLE EFFECTS OF SAFECARE ON THE LANGUAGE ENVIRONMENT OF THREE FAMILIES AT-RISK FOR CHILD MALTREATMENT

by

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A Thesis Submitted to the Graduate Faculty of Georgia State University in Partial Fulfillment of the Requirements for the Degree

MASTER OF PUBLIC HEALTH

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APPROVAL

THE QUANTIFIABLE EFFECTS OF SAFECARE ON THE LANGUAGE ENVIRONMENT OF THREE FAMILIES AT-RISK FOR CHILD MALTREATMENT

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Date : 4/7/2015

Abstract

Children who are victims of maltreatment often suffer from a lack of physical, emotional and linguistic stimulation from their caregivers. This prolonged lack of stimulation has the potential to result in language delays that can have lasting negative effects on children including behavioral problems, psychiatric conditions, an increased risk for adult long-term health sequela, and criminality and violent behavior. Research suggests that children who live in low socio-economic homes have significantly less linguistic stimulation than children who live in moderate to high-income brackets. Language Environment Analysis (LENA) technology is a device through which the language environment of the infant and mother can be captured and quantified. The mechanism records parental utterances (words spoken around the child); child vocalizations (including typical infant babble); conversational turns (verbal exchanges between parent and infant); and, time spent near televisions. SafeCare, an evidence-based family support program, aims to reduce child maltreatment by increasing bonding behaviors between parent and infant. Through implementation of the Parent-Infant Interaction module, parents are taught important bonding behaviors with their infants. What is yet to be evaluated is the quantifiable effect implementation of PII has on the language environment of families at-risk for maltreatment. The LENA device was utilized in this quasi-experimental research design to assess parental utterances pre-and postimplementation of SafeCare. Maternal utterances include adult word count, child vocalizations and conversational turns. Results from this exploratory research may have implications for future modifications to SafeCare, as well as to other family support programs aimed at child maltreatment prevention.

Key words: child maltreatment, language environment, LENA technology, chaos

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Introduction

Child maltreatment is a significant public health problem in the United States, affecting more than 678,932 children in 2013(DHHS, 2013). Child maltreatment includes physical, sexual and psychological abuse as well as neglect (Fang et. al, 2012). While attention is often focused on the burden of physical and sexual abuse, neglect accounts for the majority of child maltreatment reports (Finkelhor, Vanderminden, Turner & Hamby, 2014). Children who are victims of neglect often suffer physical and emotional distress as well as significant developmental delays extending through young-adulthood (Hart & Risley, 1980). Particularly important with young children is the effect that neglect can have on language development. Children who are victims of neglect often lack appropriate stimulation from parents and caregivers, leading to delays in linguistic development (Hart & Risley, 1980). Infancy through adolescence represents a time in which significant neurological growth is occurring. Child maltreatment, whether physical, sexual, psychological or neglectful, can have devastating effects on a child's stress response system (Hagele, 2005). Consistent exposure to maltreatment can result in changes to a child's brain structure and chemistry, leading to behavioral, cognitive and developmental dysfunction well into adulthood (Twardosz & Lutzker, 2009).

Child Maltreatment in the United States

Child maltreatment includes acts of commission (abuse) or omission (neglect) by a parent or caregiver that result or could result in harm to the child. Neglect, the failure to meet a child's basic physical, emotional, medical/dental, or educational needs (Gilbert, Spatz-Widom, Browne, Fergusson, Webb, & Janson, 2009), accounts for the majority of maltreatment reports. From 2004-2011, over 5.6 million cases of child maltreatment were

substantiated, and of those, close to 80% were specifically attributable to neglect (Wildeman, Emanuel, Leventhal, Putnam-Hornstein, Waldfogel, & Lee, 2014).

Families who are considered at-risk for child maltreatment exhibit one or more of the following characteristics: low income, single parent homes, high number of dependent children in the home, teen parents, and homes in which English is not the primary spoken language (Putnam-Hornstein, Needell, & Rhodes, 2013). Because there is often a co-occurrence of these risk factors, it is helpful to apply the social-ecological model of health to the understanding of child maltreatment perpetuation. The social ecological model of health posits that health behaviors are influenced by a number of factors ranging from micro to macro levels (Reilly & Gravdal, 2012). The model positions these factors as proximate or distal related to their influence on health behaviors. The micro levels of influence include the Interpersonal and Intrapersonal factors affecting an individual's health behavior. At the more distal level, the community, environmental and policy level factors may have influence. Because child maltreatment perpetuation is not simply the product of one risk factor, applying the ecological model can be beneficial is assessing the confluence of factors contributing to child maltreatment.

Collectively, child maltreatment costs the United States $124 billion dollars annually, thus making child maltreatment costs comparable to that of Type 2 diabetes mellitus (Wildeman et. al, 2014). It is estimated that the lifetime economic cost of each child who suffers from maltreatment in the United States is $210,012 per victim (Fang, Brown, Florence, & Mercy, 2012).

Child Maltreatment Interventions

Numerous child maltreatment prevention and intervention programs are available across the United States. Many that employ an in-home family support approach have been successful in reducing risk factors for child maltreatment (Lutzker & Chaffin, 2012). Parent-training programs such as Parent-Child Interaction Therapy (PCIT) and Positive Parenting Program (Triple P), provide parents with skills aimed at improving interactions between parent and child (Chaffin & Friedrich, 2004). Privately funded non-profit organizations such as "Family Tree" and the "Joyful Heart" provide services to victims of child maltreatment in an effort to rehabilitate the whole family. In the public sector, Child Protective Services investigates reports of child maltreatment and may remove victims of child maltreatment from harmful environments.

SafeCare. SafeCare, an evidence-based home visiting program, aims to prevent incidences of child maltreatment and to reduce recidivism rates among perpetrators of child maltreatment among families with children under five-years-old. SafeCare was developed in 1994 out of a grant supported child maltreatment program entitled, "Project 12-Ways". SafeCare has been successful in preventing child maltreatment, specifically neglect in families at-risk or reported for maltreatment and who have a child between birth and five-years-old (Whitaker et. al, 2012). The curriculum includes three core areas for parent training: home safety, child health, and parent-child/parent-infant interactions.

The SafeCare curriculum is typically delivered to families by a trained home visitor in 60-90 minute sessions over the course of 6-8 weeks per module. SafeCare employs a four-level approach in its curriculum: the skill and its importance are *explained* to the parent, then the skill is *modeled* by the home visitor, next parents

practice the target skill, and finally positive and corrective *feedback* is provided by the home visitor (Bigelow & Lutzker, 1998; Guastaferro, Lutzker, Graham, Shanley, & Whitaker, 2012). Parents are required to demonstrate mastery of skills for each module before they are able to move to the next skill set.

The Parent-Infant Interaction (PII) module, the focus of the present research, is intended for parents with infants who are not yet ambulatory. The purpose of PII is to teach parents ways to engage in stimulating activities with their infants (Lutzker & Chaffin, 2012; Guastaferro et al., 2012). Parents are taught four primary bonding behaviors and three secondary behaviors intended to prevent neglect by the parent or caregiver. The four primary bonding behaviors include looking, talking, touching and smiling (hereafter referred to as LoTTS). The LoTTS bonding behaviors can be utilized in any and all activities between the parent and child. The secondary bonding behaviors include holding, rocking and imitating. While these secondary behaviors are equally as important for infant development as the primary behaviors, they cannot be utilized in any and all situations and therefore are categorized as secondary. Examples in which the secondary behaviors cannot be as consistently utilized as the primary behaviors, include diapering or bathing the infant. Holding or rocking an infant during a diaper change or a bath would not be advised as the behavior significantly interrupts the intention of the activity. PII supports the notion that parents who consistently employ the LoTTS bonding behaviors will increase positive interactions between themselves and their child. In the final two PII training sessions, parents are instructed on planned activities training which is intended to be employed when their infants become toddlers. This portion of PII

instructs parents on ways to plan appropriately for play activities with their child so that potential challenges are diminished.

The overarching goal of SafeCare is the prevention of child maltreatment and the reduction of recidivism rates for parents reported for maltreatment. SafeCare has been successful in accomplishing both of these goals. A randomized controlled trial in Oklahoma compared recidivism rates among child welfare parents enrolled in SafeCare to child welfare parents enrolled in services as usual (Chaffin, Hecht, Bard, Silvosky, & Beasley, 2012). Results with nearly 2,200 families indicated that families who received SafeCare had lower recidivism rates than families who received enhanced services as usual. Further, lower recidivism rates were observed among Native American families enrolled in SafeCare also compared with families receiving services as usual (Chaffin, Bard, Bigfoot, & Maher, 2012). A quasi-experimental program evaluation of SafeCare examined recidivism rates among participants enrolled in SafeCare with those enrolled in the "Family Preservation", a national program aimed at preventing the placement of maltreated children in substitute care (Gershater-Molko, Lutzker & Wesch, 2002). Of the 41 families enrolled in SafeCare for the 36-month observationperiod, only 15% had an additional report of child maltreatment investigated by child protective services (Gershater-Molko et al., 2002). Of the 41 families enrolled in "Family Preservation for the 36-month observation period, 46% had an additional claim of maltreatment investigated by child protective services (Gershater-Molko et al., 2002). A randomized controlled trial compared the effects of SafeCare among high-risk, rural communities to standard home-based mental health services. Families enrolled in SafeCare had fewer

subsequent child welfare reports than families enrolled in the standard home-based mental health services (Silovsky et. al, 2011).

Child Maltreatment and Language Development

The negative effects of maltreatment on language development are long-lasting (Allen & Oliver, 1982). At the time children enter the school system, typically their language is expressive and expanding. Appropriately developing children at this age are able to engage in lengthy conversations and relate experiences through narrative description (Snow, Powell, & Sanger, 2012). Language develops in children through their interactions with caregivers, parents and the outside world. Parents who are responsive, engaging and present with their children, provide a healthy language environment for their development (Snow, Powell, & Sanger, 2012). Physical and emotional neglect interferes with children's ability to develop linguistically. Research has indicated that children who were victims of neglect score significantly lower on the Bayley-Scales of Infant Development than children who had never experienced neglect in their lifetime (Hildyard & Wolfe, 2002). Additionally, the children who had experienced neglect exhibited difficulties in problem solving, impulse control, and age-appropriate play in later years (Hildyard & Wolfe, 2002). A 1987 study evaluated the effects of Project 12-Ways (the precursor to the SafeCare parent-infant interaction module) on the language environment of six mothers at-risk for child maltreatment (Lutzker, Lutzker, Braunling-McMorrow, & Eddleman, 1987). The particular focus was on mothers' use of affectionate words. Results indicated that implementing the Project 12 Ways adapted module when prompts and feedback were provided resulted in an increase of mothers' use of affectionate words. These results support the notion that implementation of

evidence-based practices such as Project 12-Ways can have positive effects on the language environment of mothers at-risk for child-maltreatment.

What has not been recently evaluated in SafeCare research, is the quantifiable effect SafeCare has on the language environment of families enrolled in the program. In the SafeCare protocol, home visitors currently measure parents' interactions with their infants through the utilization of the iPAT Home Visitor form. This form assesses parents' progress in the mastery of LoTTS from baseline to post-intervention. While inter-rater reliability training occurs among SafeCare home visitors, the iPAT form remains a relatively subjective tool for assessment. The scoring process is conducted through observations by the home visitor. What one home visitor observes as "mastery" of a particular skill, another home visitor might score as "needs improvement". Thus, inter-rater reliability training occurs before implementation. The home visitor and a second objective party, score pre-recorded videos in which SafeCare is demonstrated. Scoring continues until a minimum of 80% agreement is met. Agreements are calculated as follows:

(Agreements/Agreements + Disagreements) * 100

Further, the iPAT assesses whether or not parents or caregivers talk to their children, but the form does not indicate the type of language utilized by the parent or caregiver. Thus, missing from the research is a quantifiable assessment of the effect of PII on the language environment of participating parents and caregivers.

The Language Environment

Children's ability to develop linguistically is impacted by the language environment in which they live. Research suggests that children's vocabularies are

related to the amount of speech that continually surrounds them. Hart and Risley (1995) documented a dramatic difference in language development between low socio-economic children and middle to high socio-economic children. It was estimated that a child living in low socio-economic environment heard an average of 30 million fewer words by three-years-old than a child living in a middle to high socio-economic environment. Further, Hart and Risley (1995) noted the rate at which children living in a low socio-economic environment were acquiring language and compared it with the vocabulary rate of children living in a middle to high socio-economic environment. The disparity gap between language acquisition widened as the children aged.

Drawing on the seminal work of Hart and Risley, the Language Environment Analysis (LENA) was developed. The LENA Digital Language Processor (DLP) is a small, unobtrusive mechanism through which the language environment can be recorded, quantified, and analyzed. The device weighs two-ounces and is worn by infants in a protective vest atop their clothing (Caskey & Vohr, 2012). It can record up to 16 hours of audio and is downloaded through a USB cord using the LENA Pro Software. The DLP has the ability to capture a remarkable amount of information pertaining to the language environment. The LENA technology has been employed in previous research related to the assessment of the language environment. A study examining the effects of long-term hearing loss among premature infants highlighted the importance of the LENA digital processor (Caskey & Vohr, 2012). Because the device allowed for the language environment of premature infants to be captured, the potential areas for early intervention were identified. Soderstrom and Wittebolle (2013) assessed not only the amount of language spoken by caregivers in a daycare setting, but also the times of the day in which

language was most used. The LENA technology allowed for examination of the language environment as broken down into hour segments. As the intensity of the activity increased, so did the adult word count. LENA technology was utilized in a study seeking to evaluate differences in verbal interactions between parents and infants dependent on the gender of the baby (Johnson et. al, 2014). The device allowed for researchers to distinguish between verbal interactions between mother-infant dyads and father-infant dyads. Zimmerman and colleagues (2009) used the LENA technology to assess the relationship between time in front of the television and language development among toddlers. While time in front of the television had a negative effect on child vocalizations, when adult-child conversations continued, it had a mediating effect (Zimmerman et. al, 2009). Research involving utilization of LENA technology is not relegated to studies involving infants and young children. More recently, Li and colleagues (2014) employed the technology in an effort to quantifiably evaluate the auditory and social environment of older adults aged 64-91-years-old (Li et. al, 2014). It was determined that that high-quality objective data on the auditory environment of older adults, could be adequately measured with the LENA recording device. Additionally, utilization of LENA technology in autism research has proved invaluable. Dykstra and colleagues (2012) examined the language environment of 40 children with autism spectrum disorders by using the LENA DLP to record words spoken in a classroom setting. The device allowed for researchers to evaluate potential correlations between child characteristics and the automated measure of child language among those with autism spectrum disorders (Dykstra et. al, 2012). Two of the three assessed LENA variables were significantly correlated with language age-equivalents. Whether employed in research surrounding autism or hearing loss

among infants or older adults, utilization of LENA technology allows for the comprehensive language environment to be recorded and analyzed.

The literature makes it clear how important a rich language environment is to child development. This language environment includes, but is not limited to, child vocalizations and dialogue spoken around or to the child. The LENA DLP provides researchers with an effective mechanism through which the language environment of at-risk families can be measured.

The present study used the LENA technology and collected posttest data with the goal of answering two research questions: 1) *what is the quantifiable effect of the PII module on the language environment of families at-risk for child maltreatment?; 2) what is the effect of PII on mother-child vocalizations?* The outcome of this pilot study could provide SafeCare with informative quantifiable data pertaining to the PII modules, and that could necessitate curriculum modifications.

Method

Participants/Setting

This research was approved by the Institutional Review Board at Georgia State University. Participants were eligible for this study if they met a minimum of two of the following criteria used to define a child "at-risk" for maltreatment: low parental education attainment, teen parents; low income or low socio-economic status, single parent home, or high number of dependent children living in the home (Putnam & Hornstein, 2013; Sedlak et. al, 2010).

Participants were recruited from a community early education organization in metro Atlanta. The organization has 15 locations across Georgia and serves more than

3,600 children annually ranging in age from 6-weeks-old to 5-years-old. The metro-based center provides childcare and comprehensive family support services to lower income families. The primary researcher (hereafter referred to as the home visitor) distributed flyers outlining the purpose of the study to the community center on two separate occasions and conducted an hour-long presentation with further description and detail of the study.

Mother-infant dyads were selected for participation contingent upon being among the first few to respond. Informed Consent was provided and received for each participant. Participants were compensated a total of $85, spread over the duration of implementation; they received $10 following each training session and $25 following the final posttest recording. A total of five mothers responded with interest in participating, but because of drop out, only three completed the research. Complete demographic information is presented in Table 1.

Table 1. Participant Demographic Characteristics

	Mother 1	**Mother 2**	**Mother 3**
*Age**	25	34	18
Infant's Age	11 months	8 months	9 months
Highest Level of Education	Some College	Some College	High School Diploma
*Annual Household Income**	$6,000-$9,999	$6,000-$9,999	$6,000-$9,999
Current Employment Status	Unemployed	Unemployed and Looking	Part-time Employed
*Marital Status**	Single	Single	Single

* = a criteria that is considered high-risk for child maltreatment

Mother 1. Mother 1 and her 11-month-old infant lived in a two-bedroom apartment that she owned, but spent weekday afternoons and weekends at the child's

grandmother's home. One of the six training sessions occurred at Mother 1's apartment and the rest were conducted at the infant's grandmother's house. It was evident to the home visitor that Mother 1 was quite burdened with responsibilities in addition to single-parenting: she helped the grandmother care for her nieces and nephews whose ages ranged from 1-years-old to 11-years-old. There were numerous distractions throughout each training session. Because Mother 1 helped care for her nieces and nephews, these young children were present for five of the six training sessions. The nieces and nephews distracted Mother 1 by asking for snacks, to have their diapers changed, and to be involved with the training. The house was periodically filled with adults, some of whom reported being related to Mother 1, others who never identified themselves. Following the first session introductions, Mother 1 confided to the home visitor that she did not have a typical routine in place for her 11-month-old son. She mentioned that bedtime was between 10-11PM each night and that he napped periodically throughout the day. When asked about what her pediatrician had advised the infant eat at this stage of his life, Mother 1 confided that the infant ate very little solid food and instead drank milk most of the day. While Mother 1 expressed interest SafeCare; her current living situation and lack of a consistent schedule made practice of the skills difficult. Session 1 was conducted at Mother 1's apartment. The training occurred in the living room of the apartment. The infant's father was in the adjoining bedroom and periodically interrupted the session to play with the infant and to ask questions of the infant's mother. Sessions 2-6 were conducted in the kitchen of the infant's grandmother's house. The sessions occurred in the kitchen and Mother 1, her and infant and the home visitor sat at the kitchen table during training. Because the house was so noisy and filled with people,

sessions 4 and 5 were partly conducted outside on the back deck, so as to minimize noise and distraction.

Mother 2. Mother 2 lived in government-assisted housing with her four children. She reported having been previously homeless after fleeing a domestic violence situation. She home-schooled her 13-and 3-year-old children and sent her 8-year-old to public school. Multiple references were made to money problems, desperation for employment and a continuing domestic violence situation with the infant's father. Sessions 1-6 were conducted in Mother 2's home. Each session occurred in the living room with the home visitor positioned on the couch, and the mother and infant on the carpet demonstrating the various behaviors. When necessary, the home visitor sat on the carpet with the infant to model and provide feedback to Mother 1.

Mother 3. Mother 3 turned 19-years-old during the course of intervention and had a 9-month-old son who was ambulatory. Mother 3 had not attended college, though, she reported to the home visitor that she was "fixing to go to school." While her son was her only child, she was responsible for caring for her two nieces, ages 3-and 4-years-old, several days per week. The home visitor observed an apparent shyness and introversion in Mother 3 that made interactions with her difficult. Further, because she was responsible for caring for her two nieces in addition to her son, there were numerous distractions throughout training sessions. Her nieces often interfered with training by yelling or throwing tantrums because they were not allowed to participate in the training. Mother 3 disclosed that the house belonged to her mother but that she intended to move to a place of her own as soon as possible. There were often between 3-4 adult males and females coming in and out of the home. On one occasion, a loud argument occurred

between two individuals standing on the front porch. Mother 3 did not disclose to the home visitor who any of these people were nor acknowledge the arguments. Mother 3 was receptive to implementation of SafeCare, but sessions were frequently interrupted by the comings and goings of people in her home and by her two nieces. Sessions 1-6 were conducted in Mother 3's home. The sessions were conducted in the mother's living room and the home visitor, mother and her infant sat on the couch for the duration of training.

Materials

Standard SafeCare materials developed for the PII module were utilized for the purpose of this study.

Home Visitor Materials. The home visitor used three PII materials throughout the study: the "Daily Activities Checklist" (DAC); the "iPAT HV"; and, the "Infant State Cards". The DAC is a checklist utilized by the home visitor at pre- and postintervention, and assesses the mother/baby activities that mother would like to change. The iPAT HV is utilized at pre- and postintervention by home visitors, and serves as an assessment tool for gauging a mother's mastery of required skills in PII. The Infant State Cards are employed by home visitors in session one, to demonstrate the five states of behavior of a baby: asleep; drowsy; calm-alert; excited, and upset. The cards are used to help the mother identify the "state" of her baby, and to understand how to react accordingly. The cards instruct the mother, through pictures and diagrams, on how to differentiate the range of signs from drowsiness to alertness in her baby. The ability to appropriately identify the state of her baby, allows the mother to react accordingly. Additionally, the home visitor brings dolls to each session for modeling purposes. The home visitor first explains the LoTTs and secondary bonding behaviors and then models each behavior

with the doll or, if the mother is comfortable, with the home visitor demonstrating the behaviors with the infant.

Parent Materials. All three mothers were given four materials throughout the duration of the training sessions. Materials included: the "iDevelop Cards"; the "iCards"; the "iActivity Cards"; and, the "PII Parent Satisfaction Survey". The iDevelop cards were distributed to mothers at baseline and provided a breakdown of appropriate developmental milestones to observe in their babies. The iCards covered a variety of information pertaining to babies' development and the actions mother can take to aid in development. The iCards were distributed throughout sessions 2-5. The iActivity Cards were distributed in sessions 2-4 and provided suggestions to mothers about activities in which they could engage with their infants. Finally, the PII Parent Satisfaction Survey, optional for participants to complete, were distributed at posttest and asked for future feedback on the PII experience.

Observer Training

PII Training. For the home visitor, training for PII consisted of both a series of online interactive training modules, as well as multiple interactive sessions with a National SafeCare Training and Research (NSTRC) training specialist. The on-line modules introduced the home visitor to PII and included quizzes at the end of each module to assess retention of the material. The home visitor was required to score a minimum of 85% out of 100% of quiz answers correectly to complete the online portion of the training. Following the online training, the home visitor participated in two practice sessions with a NSTRC training specialist. Sessions included role-playing exercises, practice scenarios, and a general discussion of PII material.

Observer Reliability. Observer reliability training was conducted prior to the start of the study and included the home visitor and a graduate student. The home visitor and graduate student scored pre-recorded training videos in which mother-infant dyads demonstrated the LoTTs and secondary bonding behaviors. The home visitor and graduate student scored each video independently and compared results to determine reliability. Training continued until inter-observer reliability was met at a minimum of 80% of the time. Percent agreement was used to calculate inter-oberserver reliability using the following equation:

(Agreements/Agreements + Disagreements) * 100

Following the training, two observers were always present in each of the three mother's homes. The home visitor explained to each of the three mothers why the second observer was present, stating that she was there to help with childcare (play with additional children so as to avoid interruptions) and to ensure that the home visitor was conducting the training sessions appropriately. During formal assessment, the home visitor and the second observer sat independently of one another and observed and recorded each mother at baseline and at posttest.

Measures

Two measures for assessing both the language environment and the impact of PII training were utilized: the LENA digital language processor and the iPAT home visitor assessment form.

LENA Digital Language Processor (DLP). The LENA DLP device was worn by all three infants at baseline and again following intervention in an effort to evaluate the effect of the Parent-Infant Interaction training on the language environment of

families at-risk for child maltreatment. The mother was instructed to have the infant wear the device for a minimum of 10 hours and a maximum of 16 hours. The device weighed fewer than 2 ounces and was safely secured on the infant by a garment developed by the manufacturer. Pre- and postintervention data were downloaded through the LENA Pro software which coded and quantified adult word count, child vocalizations, and conversational turns.

LENA Scoring. . The LENA device distinguishes between child vocalizations and maternal utterances, providing an auditory snapshot of the infant's language environment. Once recording is completed, the LENA device is connected to a computer through a USB cord and the data are securely downloaded. Upon download, the audio file is deleted from the DLP. All files were processed using the LENA Pro software. The researchers never listened to the content of the recordings. This was a privacy condition clarified with the Mothers at consent. Once processed, hourly data were exported from the LENA software into Microsoft Excel.

iPAT home visitor assessment form. The iPAT is a developmental checklist used throughout the six weeks to assess mother's attainment of bonding skills. For the purpose of this study, the iPAT was utilized pre- and posttest to assess mothers' retention of bonding behaviors outlined as appropriate by SafeCare. The core bonding behaviors include looking, talking, touching, and smiling which are applicable for all behaviors. Other behaviors, such as holding, gentle rocking and imitating were also assessed though were not deemed applicable for all activities.

iPAT Scoring. The iPAT home visitor assessment form was utilized at baseline and again postintervention by the home visitor to observe and assess each mother's

understanding and demonstration of looking, talking, touching and smiling (LoTTs), as well as the three secondary behaviors, holding, imitating and rocking. A "check plus" indicated the mother demonstrated the behavior "consistently and with ease"; a "check" indicated that the mother demonstrated the behavior but "needs improvement in ease and/or consistency"; and a "negative" mark indicated that the mother did not demonstrate the behavior at all. A "non-applicable" mark implied that the mother did not demonstrate the behavior because it was not feasible in that particularly assessed activity. An example of this would be "holding" while the baby was having a bath. For the purpose of this study, the iPAT assessment form was scored by quantifying the three possible measures. The "negative" was quantified as "0"; the "check" was quantified as "1" and the "check plus" was quantified as "2". This scoring system has demonstrated high reliability in past SafeCare research. The scores were aggregated across the two daily activities and one play activity assessed at baseline and at session six, postintervention. Averages across the three activities were taken at baseline and compared with average scores across the three activities at the end of training.

Experimental Design

This was a feasibility study that examined pretest-posttest data on the impact of the SafeCare PII module on the language environment of three mother-infant dyads at-risk for child maltreatment. The dependent variables were maternal utterances, defined as: adult word count, conversational turns and number of child vocalizations. The independent variable was the delivery of the PII module. Variables were measured through the LENA DLP (Digital Language Processor) and the iPAT.

Experimental Procedure

Participants recorded a maximum of 16 hours with their infant prior to intervention; this is considered LENA baseline. Following the LENA baseline, the home visitor implemented PII at six sessions. At the conclusion of PII training, the participant recorded a postintervention day with their infant.

LENA Baseline. The Home Visitor met with each mother-infant dyad seven times. In the first meeting, the LENA device was left with the mother and she was instructed on how to use it. Upon consent, the mother placed the LENA device in a garment worn by the infant for a minimum of 12 hours and a maximum of 13 hours prior to the first PII session. The mother was instructed to go about her day as usual, suggesting that the audio recording should capture daily life, but does not work well in unusually loud situations, such as a sporting event. While the infant was having a bath or taking a nap, the mother removed the garment holding the LENA device and placed it near her infant. When the home visitor retrieved the LENA device at pretest and posttest, she asked each of the three mothers to describe the day in which the recording occurred. Ability to recollect what happened during the day of recording varied depending on the mother. Following LENA baseline, the home visitor began implementation of the six-session PII module.

PII Baseline. The home visitor met with mother and infant once or twice per week, which varied by mother and by schedule. The first session served as baseline; no actual training occurred. The home visitor assessed mother and infant in two daily activities and one play activity. The home visitor utilized the "Daily Activity Checklist" (DAC) for assessment purposes.

PII Training. In sessions 2-4, mother received instructional information supporting positive physical and use of language with the baby. Sessions 5-6 focused on the promotion of LoTTs of Bonding and the introduction of Planned Activities Training.

Results

In-home reliability was assessed in sessions 1 and 6 for Mothers 1, 2 and 3. A score of 100% was attained in each session.

Mother 1

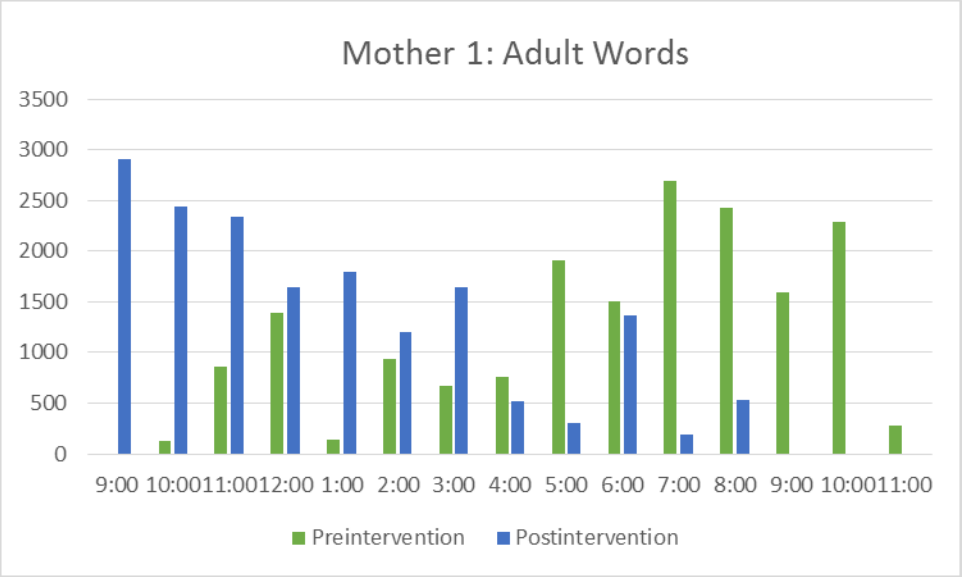
LENA. Rate data show the percent mean difference between total adult words spoken at baseline and at postintervention increased by 13.7% with conversational turns (CT) increasing from baseline to postintervention by 4.9% and child vocalizations (CVC) increasing by 4.6% (Table 1). At baseline, Mother 1 spoke 27% of all adult words (AWC) between 10:00 a.m. and 4:00 p.m. During this same time period, 18% of the conversational turns and 26% of all child vocalizations were observed. Comparatively, at post-intervention Mother 1spoke 69% of adult words, 75% of conversational turns, and 77% of child vocalizations between 10am-4pm.

Table 1. (a) Pre- and Post-Intervention LENA Mean Comparison: Mother 1

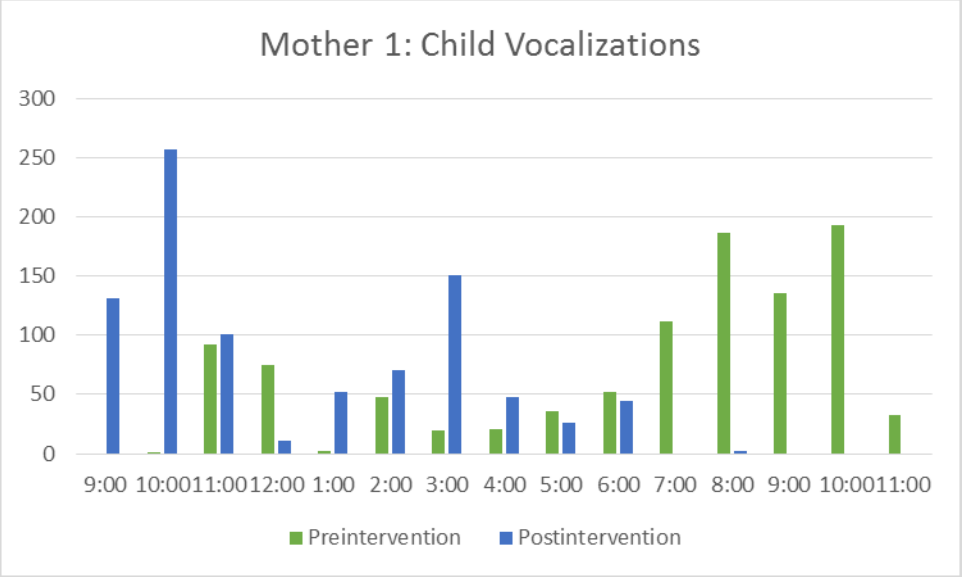
	# hr	AWC Actual	AWC rate per hour (range)	CVC Actual	CVC rate per hour (range)	CT Actual	CT rate per hour (range)
Preintervention	13	17,556	1,350.5 (98-2,695)	1,007	77.5 (1-193)	389	29.9 (0-86)
Postintervention	11	16,897	1,536.1 (109-2,913)	894	81.27 (0-257)	344	31.27 (0-94)
AWC=Adult Word Count; CVC=Child Vocalizations; CT=Conversational Turns *Rate calculated as total words/total hours recorded							

Figures 1-3 illustrate the difference in number of adult words spoken, conversational turns and child vocalizations observed from the pre-intervention and post-intervention LENA recording days.

Graph 1. Pre-and Post-Intervention LENA results: Mother 1



Graph 2. Pre-and Post-Intervention LENA results: Mother 1



Graph 3. Pre-and Post-Intervention LENA results: Mother 1

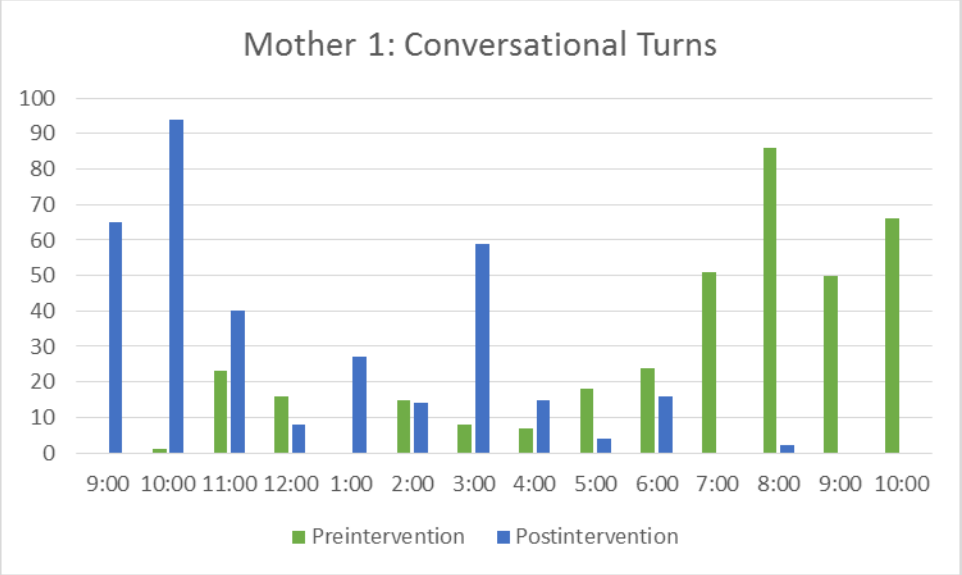


Table 2 displays the pre-intervention LENA data for Mother 1. Her infant wore the LENA device at baseline for a total of 13 hours (10:00am to 11:00pm). The mother spoke a total of 17,556 adult words with the majority of her speaking occurring towards the end of the recording period.

Table 2. (a) Pre-Intervention LENA results by hour: Mother 1

Time	AWS	CTC	CT
10am	98	1	1
11am	854	23	92
12pm	1386	16	75
1pm	136	0	2
2pm	940	15	48
3pm	674	8	20
4pm	761	7	21
5pm	1915	18	36
6pm	1501	24	52
7pm	2695	51	112
8pm	2429	86	187
9pm	1591	50	135
10pm	2295	66	193

11pm	281	24	33
Total:	**17,556**	**389**	**1,007**

The infant wore the LENA device at post-intervention between 9:00am and 8:00pm for a total recording period of 11 hours (Table 3). In the post-intervention recording, Mother 1 spoke the majority of words towards the beginning of the day, with adult words, child vocalizations and conversational turns tapering off by 8:00pm at which point the infant went to sleep for the night.

Table 3. (a) Post-Intervention LENA results by hour:
Mother 1

Time	**AWS**	**CTC**	**CV**
9am	2913	65	131
10am	2442	94	257
11am	2336	40	101
12pm	1646	8	11
1pm	1801	27	52
2pm	1201	14	70
3pm	1639	59	151
4pm	525	15	48
5pm	309	4	26
6pm	1369	16	45
7pm	190	0	0
8pm	526	2	2
Total:	**16,897**	**344**	**894**

iPAT. The iPAT scores were calculated by averaging the quantified minuses, checks and check pluses received through assessment at pretest and posttest. The denominator for the calculation depended upon how many of the behaviors were applicable during each respective activity.

At baseline, two daily activities (practicing walking and diaper change) and one play activity (“playing iPad game”) were assessed for Mother 1. Mother 1’s average

iPAT score across all three activities was 4.33 (Table 4). The same activities were assessed postintervention for Mother 1. Her average iPAT score across all three activities was 6.00.

Table 4. iPAT Pretest and Posttest Scores: All Mothers

	Pretest Score	Posttest Score
Mother 1	4.33/14.00	6.00/14.00
Mother 2	2.33/14.00	8.00/14.00
Mother 3	1.00/14.00	8.00/14.00

Mother 2

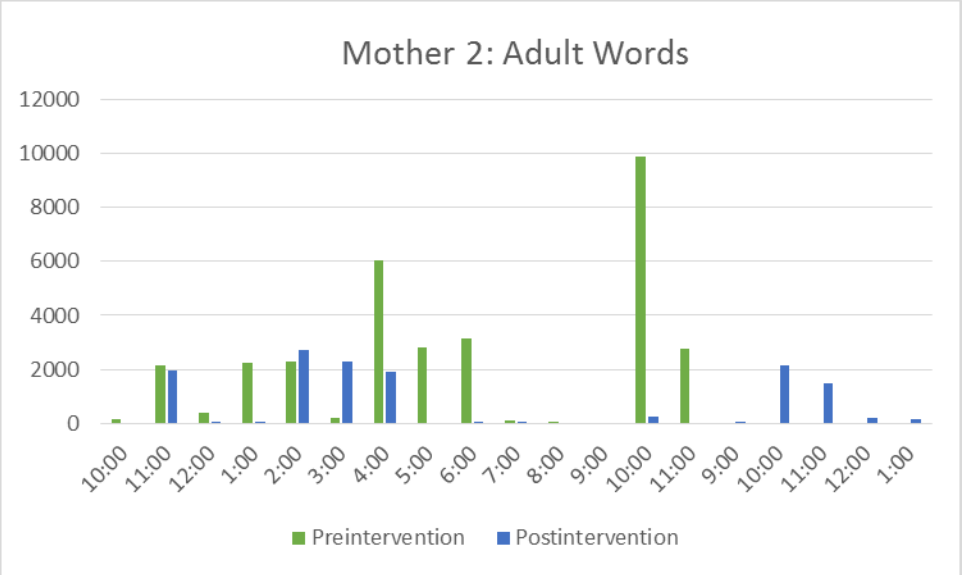
LENA. Rate data show there was a decrease in percent mean difference between adult words spoken at baseline and at post-intervention for Mother 2 (Table 5). Her adult word count mean decreased by 69.9%. Additionally the percent mean difference between conversational turns at baseline and at post-intervention decreased by 55.7% and child vocalizations decreased by 54.6%. At baseline, Mother 2 spoke her largest number of adult words (9,881). Comparatively at post-intervention, she spoke 243 adult words at 10:00:pm with the majority of her speaking occurring in the morning between 10am-2:00pm.

Table 5. (b) Pre- and Post-Intervention LENA Mean Comparison: Mother 2

	# hr	AWC Actual	AWC rate per hour (range)	CVC Actual	CVC rate per hour (range)	CT Actual	CT rate per hour (range)
Preintervention	13	32,165	2,297.5 (0-9,881)	1,872	133.7 (0-460)	429	30.64 (0-125)
Postintervention	19	13,173	693.3 (0-2,733)	1,125	59.2 (0-207)	264	13.9 (0-55)
AWC=Adult Word Count; CVC=Child Vocalizations; CT=Conversational Turns *Rate calculated as total words/total hours recorded							

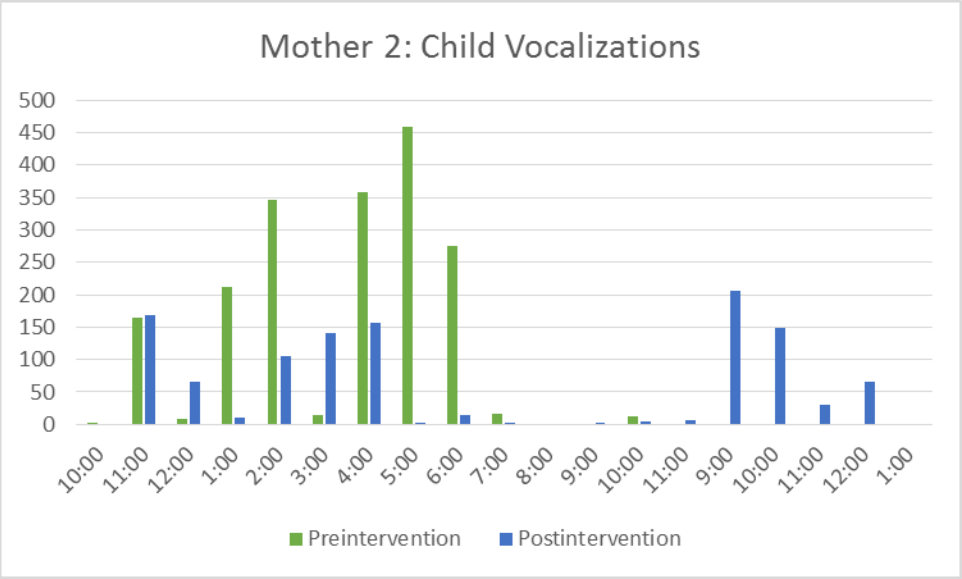
Figures 4-6 illustrate the difference in number of adult words spoken, conversational turns and child vocalizations observed from the pre-intervention and postintervention LENA recording days.

Graph 4. Pre-and Post-Intervention LENA results: Mother 2



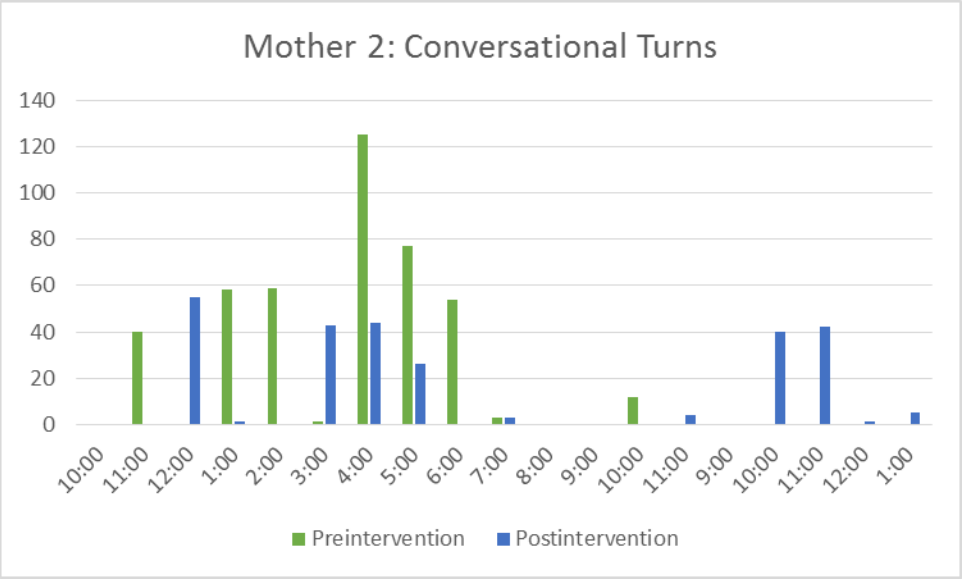
*Mother 2 turned off the device at 8:00pm and then turned it on again at 9:00am the next morning.

Graph 5. Pre-and Post-Intervention LENA results: Mother 2



*Mother 2 turned off the device at 8:00pm and then turned it on again at 9:00am the next morning.

Graph 6. Pre-and Post-Intervention LENA results: Mother 2



*Mother 2 turned off the device at 8:00pm and then turned it on again at 9:00am the next morning.

Table 6 displays the pre-intervention LENA data for Mother 2. The infant wore the LENA device at baseline for a total of 13 hours (10:00am-11:00pm).

Table 6. (b) Pre-Intervention LENA results by hour: Mother 2

Time	**AWS**	**CTC**	**CV**
10am	140		1
11am	2129	40	164
12pm	391	0	8
1pm	2240	58	213
2pm	2280	59	347
3pm	222	1	14
4pm	6025	125	359
5pm	2814	77	460
6pm	3138	54	276
7pm	120	3	17
8pm	2	0	0
9pm	0	0	0
10pm	9881	12	13
11pm	2783	0	0
Total:	**32,165**	**429**	**1,872**

The infant wore the LENA device at post-intervention from 10am-11pm and again the following morning between 9:00am-1:00pm for a total recording period of 19 hours (Table 7.) Between 10:00am and 2:00pm on the first day of recording, Mother 2 spoke a total of 4,710 adult words with 56 conversational turns and 244 child vocalizations.

Table 7. (b) Post-Intervention LENA results by hour:
Mother 2

Time	**AWC**	**CTC**	**CV**
10am	0		
11am	1962	0	0
12pm	11	55	168
1pm	4	1	66
2pm	2733	0	10
3pm	2300	43	105
4pm	1905	44	141
5pm	0	26	156
6pm	43	0	1
7pm	5	3	14
8pm	0	0	1
9pm	50	0	0
10pm	243	0	1
11pm	0	4	5
9am	11	0	6
10am	2157	40	207
11am	1461	42	148
12pm	181	1	31
1pm	157	5	65
Total:	**13,173**	**264**	**1,125**

iPAT. At baseline, two daily activities (snack time and visitor time) and one play activity (**“**play on floor time”) were assessed for Mother 2. Mother 2’s average iPAT score across all three activities was 2.33 (Table 4). The same activities were assessed postintervention for Mother 2. Her average iPAT score across all three activities was 8.00.

Mother 3

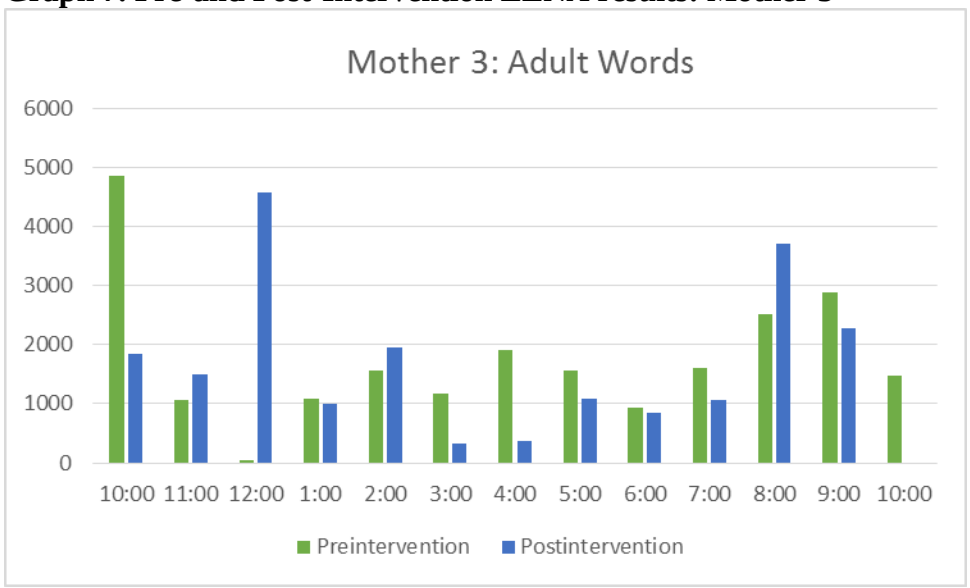
LENA. Rate data show that Mother 3 decreased the number of adult words spoken, conversational turns and child vocalizations from baseline to post-intervention (Table 8). The percent mean difference between adult words spoken at baseline and at post-intervention decreased by 9.3%. The percent mean difference between conversational turns observed at baseline and at post-intervention decreased by 49.7% and child vocalizations decreased by 32.4%.

Table 8. (c)Pre- and Post-Intervention LENA Mean Comparison: Mother 3

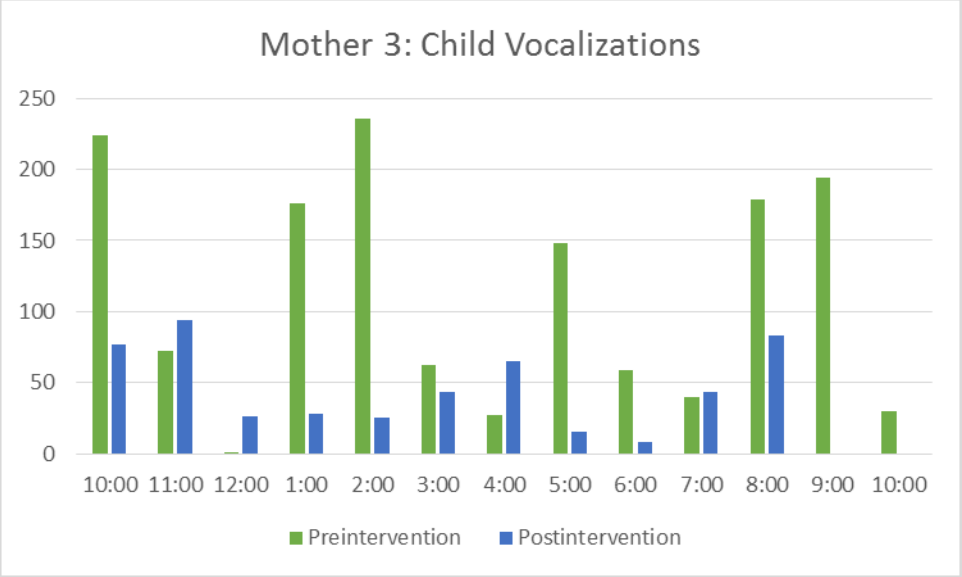
	# hr	AWC Actual	AWC rate per hour (range)	CVC Actual	CVC rate per hour (range)	CT Actual	CT rate per hour (range)
Preintervention	12	22,633	1,886.1 (38-4,862)	1,448	111.4 (1-236)	486	37.4 (0-94)
Postintervention	12	20,528	1,710.6 (334-4,566)	672	56 (8-165)	303	25.25 (5-62)
AWC=Adult Word Count; CVC=Child Vocalizations; CT=Conversational Turns *Rate calculated as total words/total hours recorded							

Figures 7-9 illustrate the difference in number of adult words spoken, conversational turns and child vocalizations observed from the pre-intervention and post-intervention LENA recording days.

Graph 7. Pre-and Post-Intervention LENA results: Mother 3



Graph 8. Pre-and Post-Intervention LENA results: Mother 3



Graph 9. Pre-and Post-Intervention LENA results: Mother 3

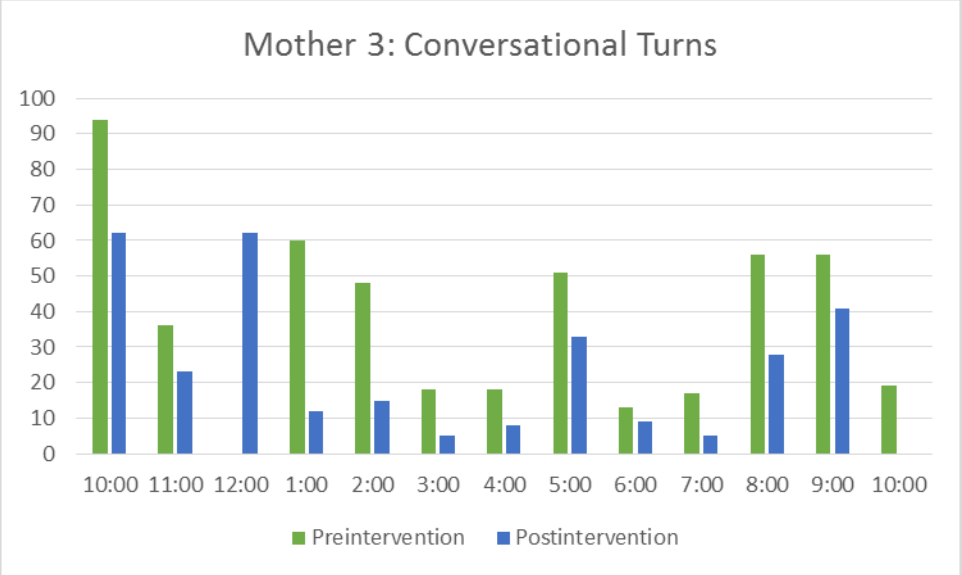


Table 9 displays the pre-intervention LENA data for Mother 3. The infant of Mother 3 wore the LENA device at baseline from 10:00am-10:00pm (total of 12 hours recording time).

Table 9. (c)Pre-Intervention LENA results by hour: Mother 3

Time	AWS	CTC	CV
10am	4862	94	224
11am	1064	36	72
12pm	38	0	1
1pm	1077	60	176
2pm	1561	48	236
3pm	1161	18	62
4pm	1916	18	27
5pm	1552	51	148
6pm	938	13	59
7pm	1597	17	40
8pm	2,511	56	179
9pm	2879	56	194
10pm	1477	19	30
Total:	**22,633**	**486**	**1,448**

The infant wore the LENA device at post-intervention between 10:00:00am and 10pm (total of 12 hours recording time). In that time, Mother 3 spoke a total of 20,528 adult words with 303 conversational turns and 672 child vocalizations (Table 10).

Table 10. (c)Post-Intervention LENA results by hour: Mother 3

Time	AWS	CTC	CV
10am	1,843	62	165
11am	1,498	23	77
12pm	4,566	62	94
1pm	1,007	12	26
2pm	1,948	15	28
3pm	334	5	25
4pm	379	8	43
5pm	1,078	33	65
6pm	840	9	15
7pm	1,065	5	8
8pm	3,698	28	43
9pm	2,272	41	83
10pm			
Total:	**20,528**	**303**	**672**

iPAT

Mother 3 was assessed at baseline in two daily activities (diaper change and snack time) and one play activity ("practice walking"). At baseline, Mother 3 received an average iPAT score across all three activities of 1.00 (Table 4). Mother 3 was assessed on the same three activities at post-intervention and received an average iPAT score across all three activities of 8.00.

Discussion

The purpose of this research was twofold: to quantifiably evaluate the effects of PII on the language environment of families at-risk for child maltreatment and to assess the effect of PII on mother-child vocalizations. Rate data show that maternal utterances for Mother 1 increased from baseline to posttest with adult word count increasing by 13.7%, conversational turns increasing by 4.9% and child vocalizations increasing by 4.6%. Maternal utterances for Mothers 2 and 3 decreased from baseline to posttest. Mother 2 decreased her adult word count rate by 69.9%, her conversational turns by 55.7% and child vocalizations by 54.6%. Mother 3 decreased adult word count rate by 9.3% her conversational turns by 49.7% and child vocalizations by 32.4%. All three mothers increased their iPAT scores significantly from baseline to posttest. There were dramatic increases in Mothers 2 and 3's iPAT scores pretest to posttest. Further, the home visitor observed noticeable improvement for all three mothers as sessions progressed. The ease and consistency to which each mother demonstrated the LoTTs and secondary behaviors increased from session to session. While the increase in iPAT scores across all three mothers supports the effectiveness of the intervention, the LENA posttest data differs. Because this was a pilot evaluation of the quantifiable effect of PII on the

language environment of families at-risk for maltreatment, it is important to consider key observations made by the home visitor throughout the study.

The home visitor observed considerable chaos in all three homes. Evans, Eckenrode, and Marcynyszyn (2010) conceptualize chaos as "crowded, noisy, disorganized, unpredictable settings for child development". Mother 1's home routinely had individuals coming in and out unannounced. The home visitor observed a smell of marijuana at each of the sessions. Further, Mother 1's infant did not follow any semblance of a consistent eating or sleeping schedule. The infant was sometimes asleep when the home visitor arrived and awake at the next session, conducted during the same timeframe as the previous session. Mother 1 reported that some weeks her infant slept at her apartment, and other times at his grandmother's house. The pretest LENA data indicate that the majority of interactions between Mother 1 and her infant occurred in the middle to later parts of the day. The last adult words spoken and child vocalizations were recorded at 11:00pm. It is understandable, then, that Mother 1's chaotic home life may have impacted her ability to appropriately demonstrate the skills learned during implementation in the posttest recording. Perhaps Mother 1 intended to demonstrate the LoTTs bonding behaviors at posttest, but was interrupted by the people coming and going from her home. Without any sleeping or eating schedule in place for her infant, Mother 1 may have not been able to appropriately demonstrate the skills she was taught because her infant was overly fussy due to a lack of sleep or a need to eat. Finally, because Mother 1's posttest recording occurred in the emergency room, it is important to consider whether this seemingly traumatic event with her infant and the unusual environment, may

have impacted her ability to demonstrate all that she had learned throughout implementation.

At baseline, Mother 2 appeared to have a structured, regimented schedule in place for her infant. She proudly displayed a laminated daily schedule to the home visitor at baseline. She regularly took notes during training sessions and asked follow-up questions of the home visitor. She appeared to have a quiet home. As sessions progressed, however, the home visitor observed considerable disorder in her home. On one occasion an adult male was present arguing with Mother 2 when the home visitor arrived. When he left, Mother 2, who appeared visibly shaken by the interaction, disclosed that he was the infant's father and that she had fled him previously due to a domestic violence situation. She reported that he oftentimes came over, unannounced and began interacting with their infant. At session 4, Mother 2 disclosed to the home visitor that she had recently been homeless, she was struggling to keep her home and that she was "desperate for employment". Mother 2's posttest data are particularly troubling. The home visitor observed considerable improvement in the demonstration of the LoTTs and secondary behaviors as each session progressed. It is understandable, however, that Mother 2's ability to demonstrate the behaviors at the posttest recording could have been impacted by the unannounced visit of the infant's father. Further, it is important to consider the likely psychological impact of financial stress on an individual's ability to demonstrate what has been learned. Perhaps Mother 2 was distracted at the posttest recording by her lack of employment and therefore was unable to demonstrate the behaviors at posttest.

Mother 3, as the home visitor observed, experienced both environmental chaos in the home, as well as intrapersonal stress in what appeared to be low-self esteem and

isolation. As mentioned, adult males and females came in and out of her home regularly during training. On one occasion when the home visitor arrived, there was a young man and woman screaming at each other in the front yard. Mother 3 and her infant were standing nearby at the time. Further, Mother 3 often cancelled training sessions at the last minute, citing unexpected visits from the infant's father, illnesses, family issues and transportation problems. Mother 3's intrapersonal chaos appeared in the form of low self-confidence and low self-esteem. She was a young, single mother who did not attend college when she became pregnant. She rarely made eye contact with the home visitor and spoke in quiet, subdued tones. She was visibly uncomfortable talking and practicing the bonding behaviors in the presence of the home visitor. The home visitor inquired whether Mother 3 spent time with other mothers in her neighborhood, to which Mother 3 replied, "she didn't know anyone else who had a baby". As was the case with Mother 1 and 2, it is understandable that the constant interruptions and conflict within the home, may have impacted Mother 1's ability to demonstrate at posttest what was learned during implementation, thus resulting in the LENA recording decline across all three variables.

Evans and English (2002; 2005) documented the positive association between "a chaotic environment" and poor child health outcomes. Dush, Schmeer, and Taylor (2013) examined chaos as a social determinant of child health and questioned whether or not a reciprocal relationship existed. Increasing chaos, both externally and internally, is associated with worse child health outcomes. Further, child development research has documented the association between escalating levels of chaos in the home and the subsequent consequences on child well-being (Bronfenbrenner, 2001). The observed

effect of chaos in each of the mother's home suggests the need for child maltreatment programs to address other socio-economic factors at play.

The iPAT scores for all three mothers increased dramatically from baseline to posttest. Further, the home visitor observed considerable progress in each session for all three mothers. The home visitor observed a consistent change in demeanor among all three mothers from baseline to posttest. Following session 2, Mother 1 appeared more engaged and interested in the training material. She asked questions and provided detailed descriptions of the times in which she was able to practice the LoTTs behaviors at home. Mother 2 originally struggled with the component of the LoTTs behaviors that requires prolonged eye contact with the infant. At sessions 4 and 5, however, she was able to demonstrate the behaviors appropriately and with ease. Finally, Mother 3 demonstrated a dramatic shift in demeanor at session 5. In sessions 1-4, Mother 3 struggled to make eye contact with the home visitor and rarely asked questions or took notes. In session 5, Mother 3 appeared more confident, taking copious notes and asking follow-up questions of the home visitor. The posttest iPAT data support the opinion that all three mothers retained what they had learned during the six training sessions. The posttest LENA data, however, challenges the notion that the intervention was effective with respect to maternal utterances. It is then necessary to consider the impact of chaos on the ability to quantifiably evaluate SafeCare in a real-world setting. Thus, future modifications to the PII curriculum should consider enhancing the language component of the module. Currently, the iPAT globally measures talking in conjunction with the other three primary bonding behaviors. The LENA data from the present research suggest

that more focus should be paid to enhancing language between mothers and infants who are at-risk for child maltreatment.

While there was certainly observed and experienced chaos in almost all of the training sessions, the environment was still relatively controlled. The mother was positioned in front of the home visitor and although chaos occurred around her, when she was asked to demonstrate the PII skills, she was able to do so. Comparatively, when she utilized the LENA device for the posttest recording, she was doing so in her real-world setting, one with seemingly uncontrolled chaos. While Mother 1 was able to implement an age-appropriate schedule for her infant at posttest, her adult word count, conversational turns and child vocalizations only increased minimally. Further, following retrieval of the LENA device at posttest, Mother 1 disclosed to the home visitor that they had been in the emergency room that afternoon because her infant "slammed his finger in the car door". Mother 2's inability to adequately record posttest data is indicative of her chaotic life. Upon returning the device following the posttest recording, Mother 2 told the home visitor that her day had been "a disaster". She cited issues with her children and the infant's father as to reasons why she could not correctly use the LENA device. Her posttest data are further reflective of her chaotic home life: her verbal interactions with her infant and sporadic and unpredictable. Finally, while Mother 3's iPAT score increased considerably from baseline to posttest, her substantial decrease in adult word count, conversational turns and child vocalizations from baseline to posttest suggests both the impact of external chaos as well as her lack of confidence in demonstrating the behaviors in a real-world setting.

Limitations

The present research was limited in several ways. The small sample size limits the potential generalizability of the results. Future research examining the effects of PII on the language environment of families at-risk for maltreatment should consider expanding the study to include additional mother-infant dyads. Further, because there was no control group and no randomization as to which mother-infant dyads received PII, it is difficult to draw conclusions about the effectiveness of the intervention based on the sample. The home visitor observed that all three mothers were relatively uncomfortable discussing the ways in which they interacted and cared for their infant. Because of the sensitivity of the topic, it is important to consider the effect to which the mothers may have withheld information or been reluctant to fully engage with the home visitor during the six-weeks of implementation. Additionally, it is necessary to consider the impact of a physical device being present and secured on the infant at both baseline and posttest. While the device was not obtrusive, each of the three mothers were aware that they were being audio-recorded, and thus may have behaved atypically. Finally, the element of chaos observed in all three mother-infant dyads may have had a detrimental effect on appropriate utilization of the LENA recording device. Mother 2 disclosed that she could not record correctly at posttest because the chaos of her day interrupted her ability to monitor whether or not the device had been turned on. Future research that utilizes the LENA device with a similar population, should consider the impact of chaos and unpredictability on the participant's ability to operate the instrument. The two measures utilized in this research (iPAT and LENA) produced contradictory results. While it appears that the iPAT and the LENA device may not be appropriate to pair in evaluating the effects of PII, if the potential effects of chaos on the data are recognized, the LENA

device may prove a complimentary measure to the iPAT. In the present research, chaos affected not only the mothers' ability to appropriately record data, but it also impacted the audio-recorded data. Thus, future research aimed at evaluating the effects of PII by utilizing the iPAT and the LENA device should consider the following: providing participants with an instruction manual and a detailed protocol for operating the LENA device may prove effective in increasing their ability to adequately record pre-and posttest data. Second, future research aimed at quantifiably evaluating the effects of PII on maternal utterances, should consider recording several days worth of data at pre- and posttest, therefore nullifying the effects of one chaotic day, and therefore perhaps "stabilizing" the data.

Conclusion

SafeCare has been effective in preventing instances of child maltreatment and reducing recidivism rates among previous perpetrators. Implementation of PII increased all three mother's ability to demonstrate the LoTTs and secondary bonding behaviors typical of the SafeCare curriculum. However, the LENA data suggest that when evaluating the impact of an intervention such as SafeCare among families who are at-risk for maltreatment, it is necessary to consider the impact of chaos on the findings.

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