Influence of Maternal Age on Infant Home Language Environment

by

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Abstract

The present study examined the influence of maternal age on infant home language environment, focusing on the environments of children born to young mothers using a naturalistic, comprehensive data collection technique. Our sample consisted of 30 mother-child pairs, between the ages of 15 and 21 years old. The current study used the LENA (LENA Research Foundation, 2011) digital processor and software to record and analyze recordings from each parent. Child language development and maternal knowledge of infant development were analyzed. We found that our sample of young mothers knows less about general infant knowledge compared to a normative general sample. We also found that our young mother sample performed similarly to a low SES sample of mothers on general infant development knowledge. Our results may provide support for the connection between knowledge of infant development in mothers leading to positive results in the form of language skills in their child.

Keywords: adolescent mother, infant, language environment, language development

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Influence of Maternal Age on Infant Home Language Environment

The philosopher, Ludwig Wittgenstein, once said, "The limits of my language are the limits of my world" (1918). A key aspect of ideal parenting involves aiding in the development of a child's language. A healthy language environment for an infant includes a large frequency of language input and interactions (Diessel, 2007). Maternal age may also influence the quality of language a child receives (Chase-Landsdale, Brooks-Gunn, & Paikoff, 1991; Culp, Osofsky, & O-Brien, 1996; Culp, Applebaum, Osofsky, & Levy, 1988). The purpose of this study was to explore the effects of maternal age on infant language development through the use of home language recordings. This research project explored the language and development of infants born to young mothers using new technology. This new technology allowed for a full day of the infant's language environment to be captured using the LENA device and software called Language ENvironment Analysis (LENA; LENA Research Foundation, 2011). I examined the influence of maternal age on amount of adult words spoken, child language development, and general knowledge of infant development, while also comparing our sample of Winnipeg mothers to other relevant normative samples. The findings from the current study will be used to inform research and intervention communities on our young mother sample, in respect to language development and knowledge of infant development.

Adolescent Pregnancy

In 2011, in Canada, there were 13,535 live births to mothers under the age of 20 years old (adolescent mothers; Statistics Canada, 2013); birth rates in Canada in 2010 were 13.5 per 1,000 of adolescents aged 15-19 years old. However, birth rates in Manitoba specifically in 2010 were 29.6 per 1,000 of adolescents aged 15-19 years old; rates in Manitoba are more than double that of the Canadian average (Statistics Canada, 2010). Also notable, Manitoba saw its teen

pregnancy rate increase by 15% or more from the years 2006 to 2010, whereas the national rates declined 20.3% from 2001 to 2010 (Statistics Canada, 2010). In both rural and urban environments in Manitoba, teen pregnancy rates increase as socioeconomic status (SES) decreases (Brownell et al., 2012). In 2006, in Canada, 8% of Aboriginal teenage girls were mothers. "In Manitoba, the fertility rate during the 2000 to 2004 period for teenage Status Indian women was 125 births per 1,000 women, the highest of all the provinces" (Statistics Canada, 2014). In other words, 12.5% of Aboriginal teenage girls became pregnant. These findings highlight an at-risk population in need of research and understanding, and, more specifically, a Manitoba population of adolescent mothers entering parenthood and raising children.

Influence of Maternal Characteristics on Child Development

Many maternal characteristics impact quality of child development and importantly, language development. McDonald, Webster, Knight, and Comino (2014) found that low SES, being a single parent, and being a mother at a young age negatively impacted development, resulting in slower development among urban Aboriginal children. These researchers recruited 159 Aboriginal infants through a maternity ward at a local hospital, who were assessed at 1 year of age and 3 years of age; the infant's birth hospital records were also examined. The Griffiths Mental Development Scales- Extended Revised was used to test infant development, including language (receptive and expressive language); additionally, the Peabody Picture Vocabulary Test was administered to test receptive language. When examining the children at 3 years of age, all of the children were within the range of normal development for their age. However, the children who came from families with risk factors (low SES, single parenthood, young mother) were significantly lower in developmental scores (including the measures of language) than children who came from families without these risk factors. Adolescent mothers are expected to be at a

greater risk for a number of vulnerabilities including life stressors (involving single parenthood, and less parenting knowledge), behavioural and psychological concerns, and SES levels.

When looking at the adolescent mother population specifically, unique characteristics emerge. Children born to adolescent mothers are more likely to become single mothers themselves (Bennett, Bloom, & Miller, 1995) and have an increased number of stressful life events (Coley & Chase-Lansdale, 1998) when compared to adult mothers. Parenting by adolescent mothers is more difficult due to the increased likelihood of poor support networks (Cowan & Cowan, 1992) and lower levels of social support than what is available to adult mothers (Culp, Culp, Blankemeyer, & Passmark, 1998). Additionally, adolescent mothers are faced with dealing with the regular teen-stressors, while also adding on the additional pregnancy, and parenting stressors (Elster, McAnarney, & Lamb, 1983). Adolescent mothers are more likely to have behavioural and emotional problems than adult mothers (Owen-Jones et al., 2013). Additionally, adolescent mothers are more likely to be depressed, have lower levels of cognitive abilities, and abuse substances than adult mothers (Camp, 1995; Hodgkinson, Beers, Southammakosane, & Lewin, 2014). Research on personality characteristics has found that adolescent mothers are more likely to have authoritarian attitudes (Camp, 1995) and low social skills when compared to adult mothers (Hix, 1998). These factors are likely to impact the quality of parenting an adolescent mother provides.

In regards to parenting, adolescent mothers know less about infant development, and understand less about child and parental roles than adult mothers (Culp, et al., 1998). Adolescent mothers are also more likely to have idealistic expectations of their children and view their children as difficult (Brooks-Gunn & Chase-Lansdale, 1995), temperamental (Field, Widmayer, Stringer, & Ignatoff, 1980), and greedy (Zuckerman, Winesmore, & Alpert, 1979), when

compared with adult mothers. These findings indicate a number of central concerns with teen parenting; more concerns emerge when examining the SES environments that infants of adolescent mothers may grow up in.

Effect of Maternal Socioeconomic-Status on Language Development

Adolescent mothers are more likely to raise their children in low socioeconomic status (SES) environments, and have a higher likelihood of being raised in low socioeconomic environment themselves (Brooks-Gunn & Chase-Lansdale, 1995; McKay, 2012). These young mothers have lower income, and are more likely to be on welfare (Klerman, 1991; Moore et al., 1993). The older the mother is when she has children, the more likely she is to be of a higher SES (Lewin, Mitchell, & Ronzio 2013). The home language environment, and child language development are impacted by notable factors related to being raised by an adolescent mother, including income, but also another key SES variable, education (Burgess, 2004; Leseman & de Jong, 1998).

SES has a well-documented role in the nature of an infants' language environment impacting the quality and quantity of language input (Hoff, 2003). Low family SES influences the home environment, and is associated with less than ideal home environments, which lead to inequalities in child development (Sarsour et al., 2011). Children raised in higher SES homes have significantly more words spoken to them (Hart & Risley, 1989, 1995). In fact, when looking at speech heard by infants during one-on-one interactions with mothers, mothers who were on welfare spoke at an average rate of 500 words per hour, while mothers who were high-SES professionals spoke at an average rate of 3,000 words per hour (Hart & Risley, 1995). The authors estimated that the children born to high-SES families heard 33 million words by the age of three, while the children born to the low-SES families heard 9 million words by the same age

(Hard & Risley, 1995; Warren & Walker, 2005). This important discovery by Hart and Risley has led to, and influenced, further research on maternal SES and child language development.

Huttenlocher and colleagues (2010) found a direct link between SES and language growth with lower SES resulting in less language growth. It has been argued that low SES mothers may have less leisure time, and an increased amount of stress, when compared to high SES mothers (Snow, Dubber, de Blauw, 1982), which may contribute to an infant's development. Low SES mothers use more directive language when talking to their infants, spend less time engaging in mutual play with their infants, talk less frequently to their infants, and direct less questions to their infants (Heath, 1983). Low SES mothers also use 'empty language' which is not specific enough to promote an increase in vocabulary, such as 'this' or 'that' (Landry, Smith, & Swank, 2002). When comparing vocabulary quantity, children from low SES families have smaller vocabularies than children from high SES families (Hart & Risley, 1995; Hoff-Ginsberg, 1998). Research from a variety of places around the world has shown the negative impact on child development (including language development) that SES is capable of playing (Australian Bureau of Statistics, 2008; McLoyd, 1998; Najman, Bor, Morrison, Andersen, & Williams, 1992). Consequently, low SES environments are tied to less than optimal child language development.

A recent, influential study by Noble and colleagues (2015) has shown that socioeconomic discrepancies are not only associated with differences in cognitive development, but also with brain structure, with those individuals of lower SES environments being most affected. The differences in brain structure for low SES children and adolescents were most noticeable in a number of learning areas of the brain, including language areas. This study shows that growing up in a low SES environment is related to brain growth and development.

Maternal & child education. Adolescent mothers, when compared to adult mothers, are less educated (Moore & Waite, 1977) and struggle educationally (Owen-Jones, et al., 2013). Adolescent mothers have been shown to offer fewer literacy experiences to their children, when compared to their adult counterparts (Burgess, 2005). The education and language usage of a mother profoundly influence their children's language skills and future academic successes (Dickinson, 2001; Hart & Risley, 1995; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002). When looking at the education of mothers influencing language environment, Greenwood and colleagues (2011) set out to replicate and build on the findings from Hart and Risley's influential studies. These authors, instead of using observation and transcription of language data, used automatic speech processing. Greenwood and colleagues completed a study to further explore and build on the findings of Hart and Risley using 12-hour audio recordings. Their sample consisted of 30 infants and their families, from middle to high SES environments. The authors found many similarities to Hart and Risley's original findings, including a wide variety of home language environments, with immense differences on adult-word count, child vocalization, and conversational turns (vocalization exchanges between child and another individual). The authors found that highly educated mothers spoke 514.8 words more per day to their children when compared with mothers who had lower levels of education. These mothers were also more responsive, and engaged in 47.6 more conversational turns when compared with lower educated mothers. The children of highly educated mothers knew an average of 161 more words than the children of lower educated mothers. In regards to early language development, maternal education is considered the most influential SES factor (Westerlund & Lagerberg, 2008).

It has been hypothesized that low education is responsible for fewer literacy experiences of children born to adolescent mothers (Oxford & Spieker, 2006). Oxford and Spieker (2006)

found that preschool aged children, who had adolescent mothers with low verbal capabilities, were more likely to live in a less than ideal language environment and have lower levels of language development. Therefore, with the increased likelihood of an adolescent mother having lower education, their children's language development may suffer, which may influence their children's academic abilities as well. Oxford & Spieker (2006) used the longitudinal study method to research adolescent mothers and their child's preschool language development. They were interested in determining risk factors in the mother that would lead to poorer language development at the preschool level for the adolescent mother's child. They found that a mother of low verbal ability intensified the likelihood of a poor home language environment. Less than ideal home language environments impact language development, but also academic performance.

Characteristics related to education found in the adolescent mother population result in additional stressors for the child and mother. It has been found that adolescent mothers have children who are more likely to fail grades when they grow up to be adolescents themselves (Grogger, 1997). Also notable, adolescent mothers have been shown to underestimate the cognitive levels of their children, and therefore do not provide enough stimulation for their child's developmental level (Epstein, 1980). Relatedly, high maternal age is associated with frequent reading (Westerlund & Lagerberg, 2007), with children of older mothers engaging in more frequent reading. Also, maternal age has been shown to influence school performance of first graders, with children with younger mothers having an increased likelihood of failing a first grade competency test (Williams et al., 2013). These factors are likely the consequence of adolescent mothers entering parenthood with less developed parenting skills, having a more negative view on parenting, and inaccurate knowledge on child development, when compared to

adult mothers (Roosa & Vaughan, 1984). These characteristics are also likely to place additional stress on adolescent mothers above the regular stressors that come with parenting.

Effect of Maternal Speech on Language Development

Relevant research argues that maternal speech is the most influential form of speech for an infant's language environment (Soderstrom, 2007). Since the mother is conventionally the primary caregiver, specifically the mother's language skills impact the child and their child's language abilities (Gilkerson & Richards, 2007, 2008; Oxford & Spieker, 2006). Additionally, it has been suggested that syntactic development is largely influenced by caregiver speech (Bybee, 1998; Huttenlocher, Vasilyeva, Cymerman, & Levine, 2002; Saffran, 2001). When looking at how a mother linguistically interacts with her child, important themes emerge which influence child language, including a focus on what the child is engaged in, the mother asking the child questions, and the mother responding to the child's vocalizations (Hoff-Ginsberg, 1986; Tomasello, Mannle, & Kruger, 1986), all which are supportive of language development. Language interactions between mother and child are therefore extremely important in the development of language for the child (Hard & Risley, 1995). Findings from previous research, focusing on maternal age, have found that adolescent mothers have lower instances of verbal interactions and overall responsiveness when compared with adult mothers (Chase-Landsdale, Brooks-Gunn, & Paikoff, 1991; Culp, Osofsky, & O-Brien, 1996).

Lacroix, Pomerleau, and Malcuit (2002) completed a longitudinal study that examined the influence of maternal speech on child cognitive and language development. Using 125 mother-child dyads, the mothers were split into three groups: adolescent mothers (32 participants) adult mothers of low-SES (54 participants), and adult mothers of middle-SES (39 participants). The mothers were invited into the laboratory where they engaged in free play with

their child while being observed (at 18, 30, and 36 months of age for the child). The authors found that adolescent mothers, and adult mothers of low-SES used language involving control and direction when engaging in play with their child, while the adult mothers of middle-SES used more questions and information with their child. Also notable, the middle-SES children had higher scores on development, both overall cognitive and language, and maternal utterances accounted for 45% of the variance on the child's developmental scores.

An earlier longitudinal study by Culp and colleagues in 1988, compared 130 adolescent mothers to 86 married first time mothers. Adolescent mothers were shown to be less verbal, and showed less sensitivity and responsiveness when interacting with their infants (Culp et al., 1988). Culp and colleagues (1996) found that children of adolescent mothers vocalized less when compared to children of low SES adult mothers. Chase-Lansdale and colleagues (1996) compared adolescent and adult mothers and their infant's language environment using coded transcripts of the natural language environments. Importantly, the two groups were similar on SES and ethnicity, with maternal age being the key differentiating variable. Other notable findings from this study include infants of adolescent mothers vocalizing less, when compared with infants of adult mothers, and adolescent mothers engaging in more command utterances when compared to adult mothers.

Much of the older research on the impact of maternal age, and being raised by an adolescent mother, has focused on the first year of the child's life when they are most likely preverbal (Barratt Stevenson, & Roach, 1995; Culp, Appelbaum, Osofsky, & Levy, 1988; Culp, Culp, Osofsky, & Osofsky, 1991; Garcia Coll, Hoffman, & Oh, 1987; Levine, Garcia Coll, & Oh, 1985) and found that adolescent mothers provide less verbal stimulation, are less responsive, and less involved when interacting with their infants, than adult mothers. Notably, most of the

research in this area is quite dated, and more up to date, current research on the language development of infants born to adolescent mothers is needed. Specifically, new methods of examining language environments have been developed, including the tools used in the current research study. There is also a need for research to examine different cultures and ethnicities. Additionally, new interventions and further understanding on the components of language that are important for language development, including those discussed below, need to be tested.

Components of Language that Impact Language Development

It is important to consider what makes an ideal language environment for infant language development. An essential aspect of a child's language environment is the amount of speech heard by an infant. What infants are hearing, in the first three years of life, plays a crucial role in an infant's linguistic understanding and development (Hart & Risley, 1995). Mothers are typically the primary caregivers and therefore maternal speech, is of high importance in the language development process. What is of most importance, is to capture what a typical day regarding language input looks like for a child in order to gain a comprehensive understanding of what a child is hearing, instead of a snapshot of for example a one-hour period.

Infants overhear a great deal of speech in their everyday environments and this may also influence development (Oshima-Takane, 1988; van de Weijer, 2002), making it essential to look at an infant's total language environment. Therefore, by examining the total language environment of infants and young children raised by adolescent mothers, we can better understand how much exposure these children have with different forms of language input. Importantly, the amount of talk a child receives from their caregiver is directly linked to child vocalization (words, babbles, squeaks, etc.), conversational turns (vocalization exchanges

between child and another individual), vocabulary quantity, language learning (Hart & Risley, 1989, 1995), and preparedness for the school environment (Duncan et al., 2007).

As mentioned earlier, the significance of frequency of language has been researched extensively and has shown to be an important indicator of language development. Higher language frequencies are ideal when a child is learning a language (Diessel, 2007; Huttenlocher, Haight, Bryk, Seltzer, & Lyons, 1991). Importantly, the amount of talk a child receives early on influences language outcomes at 3 and 9 years old (Hart & Risley, 1995). Huttenlocher and colleagues (1991) observed children and their mothers during regular daily activities, and audio recorded or videotaped the sessions, in order to examine the role that exposure to language has on a child's language development. These researchers found that the child's vocabulary acquisition and variety was related to the amount of speech the mother spoke to their children during these sessions, indicating the mother's input has a direct effect on child language outcome.

Clarke-Stewart (1973), using a longitudinal study method, discovered that there is a large amount of variation in the quantity of language spoken to children (between 4-75% of the child's wake time). The researchers examined mother-child pairs and their relationships over a 9-month period, including language development, using both observation and audio-recordings of the natural environments for a total of 1.5 hours a day for seven observation visits. The differences in the amount of language the mothers provided influenced both quantity of vocabulary and syntactic development in the children.

Pan and colleagues (2005) examined 108 low-income families using individual growth modeling to measure the growth in vocabulary for each child (between ages 1 and 3). The amounts of speech, and vocabulary variation spoken by the mother were shown to impact lexical

development in the child. Another study similar with those mentioned previously, by Gilkerson and Richards (2007) used the same recording device and software used in the present study, where children who were spoken to more frequently showed superior language development. Frequency of language is important in the development of linguistic structure and language usage (Diessel, 2007) influencing development, understanding, and construction of linguistic categories and rules (Bod, Hay, & Jannedy, 2003). Therefore, it is crucial to examine the environments where a child is exposed to the majority of this language frequency: the home language environment.

Effects of the Home Language Environment on Language Development

According to Bronfenbrenner's Ecological Model (Niederer et al., 2009), the family is positioned in the innermost system, the microsystem, therefore having a direct impact on the child and the child's development (Wasik & Herrmann, 2004). The home environment has been theorized as affecting all aspects of life, including society as a whole (Noddings, 2002); therefore, if healthy, encouraging, nurturing home environments are provided, this will in turn benefit all aspects of life. Research has shown that the home environment is an important aspect of language development and literacy skills in young children (Dickinson & Tabors, 1991). Dickinson and Tabors' study included 74 low income children who were followed from age three until the end of kindergarten, both home and school environments were included in their analyses. A variety of assessment techniques were used in the author's conclusions regarding language and literacy development, and highlighted the importance of the home environment in developing literacy skills. The National Institute of Child Health and Human Development (2006) found that family characteristics, over childcare experiences, had the greatest weight on a child's development. This study also found that the mother-child interactions, and the quality of

these interactions, were very predictive of a child's development. Qualities in the mother that were important in predicting ideal child outcomes included attentiveness, sensitivity, responsiveness, and cognitive stimulation.

Other key factors that contribute to the quality of home environment include single-parenthood, SES, and maternal age. The difficulties faced by single-parent households on the children's development, with findings highlighting the lack of material resources needed to deepen development, and not enough time to dedicate to the child (Sarsour et al., 2011). Past research has shown that a negative impact is found on language development for children raised in a disadvantaged home (e.g., Baron, 2011). Researchers have found the home environment to be important for early educational experiences that lead to future success, including literacy development (Burgess, Hecht, & Lonigan, 2002). Therefore the home environment has been shown to impact a number of facets of a child's life.

A recent study by Lewin and colleagues in 2013 used the Early Childhood Longitudinal Study-Birth cohort data set to examine parenting differences between adolescent and adult mothers (total sample of about 9,250 participants). Findings from videotaped mother-child interactions showed that adolescent mothers were less supportive and sensitive towards their children when compared with adult mothers; their findings also suggested that differences in parenting could not be attributed to SES alone, and that age is also important.

As mentioned above, an article by Burgess (2006) found, that adolescent mothers provide a more disadvantaged home language environment, through surveying 493 mothers, of which 22% were adolescent mothers. He hypothesized that these findings were at least partially due to low levels of motivation, and a lack of understanding of parenting, resources, and income (Burgess, 2006). Adolescent mothers are also more likely to come from disadvantaged backgrounds

themselves (Cowan & Cowan, 1992). A study by Deutscher and colleagues (2006) implemented a maternal-focused intervention, focused on adolescent mother-child dyads, and videotaped maternal behaviours for the intervention (48 participants) and control (46 participants) groups. A main goal was to aid the adolescent mothers in reading and responding to their child's cues in a developmentally appropriate and facilitative way. The mothers in the intervention group were much more likely to assist their child's language development, were more responsive, and less directive. The children in the intervention group performed better developmentally. This study exemplifies the ability of early intervention and instruction in positively adapting adolescent maternal behaviours and actions to improve their child's development. Most notably, these studies by Deutscher and colleagues (2006) and Lewin and colleagues (2013) show that the home environment may be less advantageous for children of adolescent mothers but also that this group is receptive to intervention.

Child Influence on Language Development

Research has shown that essential linguistic development takes place much before an infant is speaking their first few words, earlier than 6 months of age (Werker & Desjardins, 1995). The importance of maternal SES and education on a child's development, including language development, increases as the child's age increases (Berglund, Eriksson, & Westerlund, 2005). Notably, Hart and Risley (1995) found that a child's language style replicated their parents by the age of 3; the language style included amount/frequency of speech, and number of prohibitions vs. affirmations, to mention two examples. These studies indicate the importance of early child research and intervention.

The noted vulnerability of infants born to adolescent mothers reveals a population in need of research and this population needs to be shown useful interventions. The above literature

review highlights the many ways that adolescent mothers, their characteristics, speech, and SES, are capable of negatively influencing their children's language environment and development.

Significance of Current Study

What a child learns and is taught in the initial years of life have a direct influence on how they will continue to navigate and learn through the remainder of their lives (Baron, 2011). Most important are the first three years of a child's life (Golinkoff & Hirsh-Pasek, 2000) when babies have been labeled "the most powerful learning machine in the universe" (Gopnik, Meltzoff, & Kuhl, 1999, p. 1). It has been shown that early education and intervention can aid in the development of the language system, resulting in a child rapidly picking up new language skills (Thal, Bates, Zappia, & Oroz, 1996). Notably, the language environment, including amount of talk to a child, is something that is alterable, and can lead to improvements in children's knowledge of vocabulary, their language learning abilities, and school preparedness (Hard & Risley, 2003). The verbal language a child hears, the communication style, can mediate the effects of SES (Hoff & Tian, 2005), which bodes well for the potential effectiveness of language development strategies helping the mothers.

In the past, time and resources have limited the study of language environments in the homes of mothers and their children. This research has required numerous assistants, expensive transcription work, and arduous allotments of time. It involved researchers observing participant language environments in person, invalidating the naturalistic environment, or videotapes/recordings being examined and hand coded. Recent technology has allowed for much easier data collection on language input in home environments. Recording devices, along with simple instructions to the mothers, can now be used to unobtrusively gather language information for long periods of time without the presence of observers. These recordings can

then be automatically sorted using software programs to pull out key language variables. Therefore, the feasibility and ecological validity of early language environment research has seen significant progress and advancement. Our research is taking full advantage of these advancements in order to capture a realistic full day of a child's language environment, unlike much research done before.

A second constraint on our understanding of infant language development has been the focus on its relationship with SES; there is less research on the potential impact of maternal age on language development in children. There is still limited research to support whether the difficulties faced by infants of young mothers are solely due to SES discrepancies or are affected independently by the age of the mother. Subsequently, children who are born to mothers of a young age, regardless of SES, may require extra attention when it comes to infant development, including language development.

Additionally, because previous research has found support for adolescent mothers providing a less advantageous home environment, and that this is a group that is receptive to intervention, an opportunity to explore ways to help this population, including their children, is needed.

There is a need to better understand an infant's total language environment with their mother, from start of the day to finish, including the home environment, travel, outside environments, and so on, to fully understand the different types and amounts of language input the child is receiving on a daily basis (Soderstrom, 2007). The technology advances allow for this complete language environment to be captured. Do adolescent mothers speak less to their children? Maternal age may influence the quality of language environment a child receives. Very little research has been done focusing on the total language environment of children born to

adolescent mothers compared to children born to adult mothers. Therefore, there is an imperative need for research on the young mother population in order to start exploring this vulnerable population.

Purpose Statement

The purpose of this study is to determine if the age of the mother, while focusing on a young mother group, influences the language environment and development of their child, and if so, what accounts for that difference. The questions with which this study aimed to answer are:

1. Does maternal age influence the amount of adult words spoken to their child?
2. Does maternal age influence child language development?
3. Does maternal age influence general knowledge of infant development?:
    a. How does our sample compare to a normative sample of mothers?
    b. How does our sample compare to a low SES sample of mothers?
    c. How does our sample compare to a teen mother sample?
4. Does knowledge of infant development influence child language development?

Hypotheses

Hypothesis 1: Maternal age will influence the amount of adult words spoken to their child. As maternal age increases, the number of adult words will increase.

Hypothesis 2: Maternal age will influence child language development. As maternal age increases, reported child language development, and an automated measure of child language development, will increase.

Hypothesis 3: Maternal age will influence knowledge of infant development. As maternal age increases, reported knowledge of infant development will increase.

Hypothesis 3a: Our young mother sample will be less knowledgeable on infant development compared with a normative sample of mothers.

Hypothesis 3b: Our young mother sample will be similar to a low SES sample of mothers on knowledge of infant development.

Hypothesis 3c: Our young mother sample will be similar to a teen mother sample on knowledge of infant development.

Hypothesis 4: A mother's knowledge of infant development will influence child language development.

Methods

Research Design

An observational research design was used for the current study, since this is the standard best practice for gathering information on individuals engaging in their daily lives. The majority of our data collection took place in the naturalistic home environment, and the variables looked at in our study were set before the commencement of the study. The research design that was used for this study is the Casual-Comparative approach (Creswell, 2014), as we compared two groups in terms of a cause (independent variable) that has already happened. The goal was to determine whether the independent variable (maternal age) affects the dependent variables. Therefore, we aimed to determine whether there is a relationship between maternal age and child language environments/development and maternal general infant knowledge.

The independent variable, maternal age was calculated from two dates, the mother's birthdate when she gave birth and when she enrolled in the study; these are continuous variables. The youngest age in our sample for maternal age was 15 years old and the oldest age in our sample was 21 years old.

The dependent variables of language are composed of: LENA recording data (this will be discussed in detail later), and the child's reported and estimated language development. The dependent variable for knowledge of infant development is questionnaire scores.

The recordings included estimates of adult speech based on a proprietary algorithm, labeled adult word count. *Adult word count* is the frequency of language spoken by adults (number of words within a given period of time). It is important to note the data on adult word count is limited by the validity of the estimates provided through LENA's algorithm (reliability of LENA is discussed below). The child's language development reported score was obtained through the MacArthur-Bates Communicative Development Inventory (CDI; Fenson, 1993) and estimated score was obtained through the LENA system. Infant development knowledge was obtained through the Knowledge of Infant Development Inventory (KIDI; MacPhee, 1981).

Participants

This research project involved the recruitment of 30 English speaking mothers and their children ($N = 15$ for main study, $N = 15$ for the mini study, details to follow). Mothers were selected over fathers because it has been shown that adult females provide the majority of language heard by a child in a day, and are also more likely to spend their day with their child (Greenwood et al., 2011); this is particularly true for the adolescent parent population (Daryanani, Hamilton, Abramson, & Alloy, 2016). The sampling design is single stage; the sampling methodology planned is non-probability sampling (Creswell, 2014). The sampling procedure planned is convenience sampling, as families will volunteer to participate in the study (Gravetter & Wallnau, 2009). These families must have had a typically developing child (defined by no known hearing impairments, or disorders in development, language, or speech), who were between 0 and 24 months old at the time of study enrollment. Age of child was set at 24 months

or younger, this was not a more specific age group as it may have significantly reduced the number of mothers reachable who were interested in participating.

The mother must have been 25 years of age or younger at the time they gave birth (Baron, 2011), be able to provide informed consent (18 years old or older) or assent (17 years old or younger), as appropriate, for themselves and their infant (consent from a legal guardian was also collected if assent was obtained from mother, assent from the infant is also needed, assessed based on their willingness to wear the device), and be home with their child for at least two days of the week.

Recruitment

A variety of recruitment strategies were employed, including postings in local high schools, community centres, doctor's offices, and universities. Ethics approval was also obtained through River East Transcona School Division and the Winnipeg School Division in addition to the approval through the University of Manitoba's Psychology-Sociology Research Ethics Board. The study team members contacted local organizations that have regular contact with the adolescent mother demographic including parenting, health, family, and child organizations. The primary researcher gave short 10-20 minute talks at five local organizations. Recruitment materials, including our pamphlet and brochure, were dropped off at 12 additional local organizations. A Winnipeg high school specializing in educating young mothers was a paramount component of recruitment. A number of local high schools not specializing in adolescent mother education were also contacted during the recruitment process, however there was a lack of adolescent mothers enrolled at these schools.

Interested participants were given a brochure and asked to contact the research laboratory directly (via phone or email) to discuss possible participation, or they gave the research team

member their contact information at the time of initial contact, with permission for a research assistant to contact them to discuss the study in more detail, and if interested, set up enrollment in the study. Care was taken to keep recruitment organizations uninformed of which mothers were participating in the study.

This study involved vulnerable participants, as we recruited mothers aged 19 and under, and infants/young children aged 0-24 months were child participants. Having the researchers of this study aware of and mindful of these participant characteristics was important for recruitment and interactions throughout the study.

Anonymity & Confidentiality

The study team was educated on not revealing the identities of individuals who may be recorded during the study. The participants likely used names and other identifying information during the course of every day conversation, and it would not be possible to remove this information from the recordings themselves. However, pseudonyms for names and other identifying information will be used outside the laboratory setting and in any publications if specific utterances are referenced, and such references will be limited to short segments. During the recording, participants had the option to temporarily pause the device at any time if they wished to keep something private from the research team. Participants were also able to request that any recording be deleted at any point during their enrollment, however this did not occur.

Instrumentation & Materials

Demographic Questionnaire. The mothers were asked to complete a short demographic questionnaire (see Appendix A) regarding mother, child, and family, in order for the researchers to learn more about the study sample. The demographic questionnaire includes queries on date of birth, education, income, siblings, and adult members in household, childcare arrangements,

child background (birth, hearing delays, language and cognitive developmental delays, other notable physical characteristics), language background, and ethnicity. This personal information sheet was created by the Baby Language Lab at the University of Manitoba, and adapted for this study.

LENA Digital Language Processor. The audio recording device that was used in this study is the Language Environment Analysis DLP (LENA DLP; LENA Research Foundation, 2011). This device fits unobtrusively in specially designed clothing that the child wore during recording times. The DLP weighs 2 ounces and is able to record up to 16 hours of audio. The LENA computer software also processes the audio recordings from the DLP to provide reports of the audio recording, and data that can then be directly analyzed. The LENA system allows for a large amount of data to be collected with limited resources. The recordings collected from the device were analyzed and categorized. The LENA system also provides a basic report of a participant's language environment including adult speech and estimated language development level. Interactions such as other family members being present during recording times are welcome, as this is part of the child's natural language environment, which is what our research project aimed to capture. The LENA recording device is also capable of differentiating between male and female speakers, however because the accuracy of the software is not as high in this component, the data were not divided by gender.

Recent reports support the abilities of LENA described above, finding it an accurate estimate of language environments (Caskey & Vohr, 2013; Oller et al., 2010). The LENA system has been tested for validity and reliability a number of times, and has been compared to the work of transcriptions. The convergence agreement has been reported between 71-82% for adult, and child speech (Gilkerson, Coulter, & Richards, 2008; Xu, Yapanel, & Gray, 2009). More recent

research has found that the LENA software works best when estimating female adult speech (Soderstrom & Franz, 2016). Consistent with LENA's own technical reports, Soderstrom and Franz (2016) also found that when comparing LENA estimations to transcriptions in home environments, adult word count was found to be have a correlation of $r > .9$, $p < .001$, indicating a large positive relationship between the two.

MacArthur-Bates Communicative Development Inventory. This is a self-report assessment the mothers filled out on their child. The MacArthur-Bates CDI (Fenson, 1993) evaluates language and communication proficiencies in infants and young children, and was designed specifically for testing linguistic abilities of this challenging age range. The self-report measure includes two inventories, one for children aged 8-18 months (CDI: Words and Gestures) and one for children aged 16-30 months (CDI: Words and Sentences).

The test was designed to ask questions related to emerging and observed language in a recognition format in order to gather a more accurate report from parents. The information from the MacArthur-Bates CDI is desirable as children may be distracted, tired, etc. during other language development assessment forms. Moderately high reports of concurrent validity have been reported for the MacArthur-Bates CDI and observed language in toddlers (Caskey & Vohr, 2013). Also notable, the MacArthur-Bates CDI has been shown to have results similar to observational settings (Charman, 2004; Fenson, 1993; Stone & Yoder, 2001).

Knowledge of Infant Development Inventory. This is a questionnaire the mothers filled out regarding their knowledge of infant development. The KIDI (MacPhee, 1981) is a 58-item parent report designed to test parental knowledge on child development, parenting, and child norms. It was designed to be accessible to those of low education and to be culturally neutral. The KIDI takes 20 minutes to administer, and each item is scores as right (+1), wrong (-1), or not

sure (0). On the KIDI we examined the Accuracy and Total Correct outcome scores. *Accuracy* is a test of how accurate the mothers are at answering the items. *Total Correct* is the total number of items the mother got right on the inventory.

Procedures

Main Study. Of our total of 30 participants, 15 completed the main study that included the LENA recordings. Please see flow chart for organization of procedures (Appendix B). Mothers interested in participating in our research study were met with at a location and time that was convenient for the mother. During this meeting the mother completed the consent form and demographic questionnaire, and was given their first LENA recording device, instruction sheet (see Appendix C), and record log (see Appendix D). The mothers were asked to read through the consent form and ask any questions prior to study enrollment; once the form is signed the mother and child became participants in the study, although they were able to withdraw at any time without any negative consequences. During the first meeting, the mother completed a short paper and pencil demographic questionnaire. The mothers were then instructed on how to use the LENA recording device, and were given their first recording device. The mothers were instructed to contact the researcher once their first recording was completed, to exchange the recording device for another recording device when the first one fills it's recording capacity (approximately 1 week later).

The participants received a honourarium for the digital-home recordings they completed and returned to the researchers (please see Appendix E for honourarium breakdown). The participants had a choice of where they would like their honourariums (with the ability to choose between several stores within the community, or a MasterCard gift card). Each participant was asked to submit between 4-6 recordings over the study period for a total of between $40-60 in

honouraria. We asked that the recordings be 10 hours in length, however the mothers received the honouraria even if the recordings were less than 10 hours. The honourarium was provided in order to thank the mothers for their time, and to let them know we appreciate their participation throughout the study.

The remainder of participation in this study involved recording natural language interactions between the mothers and their children, with the assistance of a specialized audio recording device, over a 1-month period. The mothers were asked to record in their homes for a 10-hour period, once a week, and make note of the recordings in their recording log. We asked that the mothers be home with their child on the day of recording. However, the mothers are able to go about their normal routines with their child for the day, including outings such as grocery shopping, and the child is able to wear the recording device at all times including nap time. Ideally the full day was recorded. Each week a research team member picked up the recording from the previous week and delivered a new empty, fully charged recording device for the next week's recording.

For each recording period, the mothers dressed their child in the LENA designed clothing, and placed the device in the pouch hidden in the front chest pocket; the mothers also recorded the recording period on their record log. During the final recording pick-up the mothers completed the paper version of the MacArthur-Bates CDI if their child has reached the minimum age (8 months). After the completion of the recording period the mothers also completed the KIDI.

Once study participation was complete, the mothers were given a Parental Report Form (see sample in Appendix F), which included a copy of their child's results from the LENA recording device, MacArthur-Bates CDI, and KIDI as well as suggestions on how to create a

high quality language environment for their infants. This form was either mailed or emailed to the parent depending on their preference.

Mini Study. Of our total of 30 participants, 15 completed the mini study. Of the 15 mothers who completed the mini study, two of them also completed the main study. These mothers were allowed to complete the mini study in order to include them in the process and allow them to gain the additional honourarium. For analyses where measures from the main study and mini study were combined, the overlapping mother's second scores were excluded.

This mini study was implemented in order to gather data on the MCDI and KIDI from a large number of willing young mothers at the young mother high school located in Winnipeg who were unable or unwilling to complete the more comprehensive main study. This study involved the mothers completing a modified consent form, a short demographic questionnaire (Appendix G), followed by the KIDI, and lastly the MacArthur-Bates CDI. The mothers were invited to take a 1-hour break from their class to participate in the study. The mini study took place in a classroom at the high school with the main researcher. The mothers were given a $10 gift card to a local grocery store for their time and contributions.

Statistical Analysis

Before analyzing data, attempts were made to complete any missing data. For our research project, there is the possibility of missing data on three of our measures, our demographic questionnaire, the MacArthur-Bates CDI and the KIDI. Luckily, these measures are fairly short, which resulted in lower instances of missing data. Our researchers also checked for missing data when a participant finished each of the components and asked the participants to fill in any missing information. A strategy used to handle missing data was that we excluded participants from specific analyses if there are data preventing them from being included in those

analyses. Participants who dropped out before the end of the study were included in our hypothesized analyses for the items they completed. Research members were also instructed on methods to build rapport with mother and infant participants through reviewing relevant research articles, in order to reduce instances of dropout (Collins, Doherty-Sneddon, & Doherty, 2014; Gremler, & Gwinner, 2008; Gurland & Grolnick, 2008).

First, the daylong digital recordings were used to aid in the analysis of our hypotheses. LENA datasets were used in the analysis of adult speech and language development. The LENA software estimates frequency figures for each recording period including individual reports, (included in the reports provided to parents, see Appendix F). The LENA software also allows for the data to be exported to SPSS to perform more formal analyses, in this case, the comparison of maternal age on and adult word count. Adult word count was computed using the ADEX software that accompanies the LENA program. The ADEX software allows us to break the recordings down into 5-minute chunks (e.g. 9:00-9:05) in Microsoft Excel, and gives us the amount of adult words heard in that 5-minute chunk. We then averaged out the 5-minute chunks for each recording, and then across recordings for each participant. Naptime data was excluded manually from the ADEX Microsoft Excel documents. The expressive language development score is given in the form of a percentile and is called the Automatic Vocalization Assessment (AVA) score, which is formed through LENA examinations of child vocalizations.

Third, in the analysis phase, descriptive statistics and all major inferential hypotheses were examined using Statistical Package for the Social Sciences (SPSS) version 23.0. The means, and ranges of item scores were computed for our independent variable and dependent variables.

Fourth, Pearson's correlations were completed in order to determine how the age of our young mothers is associated with adult speech, child language development, and knowledge of infant development, and the relationship between knowledge of infant development and child language development. Each of the variables was analyzed separately with maternal age in order to determine the Pearson correlation coefficient, r, and p value.

Lastly, Welch t-tests were completed in order to determine if our sample of young mothers differed significantly from three normative samples, general, low SES mothers, and teen mothers collected on the KIDI Total Correct item. The normative samples were reported by the creator of the KIDI, Macphee (1981). The general sample consisted of a diverse group of mothers from North Carolina (N=256; Macphee, 1981). The teen mother sample (N= 101, mean age of 16.9 years) and the older mother sample (N= 116, mean age of 25.4 years) consisted of a group of low SES, Black mothers (Ruchala and James, 1997). The Welch t-tests were computed by hand since we did not have access to the normative raw data, but did have access to the sample size, means, and standard deviations. The degrees of freedom were also computed by hand.

Please see Table 1 for a summary of the variables used in our analyses.

Results

Sample Characteristics

Our sample consisted of $N = 30$ young mothers. The mother's ages ranged from 15-21 years old at the time of their child's birth ($M = 18$, $SD = 1.62$; refer to Figure 1), and 15-21 years old at the time of study enrollment (refer to Figure 2). The children's ages ranged from 2 to 24 months old at time of study enrollment ($M = 11$, $SD = 7.04$; refer to Figure 3). Of our sample, 15 mothers completed the main study, and 15 mothers completed the mini study. Since the sample

sizes differ depending on the measure completed, please see each section below for the sample size used for those analyses. See Table 2 for additional sample characteristics of our young mother participant sample.

Maternal Age & Adult Words

Pearson product-moment correlations were computed to assess the relationship between maternal age and the adult word count captured by LENA. N=12 mothers completed LENA recordings. There was no correlation between maternal age at birth and adult word count, r (11) = -.073, p = .411. There was also no correlation between maternal age at study enrollment and adult word count, r (11) = -.383, p = .109. When controlling for the age of the child through partial correlation, there was no correlation between maternal age at birth and adult word count r (11) = -.094, p = .392, nor with maternal age at study enrollment and adult word count r (11) = -.392, p = .162.

Maternal Age & Child Language Development

Pearson product-moment correlations were computed to assess the relationship between maternal age and child language development captured by the MacArthur-Bates CDI. N =15 mothers completed either the MacArthur-Bates CDI Words and Gestures, or Words and Sentences, which were combined. From the MacArthur-Bates CDI Words and Gestures (8-18 months), the percentile from the Words Understood subtest result was used, while for the MacArthur-Bates CDI Words and Sentences (18-30 months), the percentile from the Words Produced subtest result was used. These subtests were chosen as it was decided they are the best representation of the child's language development for their age range. There was no correlation between maternal age at birth and MacArthur-Bates CDI combined scores, r (14) = .169, p =

.273. There was also no correlation between maternal age at birth and MacArthur-Bates CDI combined scores, r (14) = .054, p = .424.

Pearson product-moment correlations were computed to assess the relationship between maternal age and child language development captured by the automated measure of child language development created in LENA. N=10 mothers completed a large enough amount of recordings for the LENA software to produce an AVA score. There was no correlation between maternal age at birth and AVA scores, r (9) = -.141, p = .349. There was also no correlation between maternal age at study enrollment and AVA scores, r (9) = -.246, p = .247.

Notably, when examining the LENA estimated language development, the child participants AVA percentile scores ranged from the 3rd percentile to the 83rd percentile, with an average at the 47th percentile mark. This indicates that on average our child participant's language was developing normally, however there was a large range.

The MacArthur-Bates CDI and LENA AVA scores had a large positive correlation significant correlation r (6) = .748, $p < .05$, providing evidence of reliability across these two tests.

Maternal Age & Knowledge of Infant Development

A Pearson product-moment correlation was computed to assess the relationship between maternal age and KIDI Accuracy. N = 22 mothers completed the KIDI. There was a trend that emerged in the form of a medium positive correlation between mother age at birth and KIDI Accuracy, r (21) = .320, p = .073. This indicates that there may be a relationship between maternal age at birth and KIDI Accuracy. Specifically, as maternal age at birth increases, the accuracy of the mother's KIDI scores increases as well.

A Pearson product-moment correlation was computed to assess the relationship between maternal age and KIDI Total Correct. There was no correlation between mother age at birth and KIDI Total Correct, r (21) = .230, p = .152. There was also no correlation between mother age at study enrollment and KIDI Total Correct, r (21) = .008, p = .486.

KIDI Compared to Normative Samples

Our sample was compared to the three normative samples provided by Macphee (1981) on the KIDI Total Correct item using Welch's t-tests. Please see Figure 4 for the KIDI Total Correct percentages for the four different groups. When comparing our sample to the general normative sample, it was found that our young mother sample differed significantly from the general normative sample, t (24) = -1.78, $p < .05$. The normative sample had a mean score of 72.2 total correct, while our sample had a mean score of 67.3 total correct. This indicates that our young mother sample has significantly lower total correct scores on the KIDI when compared to the normative sample of mothers.

When comparing our sample to the low SES sample, it was found that our young mother sample did not differ significantly from the low SES normative sample, t (58) = 1.099, $p > .05$. The low SES sample had a mean score of 61.3 total correct, while our sample had a mean score of 67.3 total correct. This indicates that our young mother sample is similar to the low SES sample normative sample on total correct scores on the KIDI.

When comparing our sample to the teen mother sample, it was found that our young mother sample differed significantly from the teen mother normative sample, t (60) = 4.10, $p <$ .01. The teen mother sample had a mean score of 55.1 total correct, while our sample had a mean score of 67.3 total correct. This indicates that our young mother sample has significantly greater total correct scores on the KIDI when compares to the normative sample of mothers.

Knowledge of Infant Development & Child Language Development

A Pearson product-moment correlation was computed to assess the relationship between MacArthur-Bates CDI percentiles and KIDI scores. N = 14 mothers completed both measures. There was a significant correlation that emerged in the form of a large positive correlation between MacArthur-Bates CDI percentiles and KIDI Accuracy scores, r (12) = .672, $p < .01$. There was also a significant correlation that emerged in the form of a large positive correlation between MacArthur-Bates CDI percentiles and KIDI Total Correct scores, r (12) = .613, $p < .05$. This indicates that there is a relationship between the mother's scores on the KIDI and their child's reported language abilities on the MacArthur-Bates CDI. Specifically, as reported MacArthur-Bates CDI percentile scores increased, both the mother's KIDI Accuracy and KIDI Total Correct increased.

A Pearson product-moment correlation was computed to assess the relationship between LENA AVA scores and KIDI scores. N= 9 mothers completed enough recordings to produce an AVA score, and also completed the KIDI. There was no significant correlation between the AVA scores and the KIDI Accuracy scores, r (8) = -.262, $p = .248$. There was also no correlation between the AVA scores and the KIDI Total Correct scores, r (8) = -.205, $p = .299$.

Discussion

Findings

Maternal age & adult word count. Our hypothesis that maternal age will influence the amount of adult words spoken to their child, as maternal age increases, the number of adult words will increase, was not supported. This indicates that with our sample size, we were not able to find a relationship between maternal age and LENA observed adult word count. Therefore, if our finding is not due to lack of power, this would mean that young mothers in

general, despite a difference in age from 15-21 years of age, are exposing their child to roughly similar amounts of adult words. It would also mean that giving birth to a child during the teenage years and early 20's has a similar impact on their child in terms of adult word input; the older mothers may not be learning the significance of exposing their child to more words. However, a larger sample size may have pulled out an effect that our small sample size was not able to do.

Maternal age & child language development. Our hypothesis that maternal age will influence child language development was not supported. This indicates that with our sample size, we were not able to find a relationship between maternal age and maternal reported child language development. Therefore, if our finding is not due to a lack of power, this would mean regardless of maternal age, our sample's group of children was progressing at a similar level of language development.

Maternal age & knowledge of infant development. Our hypothesis that maternal age will influence knowledge of infant development, as maternal age increases, reported knowledge of infant development will increase was partially supported. With our sample size, we were not able to find a consistent relationship between maternal age and knowledge of infant development. However, we did find a marginal trend, which with a larger sample may become significant. Specifically, the older the mother's age, the more accurate their KIDI scores were. This indicates that mothers may know more about infant development, as they get older.

KIDI compared to normative samples. Our hypothesis that our young mother sample will be less knowledgeable on infant development compared with a normative sample of mothers was supported. We found that our sample was significantly different; specifically our sample did not perform as well as the general sample in terms of total correct responses on the inventory. This was expected, as our sample is a younger sample than the general sample and therefore

most likely had not been exposed to as much information on infant development as a sample that included older mothers, as found previously by Culp and colleagues in 1998. Exposing younger mothers to more information on infant development may result in this gap being reduced.

Our hypothesis that our young mother sample will be similar to a low SES sample of mothers on knowledge of infant development was supported. Our sample of young mothers scores similarly to the low SES sample. Although we were not able to obtain measures of SES in our sample due to non-compliance in completing the forms, this is expected because adolescent mothers are more likely to raise their children in low SES environments (Brooks-Gunn & Chase-Lansdale, 1995; McKay, 2012). This indicated that the negative effects of language development found in low-SES environments are potentially prevalent among our young mother sample. This is similar to what was found in Lacroix and colleagues study (2002) where a young mother sample was similar to a low SES sample on maternal speech and child language development.

Our hypothesis that our young mother sample will be similar to a teen mother sample on knowledge of infant development was not supported. We found that our sample was significantly different; specifically our sample outperformed the teen mother sample in terms of total correct responses on the inventory. This was unexpected since our sample included a number of teen mothers and mothers close to their teenage years, and therefore we expected the groups to be similar. This finding may be explained through closer examination of our young mother sample. Our young mother sample was largely recruited through a local high school, which may result in it not being representative of all young mothers. Specifically, the mothers in our study were focused enough to regularly attend school and have their child regularly receive childcare. Other young mothers who are struggling may not be getting the same benefits of the mothers from our young mother sample. The high school attended by the majority of our sample was a high school

specifically designed for young mothers, and provides free daycare for the mother's children in the school. Therefore for these young mothers, their educational experiences and opportunities may be helping them with their knowledge of infant development.

Knowledge of infant development & child language development. We did find a correlation between mother's knowledge of language development and their knowledge of general infant development. Specifically, mothers whose self-report scores on their child's language development were high, also performed well on the KIDI, both in terms of accuracy, and total items correct. This may support the notion that mothers who have general knowledge of infant development are likely providing high-quality language environments for their children, and therefore their children are developing well in terms of language (Rowe, 2008). Another explanation is that the mothers may be responding in a socially desirable way on the MacArthur-Bates CDI, which in turn is driving this finding. This may be the case since this finding did not come through in the automated estimate provided by LENA, although the sample size was smaller in the LENA analysis.

Limitations

Notable limitations exist in the current research study. First, in regards to the sample, our study has a small sample size. This small sample size is due to the expected difficulties in recruiting this high-risk population of adolescent mothers (Santelli et al., 2005). The young mothers were hard to schedule meeting times with and regularly cancelled last minute. This made it hard for the mothers to stay on schedule and complete the desired number of recordings. It is also unlikely we were able to capture a representative sample of the city of Winnipeg's young maternal population due to our small sample size, however efforts were made to get a representative sample through different recruitment strategies and locations.

Linked with this, our sample has a high proportion of two ethnicities, White and Aboriginal. Therefore we are not able to generalize our findings to other ethnicities within Canada or elsewhere. However, our sample was reflective of the high proportion of adolescent mothers in Winnipeg who are Aboriginal, and is informative of a group that is in need of attention.

Additionally, as mentioned briefly above, the young mothers in our sample may not be representative of all mothers who give birth at a young age. The majority of the mothers in our sample who attended Winnipeg's young mother high school attended school regularly, and had free childcare for their children. These mothers had the support of dedicated school staff members, and flexible education plans were an option to accommodate the additional time and stressors of having children. Therefore, mothers who do not attend school or get services from community organizations were not adequately captured in our sample, and these mothers may be the most in need of research and intervention.

Our sample focuses on Western style parenting and only English speaking participants, and is not generalizable and representative of the language environments and parenting of all children and also reduced the recruitment of immigrants who are not fluent in English. Additionally, there may be similarities between the mothers who agreed to participate in our study which make them different or not representative of the population as a whole.

Due to the poor response rate for our maternal income and household income variables, we were not able to look at this key SES variable. We were also not able to look at education since there was a lack of variability among our mothers on this variable (the large majority were still in high school). However we can guess that since the majority of our maternal participants have not finished high school and therefore currently are at a low education level, the effects on

child language development from having a low education may be occurring for this sample (Moore & Waite, 1977). As mentioned earlier, in terms of early language development, maternal education is considered the most influential SES factor (Westerlund & Lagerberg, 2008).

Our research design is correlational and cannot be cogitated as causal, and the relationships found in our research cannot therefore be reported as causal. Our study is focusing on a limited number of aspects that may contribute to language development in young children. Other variables that are not included in our study, may contribute to the language environments. For example, birth order has been researched, and has been shown to account for different language environments (Zambrana, Ystrom & Pons, 2012), older mothers are more likely to have additional/older children than the ones in our study, which may affect their language environments; while adolescent mothers are more likely to be raising their first child. Another variable that has been shown to contribute is the gender of the child (Zambrana, Ystrom, & Pons, 2012), if a larger sample size is possible, it may be beneficial to look at this effect also. Most studies do not longitudinally study the effects of caregiver speech (Huttenlocher, Vasilveva, Waterfall, Vevea, & Hedges, 2007), this current proposal included, making it hard to discuss the long-term effects of early language development.

Not all adolescent mothers have children with lower development (Dubow & Luster, 1990). Luster and colleagues (2000) wanted to examine the differences of adolescent mothers that lead to healthier and successful outcomes in their children. They found that children of adolescent mothers who had higher education, favorable family backgrounds, jobs, fewer other children, living in higher SES neighborhoods, and having a male partner, were all predictive of high quality child outcomes. Chase-Landsdale and colleagues (1992) also highlighted the importance of adolescent mother family origin in their likelihood of success in motherhood.

Our study does also not account for other language environments the child may experience on a regular basis, including daycare environments; these environments are capable of influencing a child's language development, however findings support the importance of the home language environment over child-care environments (Miser & Hupp, 2012). In regards to the age of the child participants, they are at a stage in the lives when language development and skills are rapidly changing, therefore our one-month snapshot may show noticeable differences depending on the recording. For example the first week recording may be quite different than the last week recording for a particular child.

Also a self-report bias may be present for the parental ratings on the MacArthur-Bates CDI. Specifically, the mothers who were knowledgeable on general infant knowledge may have over reported their child's language development. This would interfere with us getting an accurate account of their child's language development, however we were able to also use the LENA recording system to get an estimate of child language development.

Lastly, the LENA system does not currently automatically differentiate different types of adult speech including specific speaker, adult speech, and infant-directed speech; this can however be done with mores sophisticated analyses and this is planned for future research. Additionally, our LENA recording device does not account for the nonverbal, social-communicative aspects that go into language exchanges (including gestures, facial expressions, etc.), which may influence language development (Kuhn, Willoughby, Wilbourn, Vernon-Feagans, & Blair, 2014).

Conclusion

We found marginal support in one of our analyses for the link between a mothers age and accuracy on knowledge of infant development which indicates maternal age may be associated

with more advanced knowledge of infant development. When comparing our sample to normative samples, we found that as expected, our young mother sample scored lower on knowledge of infant development, compared with a normative sample, indicating there is a need for improvement. And the similarities of our young mother sample to that of a low-SES normative sample highlight the possibility of similar negative outcomes occurring in young mothers as in low-SES mothers. Our results also may provide support for the connection between knowledge of infant development in the mother leading to seeing real results in the form of language skills in their child. This is an important finding as it supports the notion that education to young mothers can lead to real life benefits in their child. However since we did not find this with the LENA automated measure of language development it is to be interpreted with caution

The hypotheses that were unexpected show that the older mothers in our group are not providing a more ideal language environment for their children, particularly when it comes to exposing their child to adult words. Also, being an older mother in our group was not associated with more advanced language development in their child. Although no explanation could be found in previous research as to why this might be occurring, it may be due to the small range of ages of our mothers. All of our mothers were quite young and therefore any real world differences of maternal age may not be showing as expected. If a larger range of mothers was collected we may see our expected findings emerge. It was also found that our young mother sample performed better than the teen mother normative sample on the KIDI. Our young mother sample may not be representative of all young mothers; this may explain the difference found on their knowledge of infant development when compared to the teen mother sample. Considering

the majority of our mothers attended a high school designed for young mothers, this may be helping them with general infant development knowledge.

A number of our hypotheses were not supported, potentially due to our small sample size; therefore more research is needed to determine if our results were potentially due to a lack of power. Although our sample was a unique sample in terms of ethnicity, which limits generalizability to the general population, our sample is reflective of the high proportion of young mothers in Winnipeg who are Aboriginal, a group in need of research and support. Therefore the findings from this study are informative and have real world application.

This study is important as its results aim to help two vulnerable populations (young mothers and their children). Small changes in language environment can lead to future successes for children: notably, the language environment, including amount of talk to a child, is something that is alterable, and can lead to improvements in children's knowledge of vocabulary, their language learning abilities, and school preparedness (Hard & Risley, 2003). This research is a starting point for language research on young mothers using real-world naturalistic speech samples. Obtaining data through advanced means such as the LENA technology from a vulnerable population of young mothers and their children adds to the literature on this population. This population is in need of research and intervention due to them being a vulnerable population responsible for the upbringing of children. Therefore, despite having a number of limitations mentioned above, this research is an important beginning for this type of naturalistic data collection and analyses.

Future Research

This project serves as the starting point for language research on adolescent mothers and their children. Future research should focus on not only the quantity, but also quality of language

infants of young mothers are exposed to. This data was not included in the present study due to the additional work of transcription and coding, however will be research in the near future. As well, future research should look at other components of language interaction the LENA device does not pick up, including gestures and facial expressions. Research should also compare an adolescent mother sample to an adult mother sample with the same research methodologies to determine the differences between these two mother groups. Future research should also consider including a larger mother age range, in order hopefully see more differences between younger and older mothers. Another area for future exploration includes looking at the language environments and development of children of an older age than those included in our sample. For example, looking at children aged 3-5 may show more effects since the child has been in the language environment for longer. As noted earlier, the amount of talk a child receives early on influences language outcomes at 3 and 9 years old (Hart & Risley, 1995). Future research would also benefit from looking at other aspects of infant home environment, including the family dynamic, and personality characteristics unique to adolescent mothers.

Implication

This research project's data and results can help facilitate the development of an infant's language, and the environment mothers provide. The verbal language a child hears, and the communication style, can mediate the effects of SES (Hoff & Tian, 2005), which bodes well for the potential effectiveness of language development strategies helping young mothers as well. Since the home environment is arguably the most important environment for child development (Dickinson & Tabors, 1991), naturalistic research in the home environment is key to learning how children develop language skills. The reports given to mothers hopefully help them further improve their language environments, as simple techniques were shown to help young mothers

aid in their child's language development in Deutscher and colleagues 2006 study. Overall, this study has consequences for two vulnerable populations, young mothers and their infants. My research furthers our understanding on the language environment these children are exposed to, where they are developmentally, and the knowledge on infant development of these young mothers.

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Table 1

Study Variables

- Independent variables
  - Maternal age
    - At time of birth
    - At time of study enrollment
- Dependent variables
  - LENA
    - Adult speech
    - Language development estimation
  - MCDI
    - Language development score
  - Knowledge of infant development
    - KIDI
      - Accuracy
      - Total Correct

Table 2

Sample Characteristics of Young Mother Sample including Percentages

Characteristic	*n*	%
Education		
High School In Progress	27	90
Completed High School	2	6.7
Ethnicity		
White	7	23.3
Aboriginal/First Nations	21	70
Other	2	6.7
Child Gender		
Male	18	60
Female	12	40
Child Siblings		
Yes (one)	4	13.3
No	26	86.7
Adult Household Members		
1	5	16.7
2	9	30
3	5	16.7
4 or more	10	33.3
Previous Child Experience		
Yes	22	73.3
No/Blank	7	23.3
Household Income		
Under $15,000	5	16.7
Not reported	25	83.3

Note: These characteristics are combined for the main study and mini study participants

Table 3

Statistical Analyses Findings

Hypothesis	r	*p*	Strength	Supported? (Y/N)
KIDI				
Hypothesis 2a: Maternal Age & KIDI Accuracy	.320	.073	Medium	Y
MacArthur-Bates CDI & KIDI				
Hypothesis 3a: MCDI & KIDI Accuracy	.527	< .05	Large	Y
Hypothesis 3b: MCDI & KIDI Total Correct	.523	< .05	Large	Y

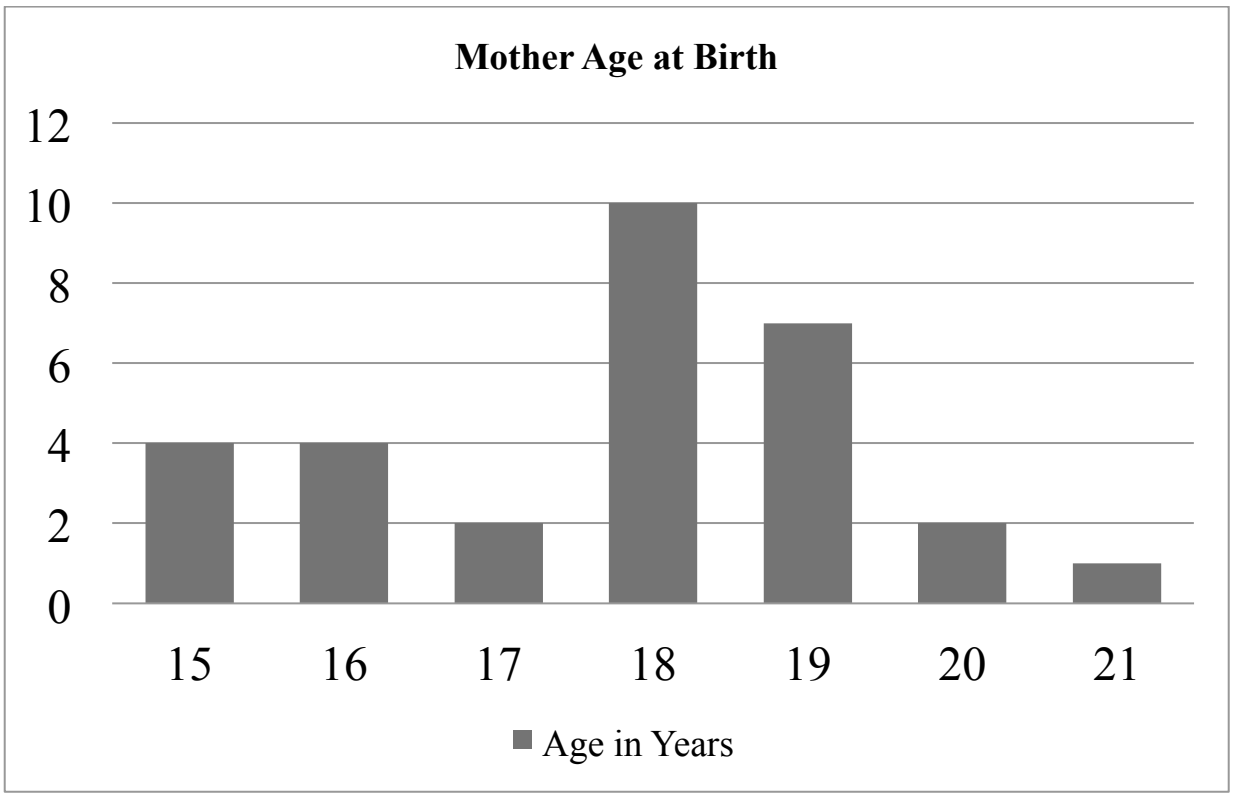

Figure 1. N=30 participants, mother's age at birth of child participating in study

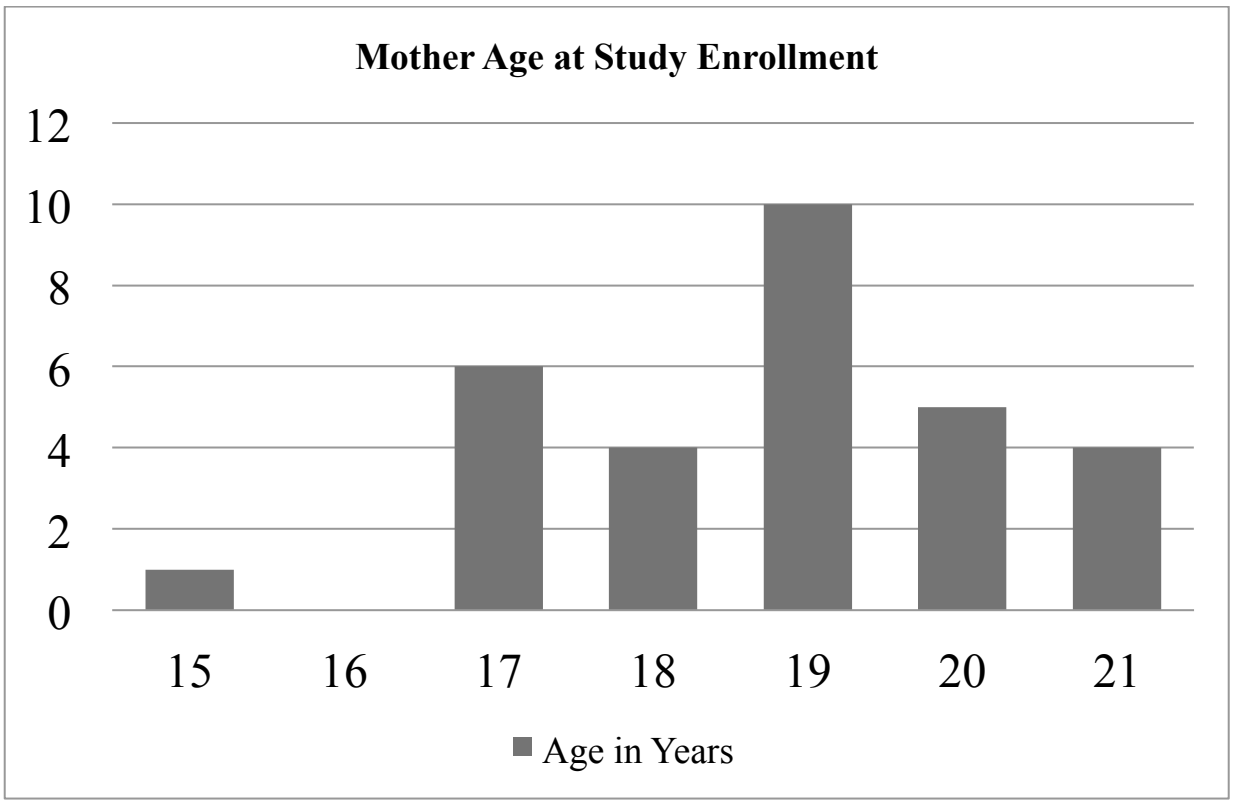

Figure 2. N=30 participants, mother's age at time of study enrollment

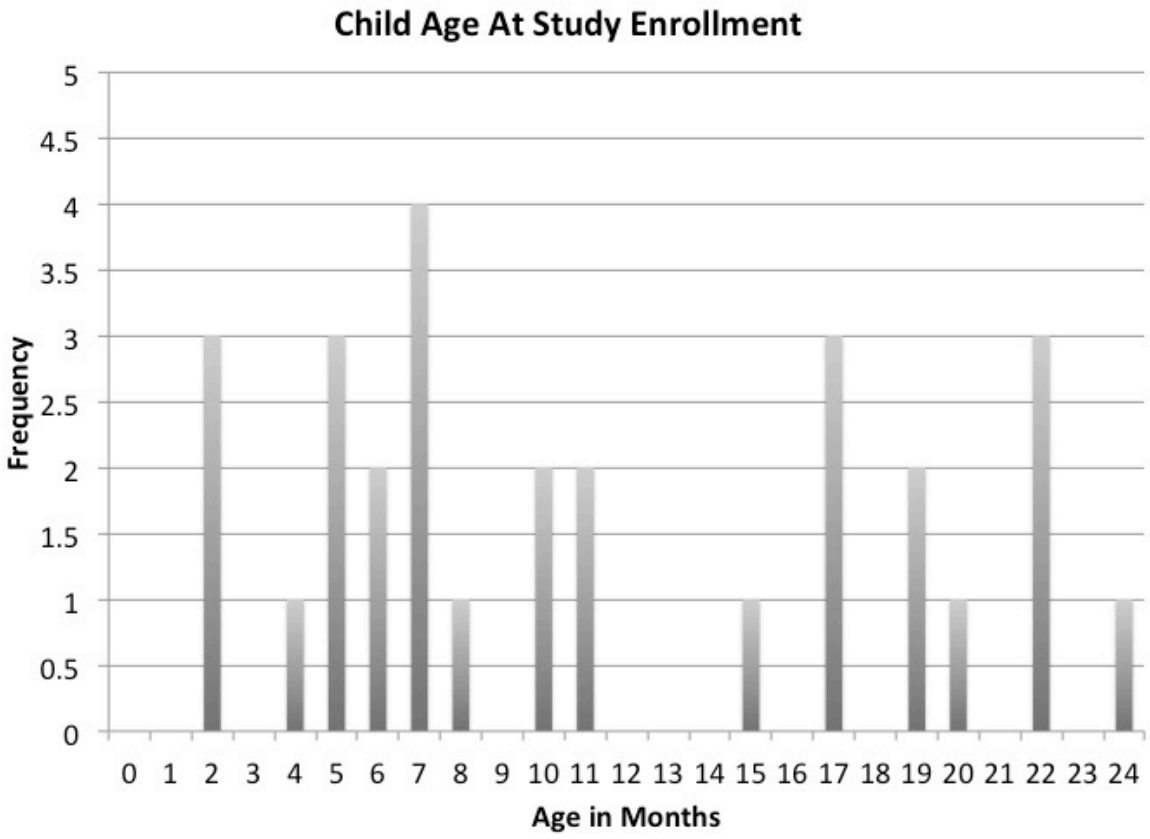

Figure 3. N=29 child participants, child's age at study enrollment

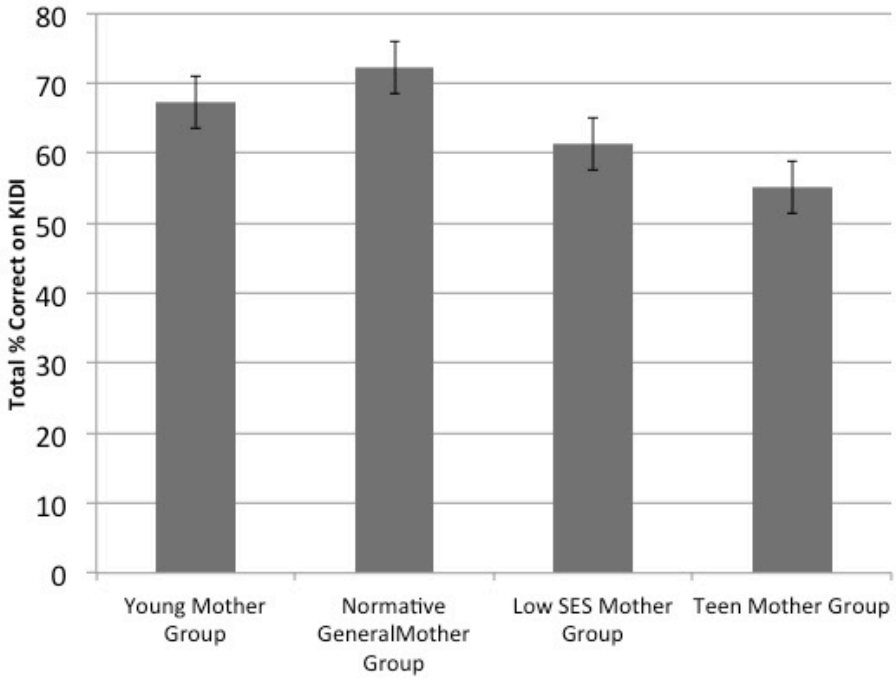

Figure 4. Mean percentages for KIDI Total Correct scores. Our young mother group compared to the three normative samples, general (Macphee, 1981), low SES, and teen mother (Ruchala and James 1997). Our young mother group scored significantly less than the normative general sample. Our young mother group did not differ significantly from the low SES group, and our young mother group scored significantly higher than the teen mother group. This indicates that our group of young mothers does not know as much about infant development as general mothers, however they seem to know more than specifically teen mothers of similar socioeconomic status.

Appendix A

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PERSONAL INFORMATION SHEET

Please Note: Responses to these questions are entirely voluntary. The information you provide us will be very helpful in our research. Please ask if you have any questions or concerns about your responses or how they will be used.

To be filled out by experimenter

Child's data code: _____

Study code: _____

Date: _____

Parental Information

Parent 1:
Age: _____ Ethnicity: _____ Gender: M/F
Parent 2:
Age: _____ Ethnicity: _____ Gender: M/F

Completed Education (circle):

Parent 1: High School College/Trade Undergrad Masters/PhD Professional Program

Other: _____ (ex. partially completed education/in progress education)

Annual Income:_____(dollar amount)

Parent 2: High School College/Trade Undergrad Masters/PhD Professional Program

Other: _____ (ex. partially completed education/in progress education)

Annual Income:_____(dollar amount)

Parent 1: Experience with Children Prior to Becoming a Parent: Some ☐ Extensive ☐

Briefly describe experience: _____

Parent 2: Experience with Children Prior to Becoming a Parent: Some ☐ Extensive ☐

Briefly describe experience: _____

Children in your Family:

Child Participating: Date of Birth (Day/Month/Year) ___/___/___ ☐ Male ☐ Female

Siblings ☐ None or DOB: ___/___/___ ☐ Male ☐ Female

DOB: ___/___/___ ☐ Male ☐ Female

Who are the adult members in your household?

Briefly describe: _____

Child Care Arrangements (on a regular basis):

How often is Parent 1 the sole/primary care provider? _____

How often is Parent 1 away from the child?_____

How often is Parent 2 the sole/primary care provider?: _____

How often is Parent 2 away from the child?_____
Are the grandparents or other family members involved in child care? If so, please describe:

Formal Childcare ☐ No ☐ Yes How often: _____

☐ In home (licensed) ☐ In home (unlicensed) ☐ Child Care Center

Other: _____ How often: _____

Child Background

Was your child born prematurely? ☐ No ☐ Yes:
Child's Due Date (Day/Month/Year) ___/___/_____

Is your child from a multiple-birth? ☐ No ☐ Yes:
If yes, identical or fraternal?
☐ Fraternal ☐ Identical ☐ Not sure

Are you aware of any hearing impairment or difficulties in your child? ☐ No ☐ Yes:
If yes, please explain:

Are you aware of any language or cognitive impairment or delay in your child's development? ☐ No ☐ Yes:
If yes, please explain:

Is there anything else we should know about your child (e.g. physical characteristics) not addressed above that might influence how they behave in our studies? ☐ No ☐ Yes:
If yes, please explain:

Language Background

What percentage of the time are the following languages used in your (your child's) household?
Canadian English 0% < 10% 10% 25% 50% 75% 90% 100% =_____
Canadian French 0% < 10% 10% 25% 50% 75% 90% 100% = _____
American Sign 0% < 10% 10% 25% 50% 75% 90% 100% = _____
Other languages: (please specify)
_____ < 10% 10% 25% 50% 75% 90% 100%
_____ < 10% 10% 25% 50% 75% 90% 100%

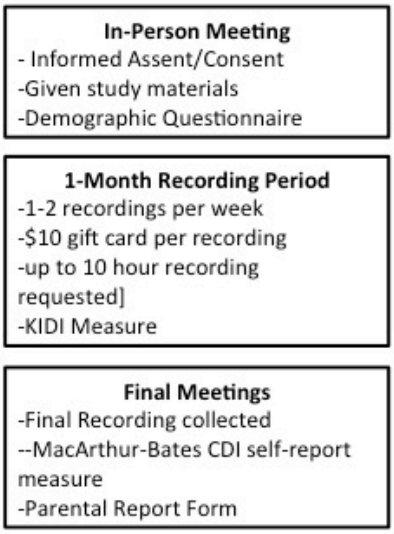
Please select "American Sign" only if you use sign language as a primary means of communicating with your child (e.g. if there is a deaf family member). If you use individual signs to help you communicate with your child, please select "Baby Sign", even if the signs are from American Sign Language.

Do you use "Baby Sign" with your child?

No ☐ Yes ☐

Other
Mother's Birthday (your birthday): _____
Household Income: _____ (dollar amount)

Appendix B


In-Person Meeting
- Informed Assent/Consent
-Given study materials
-Demographic Questionnaire
1-Month Recording Period
-1-2 recordings per week
-$10 gift card per recording
-up to 10 hour recording requested]
-KIDI Measure
Final Meetings
-Final Recording collected
--MacArthur-Bates CDI self-report measure
-Parental Report Form

Appendix C

Home Recordings – A Guide for Parents

**** Please do the recording for a full day (from when your child wakes up, to when they go to sleep at the end of the day. Please leave the recording device on the entire day. Also please make sure you are doing the recordings on days when you are with the child for most of the day.**

Using the LENA Device

1. To turn the device on, press and hold the power button.
2. To start a recording, press and hold the REC button. An indication that the device is recording will appear on the screen.
3. If you need to pause the recording press and hold the REC button again. An indication that the device is paused will appear on the screen. You will want to pause the device at the end of the recording before turning it off.
4. To turn the device off, press and hold the power button.
5. The device may be paused during the recording; all we ask is that you accurately record the time you pause the device as well as the time that you un-pause and continue the recording.
6. Please do not turn the device off for naptime! It can simply be removed from the vest and placed in close proximity to the child i.e. under the crib or on a nearby table.

Using the Observation Sheets

1. Please accurately record the time that you start the recording, as well as the time that you finish. This is a big help when it comes to matching the observation sheet to the recording!
2. Please record the time your child spends napping (start and end times), and any times that you paused the device. Please also record any other times that the device was not located in the pocket in the vest or the recording might not be as good, such as if the child was wearing a coat.
3. At the end of the day, please write a brief summary of the activities, locations, and any other important comments or things you think we should know.

Making the best recording:

- Covering the LENA clothing blocks sounds just like wearing earmuffs does for you. So please keep LENA clothing OVER sweaters and light jackets if possible.
- During baths or naps, it's best to keep the LENA recorder in the LENA clothing dry and as close as possible to the child. The LENA device can take a small amount of splash but should not be submerged. Just remember to put the LENA clothing back on your child afterwards!
- For safety and fora good recording, please make sure the LENA device is not underneath any seatbelt straps during travel

Your contribution to the project is very much appreciated. We thank you for your time and effort!
When you are finished your recording, please email adolescent@babylanguagelab.org or call or text [redacted] and we will arrange a time to pick up the recording device ☺

Appendix D

Adolescent Mother Study LENA Recording Sheet

DATE: _____

ID: _____

RECORDING #: _____

START TIME: _____ END TIME: _____

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BABY LANGUAGE LAB

Please record naptime throughout the day:

NAPTIME

START TIME (HH:MM AM/PM)	END TIME (HH:MM AM/PM)

Please record an overview of activities completed throughout the day. Please complete this *at the end of the day* (not throughout the day while interacting with your child), as a summary:

ACTIVITY CATEGORIES (examples):

PLAYTIME *STORYTIME* *OUTSIDE VISITS* *TV TIME* *BATH TIME*

ACTIVITIES (approximate start and end times)	LOCATIONS	COMMENTS

Appendix E

Gift Card Options

Please underline/highlight the option you would like.

For 1 recording: $10 Superstore
For 2 recordings: 2 X $10 Superstore or $25 Old Navy
For 3 recordings: 3X10 Superstore, $30 Safeway, $25 Old Navy or $25 MasterCard
For 4-5 recordings: $50 Home Depot, 2 X $25 Old Navy, 2 X $25 Superstore, $30 Safeway + 2 X $10 Superstore, or $50 MasterCard

Appendix F

BABY LANGUAGE LAB

UNIVERSITY OF MANITOBA

Baby Language Lab: Study Report

Dear

Thank you so much for your participation in our Adolescent Mother study! Your participation will help us understand how to address the unique needs of adolescent mothers and their babies. It is very much appreciated. Below is a report about your child's language environment and your child's development based on the information we collected during the study. We have included your child's scores on the Bayley Scales of Infant and Toddler Development (BSID-III), and the MacArthur-Bates Communicative Development Inventories (MCDI), as well as a brief summary of some of the information provided by the LENA system. We have also included your score on the Knowledge of Infant Development Inventory (KIDI) for your information.

A few important things to help you understand the report:

- ***We are not a diagnostic or medical laboratory.*** We are using these assessments for research purposes only. You should not take your child's performance in our lab as any kind of medical assessment. If you have concerns about your child's development, please consult your doctor.
- ***Children vary considerably in the timing of the milestones tested, so if your child is in the lower ranges of performances in our tests, this does not necessarily mean your child is at risk for developmental difficulties.*** These tests are NOT tests of child IQ. Children may perform very poorly but later catch up to, or even surpass, their peers. Also, sometimes children just perform poorly on the test on a given day because they are upset, hungry, or acting shy. However, if your child performed in the lower ranges AND you have other reasons for concern about your child's development, you may want to bring this report to show your doctor when you discuss those concerns.
- ***The scores are given in "percentile" form.*** So for example if your child is listed as "40-60%", that means that your child was in the middle range compared with other children of the same age, with approximately half of the children performing better and half performing not as good. If you child is listed as "80-100%", this means they performed among the most advanced for their age group during the test.

Bayley Scales of Infant Development (BSID-III)

- ***We report two measures from the BSID-III (motor and cognitive).*** The motor development score reports on your child's physical development (e.g. grasping, crawling, rolling over). The cognitive score reports on your child's developing ability to understand and respond to the world around them (e.g. interest in pictures, solving puzzles, remembering hidden objects).

Age	Motor	Cognitive

Knowledge of Infant Development Inventory (KIDI)

- ***This is the score given for parental knowledge on infant development.*** The KIDI tests the parent's knowledge of a variety of aspects of infant development.

MacArthur-Bates Communicative Development Inventory (MCDI)

- ***You may have been given either the Words & Gestures (8-16 months) OR the Words & Sentences MCDI (16+ months) booklet based on your child's age. Parents of infants younger than 8 months were not given this***

questionnaire. For either age groups e report 4 measures of language development based on the MCDI you completed. Each of the 4 components makes up an important aspect of language development, and is given a percentile score.

Words & Gestures (8-18 Months)

Phrases Understood	Words Understood	Words Produced	Gestures

Words & Sentences (16-30 Months)

Words Produced	Word Forms	Word Endings	Sentence Complexity

LENA

- ***This is a report based on the 4-6 LENA recordings you completed for the study.*** This gives us estimates of your child's vocalizations, the number of words spoken to your child per hour, and the conversational turns (number of verbal exchanges between the child and others). In addition, this report gives estimates of the percentage of time your child is exposed to several language and sound environment characteristics. Please keep in mind that all of these measures are estimates only. Based on certain acoustic characteristics of the recording, the LENA program analyzes the probability that a particular sound falls into one of these categories. In addition, the categories are somewhat broad, and the labels used by the system a little misleading. We have therefore provided some more detailed explanations of each of these categories below, so that you can better understand what they mean. Please feel free to call or email us if you have any questions or concerns about what any of this means.
- ***LENA Categories***
    - ***Meaningful Speech:*** This category is the one used by LENA to determine the estimates of child vocalizations, adult words, and conversational turns. Segments of time in this category are speech (either by an adult or child, including your infant) deemed to be clear, loud, and intelligible. They are typically produced within about 6-10 feet of the child and are assumed to provide the primary linguistic input from which the child is learning to speak.
    - ***Distant Speech:*** This is a catch-all category for segments that the system cannot easily classify. They are typically speech segments that are further than 10 feet from the child, but may also include other noises that the system doesn't recognize, or quiet speech that is close by. This is speech-like sounds that are unlikely to be helpful to your child in learning to speak.
    - ***TV:*** This is a category for TV, radio, and other electronic sounds, like music recordings. Note that if you play a music CD while the children are sleeping (for example), that will be included in this category. It is common to see about 1% TV input in your report even if there is no television.
    - ***Noise:*** This category is used for non-language noises, such as jostling, rattle, bumps, bangs, etc.
    - ***Silence:*** This category is reserved for time periods for which there is little or no noise or language taking place.

Adult Word Count: This is an estimate provided by LENA of the number of words your child hears. In general, about xxx words per hour is considered average. Hearing more words has been shown to help babies learn language.

Child Vocalizations: This is an estimate of how often your child babbles or talks. Vocalizing is how babies practice talking.

Conversational Turns: This is a measure of how often you talk to your baby and they respond, or vice versa. In addition to just hearing you talk and vocalizing themselves, having the give-and-take of a conversational turn is important for learning about language.

AVA score: This is an estimate that LENA makes based on analyzing the sounds that your child makes. The AVA score tells us how far along your child is in producing speech sounds the way adults do.

Explanation of your scores:

NOW WHAT?

Now that you have learned a little bit about how your child is progressing, and how much they are being stimulated by your language, you may decide that you want to try to talk more (or better) with your child. Here are some tips for providing a good "language environment" for your child, to increase the amount, and the quality, of the language they hear.

Read with your child. A large number of studies have shown us that children who are read to from an early age (even young babies!) learn language better and faster. Reading gives your child one-on-one language attention, and also gets them in the habit of spending time with books, which will help them to have a love of reading when they are older. When reading with your child:

- Don't feel like you have to stick with the written words. Ask questions about the pictures or story, point out things that look interesting, respond to their cues if they seem interested in something specific.

Find a community with other moms and babies, or get out of the house. It can be hard to feel like talking with your baby if you're stuck at home all day. Other moms feel the same way and there are loads of moms' groups out there. Getting out of the house and spending time together with other moms and babies will help you talk more to your baby and is important for your mental health as well. If you're not sure where to find a local baby group, we can give you some suggestions. You can also just go to the library or other outings that are fun for you and your baby. Some moms even go to "baby rhyme" groups that have play-based singing and talking activities with moms and babies.

Make use of "everyday" moments. Even a simple trip to the grocery store can become a language teaching time. Talk with your child about what you are doing and get them involved in an age-appropriate way.

Avoid the TV and screen time. TV is not recommended for kids under 2 years. Even with older children, it's important to set boundaries about how much. You can set a good example by watching less TV yourself. Avoid using your phone (texting, Facebook, etc.) as much as possible when you are with your child. Every moment you are in front of the screen is one less moment for talking with your child. If you do turn on the TV for your child, pick high quality children's programming like Sesame Street, and try to sit with them and have it be an interactive time – ask them about the things they are seeing.

Ask questions and engage your child. Questions are a key part of language learning for children. Asking questions even if they can't answer back sets the stage for learning about conversations. Talk to your child about what you are doing, point things out that might interest them, and tell them the names for things.

Once again, thank you so much for participating in our study. Please do not hesitate to contact my supervisor, Melanie Soderstrom, or me if you have any questions or concerns about this report.

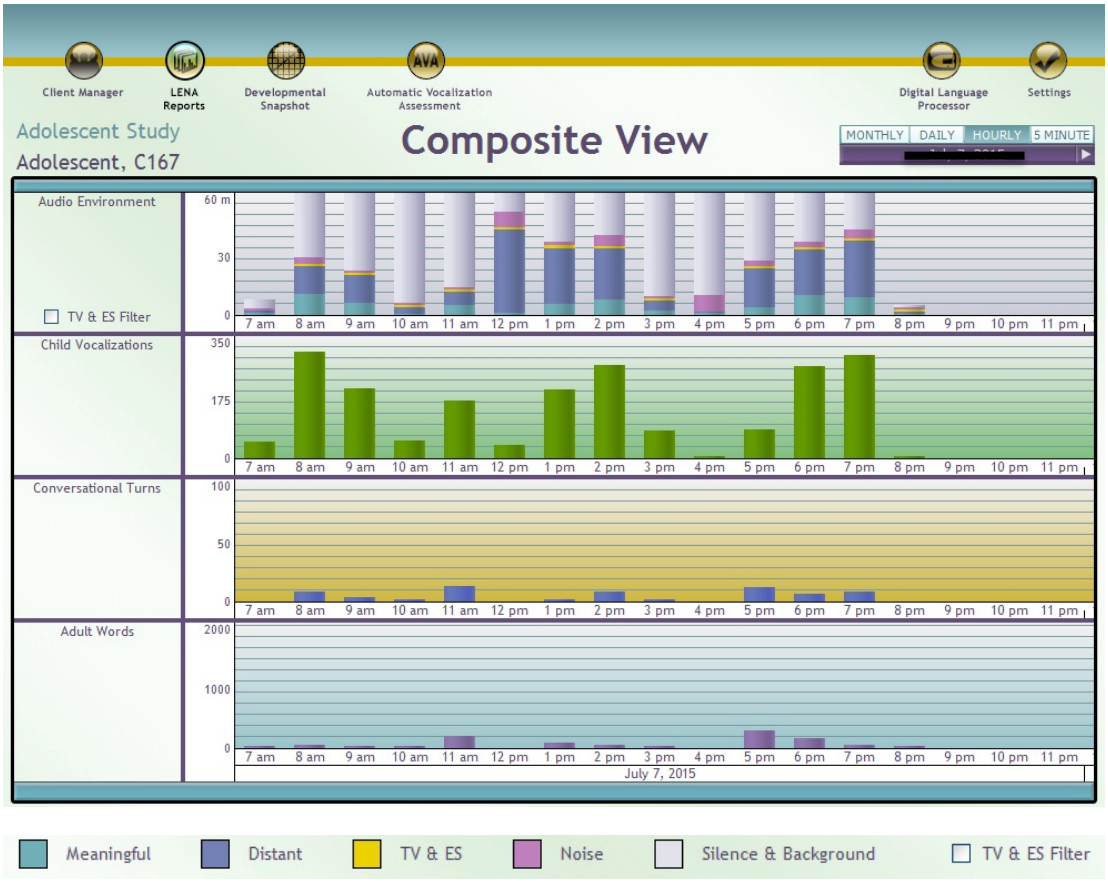
Sincerely,

Karmen McDivitt

BABY LANGUAGE LAB

UNIVERSITY OF MANITOBA

First Recording



Appendix G

KIDI Study Questionnaire
University of Manitoba, Baby Language Lab
KIDI Project of Adolescent Mother Study

To be filled out by experimenter

Data Code: _____
Study Code: _____
Date: _____

All of the questions below are important for our research, so we ask that you answer as completely as you can. However, you can leave any question blank if you are not comfortable with answering it.

Parental information

Your Age: ____

Your Ethnicity (e.g. White, Aboriginal, etc.): _____

Your Gender: Male or Female

Your Birthday: ____/____/____ (DD/MM/YY)

Education

Grade: _____

Family

How many children do you have? _____

What are you children's birthdates? ____/____/____ (DD/MM/YY) (Gender: Male or Female)
____/____/____ (DD/MM/YY) (Gender: Male or Female)
____/____/____ (DD/MM/YY) (Gender: Male or Female)

Home

Who do you live with? _____

On a scale from 1-10, how much do you think you know about child development?

1 2 3 4 5 6 7 8 9 10

On a scale from 1-10 how much do you think you know about language development?

1 2 3 4 5 6 7 8 9 10

Did you spend time around children before you became a mother? Yes/No

If yes, describe:

_____
_____
_____
_____
_____

Have you had talks or classes on child development? Yes/No

If yes, describe:

_____
_____
_____
_____
_____