

2023

## Language Development and Poverty: Considerations and Applications for Speech-Language Pathologists

Samantha Lynn Ehler  
*University of Northern Iowa*

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### Recommended Citation

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LANGUAGE DEVELOPMENT AND POVERTY:  
CONSIDERATIONS AND APPLICATIONS FOR SPEECH-LANGUAGE PATHOLOGISTS

A Thesis Submitted  
In Partial Fulfillment  
of the Requirements for the Designation  
University Honors

Samantha Lynn Ehler  
University of Northern Iowa

May 2023

This Study by: Samantha Ehler

Entitled: Language Development and Poverty: Considerations and Applications for Speech-  
Language Pathologists

has been approved as meeting the thesis requirements for the Designation University Honors

Approved by:

Dr. Ken Bleile, Honors Thesis Advisor

Dr. Jessica Moon Asa, Director, University Honors Program

## **Abstract**

Economics is one vital variable that can support or hinder the successful development and acquisition of language. A large body of research has shown that conditions of poverty often negatively impact a child's language learning environment and brain development, resulting in poor language development and a high risk of speech and language disorders. Language development is a dynamic process that begins during the first years of life and is contingent on social interactions and safe predictable routines. A thorough examination of the relationship between familial financial standing and language development is the foundation for developing interventions that will minimize the negative impacts of poverty. This literature review found that in order to minimize these impacts, speech-language pathologists should look to expand access to early intervention services and provide treatment with a focus on holistic care.

## **Introduction**

Language is a crucial foundation for human communication. Language enables the establishment of governments, transmission of ideals and religion, and the formation of meaningful social relationships. This pivotal role that language holds in society is why language development is one of the most predictive measures of late academic achievement and is crucial for individuals to take their place in their community and world.

Language development begins when a child is still in their mother's womb as they grow accustomed to the sounds of conversational speech. During the first few years of life, language acquisition is shaped by trusting social relationships between a child and their caregivers. Later on, in typical language development, unfamiliar environments and conversational partners push children to acquire a full range of speech sounds and morphological and syntactic complexity in order to communicate.

There are many factors that have been shown to contribute to this process. Ultimately, language development is a neurological process. Thus, impacts to brain development can support or hinder the acquisition of language. Brain development is an environmentally dependent process. The brain is designed to acquire skills that are necessary for the environment it is placed in. Significant enrichment or deprivation of this early developmental environment will be evident in the strengths or weaknesses of the child's brain.

Poverty is a well-known risk factor for language disorders. Statistically, children from poverty are more likely to develop speech and language disorders than their peers of middle or high socioeconomic status (McNeilly, 2016). Hart and Risley (1995) first identified the reason for this divide, estimating that there was what they termed a '30-million-word gap' between the number of child-directed words heard by a child in the most economically advantaged

environment and a child in the most economically disadvantaged environment by the time they reached four years of age. Many researchers have replicated and expanded upon this research. Low socioeconomic status is highly correlated with less child-directed speech, less conversational turns with more knowledgeable conversation partners, and less overall linguistically stimulating environments (Bradley et al., 2001). This begins to explain the clearly documented socioeconomic discrepancies in language acquisition, as social contexts are a key factor in the development of language.

The impacts of poverty on language development go beyond linguistic enrichment and can be seen by the way poverty impacts the brain. Poor nutrition, toxic stress, and strained interpersonal relationships have evident impacts on the structure of children's brains. Children in poverty have been shown to have less gray matter, specifically in areas of the brain necessary for language acquisition, such as the frontal and temporal lobes, as well as the hippocampus (Blair & Raver, 2016; Noble et al., 2015). Poverty is not simply a financial issue but impacts all aspects of a child's life as it changes the brain.

Speech-language pathologists (SLP) may be unclear regarding the impact of economics and environmental factors on development. Thus, their interventions may fail to consider how the economic life of the family of the child may impact the child's language delay. Speech-language pathologists have in-depth understanding of brain and language development and are well equipped to minimize the effects of low socioeconomic status on development. However, adequate research and tools do not yet exist to guide SLPs in their treatment. Thus, treatment is not as effective or functional as it could be for children in poverty. This literature review will outline the process of typical language acquisition, the neurology of language development, and the effects of poverty on a child's development. It is essential that a complete understanding of

how language acquisition occurs, environmentally and biologically, be formed in order to evaluate poverty's impact on this system. Thorough examination of these topics will explain what factors of poverty are dangerous for language development. As the relationship between language and economics is demystified, intervention for the specific population of children from a cycle of poverty can be adapted to meet their unique needs and ensure the highest quality of care.

## **Literature Review**

### **Language Development**

#### ***The Last Trimester***

The development of an infant's receptive language begins in utero. Fetal hearing of sounds outside of the womb is established by 28 weeks gestation (Das et al., 2020). While in the womb, a child's brain begins paying attention to the sounds in their environment and shows preference to the intonation of familiar language and speakers (Kisilevsky et al., 2009; Minai et al., 2017). Fetal heart rate monitoring provides the first indications that fetuses are able to differentiate between their native language and foreign languages (Minai et al., 2017). Analysis of fetal movement also provides evidence that fetuses have the capacity to discriminate between their mother's voice from unfamiliar speakers of the same language (Kisilevsky et al., 2009).

This familiarity of the mother's voice and native language lays the foundation for bonding between the mother and infant. An infant remembers its mother's voice from utero, when the infant was protected and cared for. The womb is the most familiar and safe environment known to the infant. For this reason, a mother's voice serves as a source of soothing and comfort for the child. Bonding and trust between the infant and mother is a crucial motivator for the infant in their quest for safety and security. This bonding is the foundation on which

language is learned and transmitted. Thus, fetal auditory perception is a critical component that precurs development of expressive and receptive language skills during the first few years of life. Understanding further language development requires an appreciation of the role of parental bonding and fetal development.

### *Infancy*

The first year of life is the time when infants lay the foundation for all language learning to come. Remarkably, at birth, an infant has the capacity to learn whatever language is present in the environment they are born into (Kuhl et al., 2003). Their brain is equipped with all of the synapses necessary to identify and assign meaning to any speech sound. As infants are exposed to language, the synapses of speech sounds present in the native language are activated and strengthened. Conversely, speech sounds not encountered in the environment are not strengthened in the brain and eliminated. Synaptic pruning is the process of getting rid of unnecessary neural pathways and strengthening ones that are used. Synaptic pruning occurs during the first six months of life and allows infants to distinguish native speech sounds from other sounds in their environment.

During infancy, the auditory and visual cortices finish this process of synaptic pruning and mature. After this time frame, sensory pathways are established. It then becomes much more difficult to acquire receptive awareness of speech sounds or visual acuity that was not needed or utilized, and thus eliminated in the brain. This sensory information allows children to explore, understand, and survive in the world they are born into, and provides the basis for interpretation of intonation, word learning, and vocal development.

Infants pay special attention to intonation. During the first year of life, an infant's perceptual skills allow them to learn the intonation, melody and stress patterns of spoken



language (Kao et al., 2022). For example, infants learn that a rising pitch at the end of a phrase indicates a question, and intense, abrupt phrases are commands. Even before infants acquire the semantic meanings of a word, they are able to communicate and receive messages based on their prosodic knowledge. For example, if you tell an infant “yes” or “no” or “cat” with loud firm intonation, they will likely stop what they are doing. They understand the intonation to indicate a negative command because they are skilled in the recognition of emotion in speech (Kao et al., 2022). Knowledge of stress and intonation is crucial in acquiring further language skills as it scaffolds a child’s receptive understanding to learn the meaning of new words and phrases.

Sensory input enables infants to learn that speech sounds are special and hold meaning (Sokol-Chang & Thompson, 2011). Knowledge of the uniqueness of speech tunes the infant’s attention to conversation in their environment. For example, an infant may learn that every time they hear “bye-bye” they change location. They learn that “bye-bye” is different from the sound of leaves rustling or any other auditory input from the environment. “Bye-bye” results in a predictable effect on the environment as they, or another individual, leaves the room and goes somewhere else. This understanding of speech’s effect on the world around them encourages infants to pay more attention to these speech sounds as well as the effect that their unique combinations have on their environment. This interest in cause and effect, scaffolds and molds language understanding.

During the first few months of life, infants begin to experiment with vocal play. In vocal play infants explore their articulators and the movement of their vocal tract to produce different sounds. Equally as important, is the turn taking and conversational structure learned through vocal play. When vocal play is met by child directed speech from a trusted caregiver, the infant learns that their sounds communicate a message to those around them (Goldstein & Schwade,

2008). Back and forth vocal play encourages the infant to continue vocalizing and establishes the ‘my turn, your turn,’ flow of conversation.

Around seven months of age, an infant begins to transition from vocal play to babbling. Babbling is the organized vocal play of consonant-vowel combinations. Numerous studies have found that infants babble in speech sounds present in the language(s) they are exposed to (Rvachew & Alhaidary, 2018). This makes sense as they have learned these sounds to be unique in carrying meaning and having an effect on their environment. Babbling is a crucial precursor to language because it establishes syllable structure. The consonant-vowel organization of canonical babbling prepares the motor plans for word production as all words are composed of syllable parts. Strong babbling skills are necessary for articulate word pronunciations. Babbling is such a significant milestone in an infant’s development that late babbling, or an absence of canonical babbling, often precedes speech and language disorders (*Early Identification*).

The first year of life is crucial to language development for many reasons. It is during this time that children learn the pattern, flow, and purpose of verbal communication. Infants have mature sensory processing systems that allow them to learn the sounds that are present in their environment and begin to practice how to produce them themselves. By a child’s first birthday, a typically developing child recognizes language as meaningful, understands some spoken language, is able to organize their vocalizations into syllables, and may have said their first word.

### ***Toddlerhood***

A new year brings new skills and the second year is marked by improvements in both receptive and expressive language. Toddlers learn how to correctly produce more and more phonemes in their native language and combine words to communicate in short phrases.

Intentional social relationships and predictable routines provide the backdrop for toddlers to learn language.

Language acquisition happens in the context of a social interaction (Ramirez-Esparza et al., 2014; Tierney & Nelson, 2009). During the second year of life, the most important social interaction for language development is between the child and their primary caregiver. As the parent and child interact, the child hears language in many contexts and learns to code the vocabulary they hear, establishing a link between the environment and the meaning of the words. The bonding of a caregiver with their child, which was crucial in the first year of life for language acquisition, and child-directed speech, are some of the best supports for healthy language development (Golinkoff et al., 2019).

A 2014 study found that parentese spoken to infants in a one-on-one context had a direct increase on the number of the infant's utterances (Ramirez-Esparza et al., 2014). This is significant because, while all language exposure, including incidental language, is important for language acquisition, only parentese, a specific type of spoken language marked by less grammatical complexity and increased pitch variation, spoken to the child one-on-one, showed a direct impact on the child's expressive language (Ramirez-Esparza et al., 2014). This study also found that this support of a child's utterances was most significant when they consistently experienced one-on-one communication in social contexts (Ramirez-Esparza et al., 2014).

Building on this idea, Roseberry et al. (2014) performed a research study to understand the mechanisms of social interaction that facilitate language learning. They set up three test scenarios. Toddlers were either placed in a room with an experimenter in person, an experimenter via live video conferencing, or a prerecorded video of an experimenter. In every situation, the experimenter introduced the child to a novel verb and taught the child the meaning.

After the training period, the child was tested to see if they could generalize the new word to a different situation.

Roseberry et al. (2014) found that the children's learning of new vocabulary was most successful in the context of social interaction, when the child was able to engage with the experimenter and the child's words and actions could shape the experimenter's response. They concluded that "socially contingent interactions are a powerful catalyst for word learning" (Roseberry et al., 2014, p. 965). They also found the amount of eye contact between the adult and child was positively correlated with word learning, strengthening the argument that social environments are irreplaceable for a child's language development (Roseberry et al., 2014).

While social interaction is critical for language development at any age, it is during toddlerhood that a stable social environment is particularly important. These stable social interactions and routines allow children to understand simple requests and build their vocabulary. For example, if a stranger asked a toddler to point to a calculator, the child would likely not understand. They don't know or trust the individual, and do not have any routine based social framework to know what a calculator is. Conversely, the same child would be able to correctly bring their mother a binkie for their younger sibling when the baby is crying. The difference is, this request is made by a trusted person and contains concepts that are familiar and routine to the child. The child has likely seen the mother grab a binkie for the baby numerous times before and knows that it stops the baby from crying. The familiar social routine of a binkie soothing a baby allows the child to not only respond to the request, but map those words to their semantic meaning. In this way, the social context is absolutely vital to language development.

The second year of life is marked by tremendous receptive growth as well as a quickly expanding vocabulary of words and phrases that are present in the child's environment and are

encountered over and over again (Rosselli et al., 2014). Toddlers are dependent on social relationships and stable routines to scaffold this language. An absence of routine, child-directed speech, or trust between the caregiver and toddler will inevitably hinder this process.

### ***Preschool and Beyond***

The ages of two to five years of age are widely regarded as the most rapid period of speech and language development in an individual's life. During this time frame, a typically developing child will expand their vocabulary from approximately 200 words to upwards of 2,000 words (Rosselli et al., 2014). At two years of age, they will produce short, two-three word telegraphic sentences (Rosselli et al., 2014). By five years of age, their sentences will become longer, more complex and adult-like (Rosselli et al., 2014). Where a two year old might say "Dog run!" a five year old may say "Look, mom! That dog is running away so fast!" Neurologically, the brain is equipped for language acquisition and growth at impressive rates from two to five, however after five, language acquisition uses similar processes at a slower rate.

By the age of two or three, children are often taken out of their home environment and spend large amounts of time in either daycares or preschools. These environments force children to expand the use of their language in order to communicate their wants and needs. For example, the child's mother might know that "ya-ya-ya" means that they want to watch their favorite TV show, but a childcare provider would not receive the same message. In this way, new social environments force children to acquire a richer vocabulary. Equally as significant, this new environment exposes the child to other people, toys, games, and social routines that were not present in their home environment. Because of this, children are constantly being bombarded with new vocabulary and new commands that help them move towards a robust vocabulary and correct sentence structure.

While language acquisition occurs most obviously and significantly in the first three to five years of life, it does not end when a child enters school. Throughout childhood and adolescence, children learn complex syntactic structure, figurative language, abstract concepts and appropriate social communication. Largely, this happens in the setting of formal education. Novel social settings from the school environment, especially those with more knowledgeable peers, allow children to learn complex language rules. Direct instruction of language parts and indirect observation of these concepts exposes children to sophisticated language structures. The school setting also gives constant opportunities for individuals to practice these new language skills and receive feedback on their performance.

The school setting consistently pushes children to apply their language skills to literacy and academic endeavors. There is a significant connection between language development and formal school curriculum. Prior to going to school, a child's vocabulary and language skills were largely dependent on people, things and events in their environment. In elementary school and beyond, however, this is not the case. New vocabulary is learned within the context of units beyond what can be seen and experienced in daily life. Understanding of these abstract concepts is dependent on appropriate language acquisition up until this point. For example, a science unit on the solar system will be difficult to comprehend for a child who has not acquired the vocabulary of "night," "sky," and "stars," or has not acquired directional concepts such as "far away" or "above." This illustrates the ways academic success and normal language development is dependent upon earlier language acquisition as well as education of topics beyond what can be experienced in the environment. Thus, risk factors for difficulty in acquiring language must be identified and addressed through early intervention for the best possible outcomes.

## **Language in the Brain**

### ***Language Processing Centers***

Classically, neuroscientists and speech-language pathologists have identified Broca's and Wernicke's areas as the two locations in the brain that are primarily responsible for understanding and producing language (Price, 2000). It is commonly understood that Broca's area is located in the frontal lobe, and controls language expression, while Wernicke's area is located in the temporal lobe, and is responsible for language comprehension (Price, 2000). However, this conception has come under recent scrutiny. A 2016 study by Tremblay and Dick found that the specific neural location of these language skills is not well defined and the neural complexity of language skills has been oversimplified. It is clear that numerous areas of the frontal and temporal lobes are the center of language acquisition and are supplemented by many other neural regions (Tremblay & Dick, 2016). This complexity of neural control is vital to appreciate as there are many areas of the brain that contribute to the complex process of language acquisition.

Recent research has emphasized that the quality, rather than the quantity, of language input is of paramount importance in the development of a child's language (Golinkoff et al., 2019). To illustrate, Romeo et al. (2018) found that there is a neural mechanical difference in brain activation based on the type of language exposure. Neuroimaging showed that a high number of conversational turns, not a larger volume of speech, between the parent and child resulted in a greater activation of the inferior frontal gyrus of the frontal lobe, Broca's area (Romeo et al., 2018). This difference in neural activation and conversational turn taking "could account for 23% of the total relationship between SES and children's language skills" (Romeo et

al., 2019, p. 707), strengthening the argument that it is experience, not ability, that explains the gap in linguistic and academic performance between social groups.

### *Executive Functions*

While it is clear that the successful development of Broca's and Wernicke's areas is paramount to mature typical language development, other areas of the brain play equally crucial roles in the process of language acquisition. Often overlooked is the role of the prefrontal cortex in the frontal lobe. The prefrontal cortex controls development of executive functions, which have been defined as "the decision-making and planning processes that are invoked at the outset of a task and in the face of a novel challenge" (Singer & Bashir, 1999, p. 266).

Executive functions, including attention, memory, judgment, cognitive flexibility, and inhibition are uniquely tied to language and language development. The ways in which executive functions impact language abilities are complex and still under research. Which executive functions contribute specifically to which specific language skills has yet to be discovered as organizing research methods to test these skills independently is difficult. However, considerable evidence has recently proven the executive function of domain-general inhibitory control skills broadly supports a children's syntactic ability (Kaushanskaya et al., 2017). A meta-analysis by Pauls and Archibald (2016) reviewing executive functions in children with specific language impairment (SLI) found similar connections. They found delays in inhibition control as well as cognitive flexibility were present in children with SLI. Understanding of the intricacies of the prefrontal cortex's involvement in language skills is still developing but the relationship between the two is clearly established.

In addition to inhibitory control, Smolak et al. (2020) studied the relationship between attention and other cognitive deficits and developmental language disorders (DLD). In



comparing sustained attention, working memory, and language tasks in children with DLD and typically developing children (TLD), they found that attention skills significantly impacted working memory, which in turn, impeded language development. DLD children completed memory tasks with consistently less accuracy than their TLD peers. They found overall “narrative language, narrative language production, and working memory ” to be significantly associated with sustained attention (Smolak et al., 2020, p. 4103). Significantly, they concluded that this relationship may be bidirectional. The study found that “limitations in sustained attention and/or working memory result in delayed language development, and language deficits, in turn, result in reduced performance on domain-general cognitive tasks” (Smolak et al., 2020, p. 4105). This illustrates both a potential cause, and effect, of language disorders. Executive function is a key indicator and predictor for language skills.

Children who grow up with financial hardship are uniquely at risk for poor executive functioning. There is clear evidence that chronic poverty plays a role in the executive functioning of children by four years of age (Raver et al., 2013). In this study, even after maternal demographics and poverty related hazards were accounted for in the data analysis, financial strain was still shown to be a factor in executive function (Raver et al., 2013). Deficits in development of executive function skills in the prefrontal cortex have clear and detrimental effects to language development, once again placing children from low socioeconomic status at a disadvantage. This bidirectional relationship between executive function and language development however, provides an avenue for meaningful therapy approaches to support these children.

### *Neurotransmitters*

None of the functions in Broca's and Wernicke's areas or the prefrontal cortex are possible without neurotransmitters. Neurotransmitters are the chemical messengers of the brain, allowing signals to travel from one neuron to another. When a neuron sends a signal, neurotransmitters are released from the axon terminal, and travel across the synaptic cleft to awaiting receivers on the neighboring neuron. The neurotransmitters excite or inhibit the receiving neuron to send the chemical signal onto the next neuron. This process is the foundation for all thought, action, and sensation.

Normal balances of these chemical signals allow learning and development to take place in a predictable and successful manner. Normal levels of neurotransmitters regulate sleep, feelings of pleasure, reaction times and survival responses. However, environmental or psychological disorders can cause these everyday interactions to become very harmful. It is these imbalances that SLPs must be aware of in order to promote healthy language acquisition.

One example of a potentially harmful neurotransmitter balance that can affect language development is a lack of oxytocin. Oxytocin production produces feelings of enjoyment and attachment (Scatliffe et al., 2019). It is the neurological basis for bonding between a child and caregiver. The vitality of bonding for language development has already been discussed in this paper. The caregiver/infant connection provides the motivation for an infant to tune their perception and mental energy to the caregiver by directing the child to “preferentially select species-specific social stimuli to form dyadic attachments” (Scatliffe et al., 2019, p. 446). Increased oxytocin levels in parents and infants are seen after skin-to-skin contact and have been shown to facilitate social attachment (Scatliffe et al., 2019). The neurotransmitter, oxytocin, is vital for language development as it neurologically creates the social relationships that language

development is contingent upon. It can be then gathered that a lack of attachment or care to facilitate early bonding will result in low levels of oxytocin and damage an infant's ability to learn language.

While low levels of oxytocin can be damaging, high levels of cortisol, another neurotransmitter, has the potential to hinder cognitive functioning. This illustrates the equilibrium that must be maintained for optimum language learning. Cortisol floods the nervous system in response to stressful situations, allowing the body to adequately defend itself from the threat. Continuous activation of the cortisol awakening response, however, can have damaging effects to the nervous system. High amounts of cortisol have been associated with worse memory and lower amounts of gray matter in the frontal lobe, specifically in the prefrontal cortex (Blair & Raver, 2016; Echouffo-Tcheugui, et al., 2018). Excess amounts of cortisol have also been shown to reduce the volume of the hippocampus, which creates and stores memories, (Bremner, 2006) and an increase in the volume of the amygdala, the fear center of the brain (Fowler et al., 2021). This means, over time, situations will need to be less and less stressful to trigger the same fight or flight response of the amygdala, creating a devastating cycle of stress, fear, and neural damage. Overproduction of cortisol inhibits the function of executive functions and other 'excess' brain activity in order to allow the body to devote as much energy as possible to escaping the stress inducing situation. This mechanism was designed for an individual's survival but can have significant negative effects on learning. Memory, executive functioning and stress control are essential skills for language development. The impact of cortisol means that a child constantly placed in distressing environments will have less cognitive capacity to acquire language than their peers.

While there are many other neurotransmitters that could be discussed, oxytocin and cortisol are some of the most applicable to the scope of this paper. These neurotransmitters illustrate the principle that environmental variables impact the function of the brain. While language development is often viewed as only a cortical task, neurotransmitters are the link to the limbic system. The subcortical structures of the brain house love, fear, anxiety, and attachment. Relationships between the cortex and the limbic system are complex and run by neurotransmitters. Because of this, variations from the chemical equilibrium can have damaging effects on the cognitive abilities of children. Special attention must be paid to the upbringing of a child to ensure that neurotransmitters are supporting language acquisition and not hindering it.

### **Poverty**

In 2020, it was estimated that around 16% of children in the United States were part of families living below the poverty line (The Condition of Education, 2022). One in four children under the age of four live in poor families (Jiang et al., 2015). Importantly, the impacts of poverty are complex and go beyond a lack of money. Low socioeconomic status (SES) has been tied with lower parental education level (Bradley et al., 2001), less access to educational experiences, books and toys (Bradley et al., 2001, Neuman & Moland, 2019), poor health (Pierre et al., 2022; Spencer et al., 2013) and toxic stress (Duncan et al., 2016). All of these factors, whether biological or environmental, play a significant role in the development of the child. While low socioeconomic status is not the cause of poor language development or academic underachievement, there are distinct trends in achievement following economic lines that cannot not be ignored.

Poverty is a one dimensional measure of economic status. The federal poverty line is determined by the Department of Health and Human Services each year and sets an annual

income criterion based on household size. For example, in 2022, for a family of four, the federal poverty line is defined as an annual income of less than \$27,750 (Federal Poverty Level). While the federal poverty line and annual income is an important measure of a child's home environment, it may fail to capture the complexity of the issue. Socioeconomic status (SES) is a dynamic measure that goes far beyond financial wealth.

### *Poverty and Stress*

Conditions of poverty have been significantly linked with high levels of stress. Families that live in poverty are more likely to live in homes that are structurally deficient, noisy, and crowded (Duncan et al., 2016). These homes are often in neighborhoods that have high levels of violence and crime (Duncan et al., 2016). Children living in poverty are also often exposed to poor air quality and industrial emissions (Duncan et al., 2016). External living environments such as these intensify feelings of stress. Many people can relate to the feeling of peace when they return to a safe, warm, clean, home after being away for a while. Suddenly, they are less irritable, more able to focus on cognitive tasks, and able to care for people around them. This noticeable relief illustrates the relationship between physical environment and mental health. Individuals who live in poverty are continuously exposed to external stressors such as inadequate heating and street noise, exacerbating their stressful circumstances (Duncan et al., 2016).

Internal and interpersonal stressors of poverty can cause relational conflict, less nurturing parenting and atmospheres of hostility, depression, and isolation (Duncan et al., 2016). It is clear that the psychological impact of poverty on childhood development goes far beyond financial need and involves external factors of living conditions and exposure to environmental dangers, as well as the strain on interpersonal relationships. Children living in impoverished environments

for extended periods of time are at risk for toxic stress which is detrimental to a child's overall development (Francis et al., 2018).

### ***Poverty and Educational Resources***

Poverty places strains on a family's ability to obtain educational toys, resources, and books to support their child's development. Families living paycheck to paycheck often simply cannot afford to buy books and safe educational toys. However, even if a family had the resources, Neuman & Moland (2019) found that these resources are not available in low income neighborhoods. Neuman & Moland (2019) analyzed six urban neighborhoods across the US and categorized them as borderline/middle income or low income. They found "stark disparities in access to print for those living in concentrated poverty" (p. 216). In analyzing two nearby neighborhoods in the same city, the researchers found that there were significantly more books available for children in the high income neighborhood than the low income neighborhood. Their findings summarized that the neighborhood a child grows up in significantly impacts their access to print. Low-income neighborhoods are not equipped with the print availability necessary to support children's literacy needs. Low SES impacts a family's ability to financially afford, as well as access, educational resources that support the language development and literacy of young children.

While Neuman & Moland's (2019) study is very recent, it unfortunately reveals truths that have been observed and studied for decades. In a comprehensive analysis of the home environments of the children in the United States, Bradley et al. (2001) found that poor families were much more likely to have few educational toys and books in the home than non-poor families. This translated to notably less reported parent-child read aloud time and direct, positive interaction between the parent and child (Bradley et al., 2001). The access of educational toys

and books is meaningful because they facilitate interactions between the parent and child. Books are an excellent facilitator of language and promote bonding. Not having access to educational books and toys is another way childhood poverty places children at a disadvantage in learning language.

### ***Possible Effects of Poverty on the Brain***

A growing body of research is finding significant negative neurological implications of toxic stress on the developing brain. Multiple studies have found that children in poverty have less gray matter than is developmentally appropriate. Hair et al. (2016) looked at the brains of 389 children and found reduced gray matter in the frontal and temporal cortices as well as the hippocampus of children in poverty. The significance of the reduction of gray matter volume was found to be driven by the extremity of poverty. Families at 150% of the poverty line had children with 3% to 4% less gray matter than the developmental norm. Blair and colleagues (2016) discovered that “For children in families at 100% of poverty or below, reductions in these regions were 8% to 9% below developmental norms” (p. S30). Significantly, Hair et al. (2016) found that these structural differences accounted for up to 20% of the achievement gap on cognitive assessments.

A similar study examined the relationship between parental education as well as family income on brain structure. They found that family income and cortical surface area are positively correlated (Noble et al., 2015). Interestingly, this relationship was found to be logarithmic. On the low end of the socioeconomic status spectrum, similar increases in family income were associated with more increase in gray matter, or made more of a positive impact on the child’s development, than the same increases in income in wealthier families (Noble et al., 2015). Higher parental education was also found to be correlated with improved brain structure in

numerous regions of the brain including the left inferior frontal gyrus, Broca's area (Noble et al., 2015). This means that for children living in poverty, the areas of their brain specialized for learning language are structurally different.

Compounding the effects of stress in poverty are nutritional health risks of food insecurity and poor diet. According to the USDA, in 2020, 14.8% of households with children were food insecure (Hales & Coleman-Jensen, 2022). Food insecurity is defined as not "having access at all times to enough food for an active, healthy life." (Hales & Coleman-Jensen, 2022, p. 1). Over the past few years a possible trend has been noted that food-insecure households are at a higher risk of obesity. A recent meta-analysis found that while the relationship between food-insecurity and obesity is complex, there is evidence to link food insecurity and increases in BMI (Pierre et al., 2022). This co-occurrence of under and overnutrition has detrimental effects on the overall health of children in poverty. Nutrition has been found to play a critical role in supporting functional neurological changes that help determine cognition (Polverino et al., 2021). Proper nutrition and strong overall health are vital to the thriving of a child. Food insecurity is one more aspect of poverty that can hinder a child's successful development.

### ***Poverty and Language Learning***

Levine et al. (2020) recently underwent research to summarize the effects of all of these factors of poverty and explain the gaps in language skills along SES lines. They went beyond Hart and Risley's (1995) research that looked only at vocabulary skills, to gather a more complete picture of the language skills in children. Specifically, the researchers collected data on vocabulary, syntax, and language processing skills. This research demonstrated that SES impacts not only experiential language skills like vocabulary, but also the process of learning language as a whole. Their findings showed that low SES students performed "significantly worse" than their



mid-high SES peers on all three language skills (Levine et al., 2020, p. 124). These disparities were identified by age three, and by age five, low SES students were one to two years behind their peers (Levine et al., 2020).

The significance of this study is that not only does low SES have a significant impact on the language performance of children, it impairs their language learning processes, making it more difficult to make meaningful gains in acquiring language. Their conclusion is that low economic standing impacts academic readiness and educational experiences. This finding holds across children with different ethnic and racial backgrounds, and has detrimental effects on the health and development of children in poverty. Combined, these factors help to explain the stark disparities seen in the language skills of children from low socioeconomic status compared to their higher socioeconomic status peers.

## **Discussion**

### **Summary of Findings**

This literature review focused on language acquisition and brain processes, as well as the complex reality of poverty. The purpose of this review was to use this knowledge to draw conclusions as to what should be done to best support students from low socioeconomic backgrounds to minimize the effects of poverty on language development and to better treat existing speech and language delays in an informed and empathetic manner.

The first topic of review was the typical process of language acquisition. It was shown that language acquisition begins in the womb as the child becomes familiar with the languages present in their environment, their mother's voice, and the intonation patterns of speech. These receptive skills prepare the child for life outside the womb. To illustrate, familiarity with the mother's voice promotes the vital connection of bonding between the child and caregiver.

During the first six months of a child's life the sensory areas of the brain mature, eliminating unused synapses and strengthening the neural connections present in the child's environment. The maturation of the primary auditory cortex gives infants a reliable way to experience and learn about the world around them, including spoken language. Additionally, the first year of life is marked by a progression from vocal play, to babbling, and to the milestone of their first word.

Meaningful social interaction and safe, predictable, routines scaffold the child's understanding of language during the second year. Children begin to express their wants and needs through language and respond to verbal requests from caregivers. Once a child leaves the home environment and begins to attend preschool or daycare, motivation for language acquisition comes from a need to communicate with unfamiliar conversation partners about topics not necessarily present in the child's home environment. This need fuels the development of complex sentence structure, grammatical markers and descriptive language.

It is unwise, and almost impossible, to understand language development without an understanding of neurologic development. There are many neurological principles that can support or hinder the development of language skills. For example, damage or underdevelopment of Broca's and Wernicke's areas will have detrimental effects to a person's language abilities. However, language processing is not limited to Broca's and Wernicke's areas. The neurotransmitters of oxytocin and cortisol also play crucial roles in allowing the brain to learn language. Oxytocin promotes bonding between the child and caregivers, reinforcing the social relationships that language is dependent on. Because of this, oxytocin minimizes the secretion of cortisol, a neurotransmitter that, in large quantities over extended periods of time, has damaging effects on the brain.

Lastly, recent research has begun to understand the role of the prefrontal cortex and executive functions as vitally important for language development. Executive functions have a reciprocal and complementary influence on language. Language skills are necessary for the higher order cognitive function of the prefrontal cortex and strong executive functioning skills have been shown to improve language skills. The contributions of executive functions include the ability to inhibit competing stimuli, focus attention, and to reason.

As discussed in the review, poverty is a known risk factor for language disorders, inhibiting development of language and the functioning of the brain. Numerous correlational studies have shown, time and time again, that low socioeconomic status is associated with poor language development and academic performance. Beyond financial need, toxic stress, a lack of access to educational resources, and poor nutrition, compound to create an environment that makes language acquisition much more difficult. These environmental factors alter the development of the brain through higher levels of cortisol production, less gray matter, and less neuronal activation.

Further, a key finding of studies of poverty and language is that there is a contrast between the language environment of children from low socioeconomic backgrounds and their peers' language environments in middle and high socioeconomic backgrounds. Overall, children in poverty are exposed to less incidental language, child-directed speech, and conversational turns with trusted caregivers. This creates a system that not only impacts a child's vocabulary, but changes their brains and hinders their ability to learn language skills at all.

From these studies conclusions can be drawn as to why socioeconomic status has such clear and consistent impacts on developmental processes. Simply, language development is impacted by poverty because poverty changes the brain. Brain development is dependent on

environmental stimuli, and poverty creates a unique combination of damaging environmental realities to a young brain. Bonding, language exposure, safety, and nutrition are expected by the developing brain and required for complete and successful development. All of these may be compromised by the realities of poverty. To illustrate, financial strain may hinder a caregiver's ability to physically provide for and emotionally connect with their child. Conditions of childhood poverty are consistently shown to result in less quality language exposure. Importantly, finances do not guarantee a child's language outcomes. Families in poverty are not inherently less capable of raising their children well. Poor does not equal low performing. However, low socioeconomic status is one measure that denotes a high likelihood of children experiencing many challenges to language development.

### **Limitations and Future Research**

There are limitations to the present study. One limiting factor is the scope of the literature review represents only studies conducted in the United States relevant to language development and poverty. For this reason, global conclusions and factors are not considered. This research also did not outline or discriminate between varying levels of financial need. In many ways, this study took the case of a stereotypical child from a poor family who faces all the concomitant factors that can arise with poverty, and explored what the current research would say the impact of that situation would have on language development. Future research should look to pull apart the complexities and levels of poverty and the unique experiences that come with it to understand where exactly the dangers lie. This would allow speech-language pathologists to have a more complete understanding of what level of financial need truly poses a concern for language development so that proper services can be given. The design of the present research also prevents any conclusions to be drawn as to the weightiness of specific factors like

neighborhood, nutrition, family structure, or access to educational resources. Future research should look to control many of these variables to understand how each one plays a role in language development.

### **Proposed Solutions**

Analysis of the present research suggests several possible avenues that might reduce the effects of poverty on language development. When considering the timeline of language acquisition beginning in the first year of life, the discrepancies in language development between socioeconomic lines, and the serious implications of poverty on brain development, solutions begin to emerge. A key to supporting the language development of children from low income households is to start as early as possible, before these delays have a chance to rise to the surface.

#### ***Early Intervention***

While the future for many children growing up in a cycle of poverty may appear bleak, there are solutions to minimize the barriers of financial hardship. Many studies have shown that early intervention has the potential to stop delays in language development before they occur (Ramey & Ramey, 2004; Romano et al., 2021). By providing direct language instruction and quality social interaction, speech-language pathologists can support the language development of a child in poverty.

Neurodevelopmentally, the process of pruning supports this idea. The brain is most responsive to the environment and able to learn at younger ages, before pruning is complete. After the timeline has passed for pruning specific areas of the brain, changing that area of the brain is much more difficult. For example, Broca's area matures by late elementary school (Rosselli et al., 2014). This means that the majority of a child's expressive language skills are typically acquired by age eight. If a child has not experienced certain language characteristics

before that area of the brain matures, the neurologic structure will not be there for the child to build upon later. Thus, teaching the present progressive tense to a high schooler will be much more effortful than teaching an elementary school student. This principle of synaptic pruning provides, neurologically, the rationale for enriching a child's early language learning environment. Rich and robust language environments expose the child to large amounts of language and thus, those synapses are preserved.

This may be one reason why a quality education, including preschool, has long been regarded as the great equalizer, able to level the playing field for children from all different backgrounds and socioeconomic strata. A 2004 study sought to prove that this is true. Ramey and Ramey (2004) performed a study by dividing infants from low income, high risk backgrounds, into two groups. The control group was given nutrition, health care and social services. The treatment group was given the same services as well as a high-quality, complete, preschool early intervention program. Their study results found that the treatment group was more developmentally and intellectually successful across all areas measured. This study widely supported the benefit of early education for children from backgrounds of poverty (Ramey & Ramey, 2004).

A recent study by Romano, Eugenio and Kiratzis (2021) looked specifically at the effectiveness of a language intervention curriculum in childcare centers. They also believed early intervention to be the key to supporting language development. The researchers trained childcare providers to use strategies such as modeling and expansion to increase the toddler's use of gestures for communication. These strategies enriched the linguistic environment in which the children were learning and contributed to greater interactions between the caregiver and child. The childcare providers reported that the toddlers showed improved communication skills after

implementing the language intervention (Romano et al., 2021). This study adds to literature supporting the implementation of early intervention to improve the language development of children.

### ***The Need for SLPs***

Importantly, it is not clear that general preschool education, even with language interventions, is sufficient to bridge the gap caused by economics on language acquisition. A 2008 study evaluated the effectiveness of the Language-Focused Curriculum (LFC) on the expressive language of at-risk preschool children (Justice et al., 2008). This study sought to understand the extent to which preschool teachers are able to support the language development of low-income children on their own. Classrooms were randomly assigned to be control classrooms, continuing with the current curriculum, or treatment classrooms, implementing LFC. Interestingly, the results of this study found that LFC classrooms improved the expressive language of preschoolers only under-highly specific circumstances and were overall, not significant compared to the control group (Justice et al., 2008). The researchers concluded that one of the reasons for the lack of significant improvement of language skills, among other factors including attendance of children, was the lack of education and experience of the preschool teachers on language development (Justice et al., 2008). They concluded that the experience and education of speech-language pathologists simply cannot be replaced by a general education teacher or childcare provider.

A large body of literature has proven the effectiveness of early intervention in combating the negative effects of the experience of childhood poverty on language development. Childcare centers, preschool programs and early elementary schools play vital roles in exposing children to complex and unique vocabulary necessary for language acquisition. However, these general

education programs are insufficient in providing the services needed by many of these children. Speech-language pathologists are equipped with the knowledge and training to provide the early intervention services needed by high risk children.

The services of speech language pathologists are needed. However, Kollia et al. (2018) found that for children in poverty who qualify for treatment from SLPs, speech and language services are currently not being received. Kollia and colleagues (2018) evaluated the effectiveness of speech and language screening of preschool children enrolled in Head Start programs. Head Start is a federally supported preschool program for low-income children. Kollia et al. (2018) studied 139 children who were screened for speech and language disorders. Of these, 60 children received failing scores in the language screening and were recommended to receive a full evaluation and 19 others were recommended a rescreen for language abilities (Kollia et al., 2018). This high number of referrals supports the conclusion that speech and language services are desperately needed by low-income preschool children. Shockingly, it was unclear whether or how follow up was communicated from the Head Start program to SLPs and to families. The researchers were not able to be certain whether or not families were aware of their child's screening results and whether a failed screening led to a comprehensive evaluation or additional services (Kollia et al., 2018). This study proves that speech-language pathology services are needed, and not effectively being accessed, by children in poverty.

### ***A Shift in Framework***

The model of early intervention through speech-language pathology is traditionally only a few hours a week for birth to three-years of age. One of the key differences of the early intervention framework, versus general preschool education, is the role of families. The goal of early intervention is primarily to train parents and caregivers. Speech-language pathologists



understand that language acquisition is a byproduct of meaningful social interactions. Thus, by training caregivers to interact with children in a way that supports their development, children are receiving intervention from individuals whom they spend many hours a week with, and trust. The factor of social relationships and sheer amount of time makes parent training a more effective strategy for therapy than a traditional education model. Additionally, in parent training, families are equipped and feel more confident and competent in supporting their children. Speech-language pathologists serve primarily as a coach and cheerleader for the caregiver rather than a teacher for the child.

It is clear from Kollia et al. (2018)'s study that there is an issue of access to early intervention services, specifically for low income families, that needs to be addressed. Instead of preschools and speech-language pathology services operating independently, greater child progress is likely to be seen if they were combined. The infrastructure and cultural systems are already established to ensure children are able to access some sort of pre-kindergarten education. The question becomes how can the benefit of preschool programs be maximized to support children in poverty with speech and language needs? Speech-language pathologists must make themselves an integrated part of the preschool system by continuing the early intervention framework, used from children birth to three years old, into preschools. The Individuals with Disabilities Education Act (IDEA) Part B mandates that children aged three to twenty-one years old receive the appropriate special education services provided by the federal government. This includes children with speech and language disorders. The proper treatment of these disorders is only possible if there is a higher number of speech-language pathologists employed to serve this preschool population specifically.

SLPs must also shift the way in which speech and language services are provided in preschools from the traditional pull out method to incorporating an early intervention framework. It is likely that this shift will empower caregivers to feel competent educating and supporting their child's development. A parent training framework would encourage caregivers to engage and interact with their children in significant ways that will decrease the negative impact of socioeconomic status.

Overcoming the barriers that poverty places on language development is best done early in a child's life, before deficits have the opportunity to form. Ideally, every family, regardless of socioeconomic status, would receive in depth education on the importance of child directed speech, quality language exposure, executive functions, and bonding. However, this would be a costly and time consuming endeavor. It would be most beneficial to extend the framework of early intervention into preschools by ensuring all children and families in poverty receive services from licensed speech-language pathologists to support their development.

### ***Expansion of Qualification***

The question then becomes, what requirements must be met for a child to be eligible for early intervention services? Laws outlining eligibility vary across the country. Generally, they require that a child be displaying a significant developmental delay, or have a health or physical condition that puts them at risk for developing a delay, in order to receive early intervention services. Based on the results of this literature review, in order to ensure the best possible outcomes for children experiencing childhood poverty, socioeconomic status should be another avenue for eligibility for early intervention services. It has been clearly shown that low-socioeconomic status is highly correlated with poor outcomes in speech and language

development based on environmental and neurological factors. Thus, financial status should be a physical condition that grants access to the proven support of early intervention.

One way to quantify this risk for later developmental delays in children experiencing poverty is through screening for Adverse Childhood Experiences (ACEs). Adverse Childhood Experiences scale measure experiences of childhood trauma such as physical, emotional and sexual assault as well as various indicators of household dysfunction. Each event is noted as a point on the ACE scale. High ACE scores are shown to cause detrimental effects to an individual's health and overall development. Kerker et al. (2015) found that for each ACE an individual had, they showed a 32% increased risk for developing a mental health condition and a 21% increased risk for a chronic physical health condition. In this way, ACE scores can quantify the risk for toxic stress and other developmental problems. High ACE scores are significantly linked with poverty (Walsh et al., 2019). Because of this, ACE scores are a great starting place for identifying children in poverty who face significant barriers to language acquisition, and would benefit from early intervention services. Currently, many states wait for these predictable delays to rise to the surface before taking action. Expanding the access and eligibility for early intervention is supported by research and should be enacted to ensure the highest quality of care for children and families.

### ***Holistic Approach to Therapy***

Looking beyond the early intervention framework and the eligibility of services being provided by SLPs to students from low socioeconomic strata, it is also critical that careful consideration be given to how services are being provided. Poverty is a complex and multifaceted issue that has implications far beyond the financial. Poverty is not just a lack of resources, it is a lack of opportunities. Supporting families in poverty requires an understanding

of the nature of poverty and the way it impacts the individual. In order for children to make improvements in language development, they must feel safe, cared for, and respected. This is a principle that transcends race, gender, or class divides. Learning only happens when an individual feels emotionally and physically safe. For this reason, it would be entirely unhelpful for an SLP to come to a meeting with a family and only talk about speech and language needs, therapy interventions, and milestones if they had not first taken the time to know the family, know the child, and understand what their life is like. This marker of cultural humility is a trait that separates great SLPs from good SLPs.

SLPs must advocate for the child and family and care for them as individuals. This may look like ensuring families have access to transportation to and from IEP meetings. It may look like providing information for free and reduced lunches or local food banks. It may look like collaborating with a principal to find safe, affordable housing for a family. Importantly, this is not the sole role of the SLP, but should be a collaborative effort with other educators and providers. However, according to the American Speech Language Hearing Association Scope of Practice, SLPs are responsible for “enhancing or improving general well-being and quality of life” to the extent that it reduces the development of communication disorders for those deemed “vulnerable or at risk” (American Speech Language Hearing Association, 2016). It is clear that supporting the home life of a child in poverty fits under this description of improving the general well-being of vulnerable populations in order to reduce the development of communication disorders. When general well-being is supported, speech and language gains will naturally follow.

## **Conclusions**

The relationship between language development and poverty is complex and difficult to untangle. While this relationship is variable and unique to each individual child, the literature is clear that low socioeconomic status is a significant risk factor for language disorders. Poverty negatively impacts language development because poverty negatively impacts the brain. Quality education is not sufficient in bridging the gap. It appears the key to reducing the negative effects of poverty on the brain is through quality early intervention services. These services should combine caregiver training on the importance of bonding and language interaction as well as direct language therapy interventions from speech-language pathologists. Poverty is not a sentence for poor language skills and academic achievement, but it is a warning sign for speech-language pathologists to take seriously and provide the services necessary to allow every child to thrive and reach their full potential.

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