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Influence of the Home Linguistic Environment on Early Language Development

Natalie H. Brito[1]

Abstract

Approximately 15.5 million children in the United States (21%) live in impoverished households, with child poverty rates highest among Black, Hispanic, and American Indian children. Growing up in a socioeconomically disadvantaged environment is associated with substantially worse health and impaired psychological, cognitive, and emotional development throughout the life span. Socioeconomic status (SES) has a robust association with language development—across different language outcomes, across different ethnic and language-exposure groups, as well as within these groups. This review examines pathways for SES disparities in language skills emerging early in development and contributing to later gaps in school readiness and academic achievement.

Keywords

language, socioeconomic status, bilingualism, early experience

Tweet

The quality of the home language environment is vital for early brain development and later academic achievement.

Key Points

- Among more economically developed countries, the United States has one of the highest levels of childhood poverty, with one in five children living in poor households.
- Overall, children from lower socioeconomic status (SES) homes tend to experience less linguistic, social, and cognitive stimulation than children from higher SES homes.
- Differences in children's language outcomes trace, in part, to SES-related differences in language input at home.
- Language development for both monolingual and bilingual children directly relates to the quantity and quality of speech they hear in their language(s).
- Children from dual-language homes receive reduced linguistic input to each of their languages; therefore, bilingual children from lower SES backgrounds may be at a greater risk for language delays.
- Substantial within-SES variability in the home language environment significantly influences children's language development; policies and interventions must accommodate children from a range of cultural and linguistic backgrounds.

Introduction

Among economically developed countries, the United States has one of the highest levels of childhood poverty, with more than one in five children (approximately 15 million) living in poor households. Very young children are even more susceptible to poverty, with one in four infants, toddlers, and preschoolers currently living in impoverished environments. In addition, poverty rates for children of color (Black, Hispanic, and Native American) are twice as high than their age-matched peers from White or Asian households (U.S. Census Bureau, 2015).

Poverty plays an instrumental role in influencing development. Although poverty is oftentimes synonymous with income level, childhood poverty is a multidimensional experience. Understanding the wider effects of social status on development can disentangle the many pathways for impoverished environments to negatively impact the developing brain. Socioeconomic status (SES), typically characterized by family income, parental education, occupational prestige, or neighborhood quality, predicts children's cognitive ability and later academic achievement. SES disparities in cognitive outcomes appear throughout the life span (Bradley & Corwyn, 2002), as early as the

[1]Columbia University Medical Center, New York, USA

Corresponding Author:
Natalie H. Brito, Columbia University Medical Center, 1051 Riverside Drive, Room 4919-C, New York, NY 10032, USA.
Email: nhb2111@cumc.columbia.edu

second year of life (Fernald, Marchman, & Weisleder, 2013; Noble, Engelhardt, et al., 2015).

Socioeconomic disparities early in life may be more impactful than adversity faced later in life. Family income differences in early childhood are a much more significant predictor of academic achievement than income differences during adolescence: The increased neuroplasticity available early in life may increase vulnerability to environmental experiences during this period. The largest effects of SES emerge for children who endure a longer period of economic adversity or who live in households at or below 50% of the poverty threshold (Duncan & Magnuson, 2003).

Although SES differences appear throughout the brain (for review, see Brito & Noble, 2014; Hackman & Farah, 2009), specific cognitive domains such as language (left inferior frontal and fusiform gyri), executive functioning (prefrontal cortex), memory (hippocampus), and social-emotional processing (amygdala) have garnered the most attention (Brito & Noble, 2014; Hair, Hanson, Wolfe, & Pollak, 2015; Noble, Houston, et al., 2015; Noble, Wolmetz, Ochs, Farah, & McCandliss, 2006).

A cognitive neuroscience approach to poverty on development contributes to decades of social science research by illuminating the timing and pathways through which SES shapes early brain and cognitive development. For example, a large representative sample of children (ECLS-B: Early Childhood Longitudinal Study Birth Cohort) found SES disparities in cognitive measures (Bayley Scales of Infant Development), by 9 months of age; this difference widened by 24 months of age (Halle et al., 2009). Using electroencephalography (EEG), baseline brain activity differed by SES (family income, maternal occupation) in 6- to 9-month old infants (Tomalski et al., 2013). Infants from lower SES homes demonstrated lower EEG power in frontal brain regions. Disparities in neural circuitry may be evident before behavioral differences emerge; that is, neural markers may provide early indicators of differential cognitive trajectories.

In addition, differentiating between different neural and cognitive systems may help to explain distinct causal pathways. The largest study to date investigating SES and brain structure (Noble, Houston, et al., 2015) recruited 1,099 children and adolescents from families representing a wide range of socioeconomic backgrounds. Both parental educational attainment and family income accounted for differences in cortical surface area across the brain, but particularly in areas supporting language and executive functions.

Although poverty's effects are widespread, the remainder of this review concentrates on SES impacting language development. Language exposure and use generate an intense, sustained experience that engages multiple regions of the brain (Friederici, 2011). Early language ability is one of the best predictors of school readiness and later achievement (Burchinal, Pace, Alper, Hirsh-Pasek, & Golinkoff, 2016; Hoff, 2013).

SES and Early Language Development

Associations between SES and later language outcomes are robust across multiple measures. Also, associations between SES and early language occur both within and across different ethnic groups. This is important as SES and minority-group status are frequently confounded (Hoff, 2006). Furthermore, although differences in verbal abilities are impacted by genetic factors (Oliver & Plomin, 2007), the contribution of early experience is undeniable. For example, when examining language development in children from the same family, environmental factors are better predictors of language problems in twins than genetic factors (Oliver, Dale, & Plomin, 2004).

For children from higher SES families, the majority of the variance in cognitive ability is attributed to genetics (Turkheimer, Haley, Waldron, D'Onofrio, & Gottesman, 2003). In contrast, the opposite finding emerged for children from lower SES families, with 60% of the variance in cognitive abilities accounted for by the shared environment and almost none of the variance accounted for by genetics. Evidently, adverse environmental experiences limit children's developmental potential. Past studies link SES and IQ (Scarr, 1981), but language skills, specifically vocabulary, are a large component of most IQ tests. These SES-related differences in IQ may be a consequence of SES disparities in language development instead of variations in genetic intelligence.

By school entry, children from higher SES homes outperform their age-matched peers from lower SES homes on standardized measures of language comprehension and production (Ginsborg, 2006). In the federally initiated Comprehensive Child Development Program (CCDP), U.S. children living in poverty averaged 15 months behind the national norm on receptive vocabulary by the age of 5 years (Layzer & Price, 2008). As disparities in language skills magnify over time, 50% of children in poverty are not reading at basic proficiency levels by the fourth grade (National Center for Education Statistics, 2013).

SES disparities in language skills may already be present in infancy. A sample of 189 infants was tested on developmentally appropriate measures of memory and language (Noble, Engelhardt, et al., 2015). Consistent with past studies demonstrating socioeconomic disparities in early language skills by the age of 2 years (Fernald et al., 2013; Hoff, 2003; Rowe & Goldin-Meadow, 2009), SES disparities in language emerged between 15- and 21-months of age, with children of highly educated parents scoring higher in both language and memory than children of less educated parents. Characteristics of the home environment, including literacy resources and parent–child interactions, partially accounted for disparities in language, but not memory.

SES-related differences in early language skills may reflect early developmental differences in real-time language processing efficiency (speed of listening to and comprehending linguistic input). Using the looking-while-listening (LWL) task, infants viewed two pictures of familiar objects while listening to speech labeling one of the pictures (Fernald et al., 2013). The child's video-recorded gaze patterns were analyzed frame-by-frame to determine looking accuracy and reaction time. Children from lower SES families were less efficient in real-time processing of labels (i.e., lower accuracy and slower reaction time to the correct picture) than their higher SES peers, corresponding to a 6-month gap. Moreover, processing efficiency correlated with vocabulary, so children with less efficient processing also had lower vocabulary scores (Fernald et al., 2013).

Beyond comprehension and vocabulary, SES disparities emerge for various language skills: phonological awareness, gestures, grammar, and literacy (Hirsh-Pasek et al., 2015; Lee & Burkam, 2002; McDowell, Lonigan, & Goldstein, 2007; Rowe & Goldin-Meadow, 2009). SES differences in brain structure and function relate to numerous language outcomes during childhood (see Brito & Noble, 2014; Hackman & Farah, 2009). For example, children from lower SES homes demonstrate less lateralization in the left inferior frontal gyrus (LIFG) during a phonological awareness task than their higher SES peers (Raizada, Richards, Meltzoff, & Kuhl, 2008); other studies link left-hemisphere lateralization to higher language skills (Emerson, Gao, & Lin, 2016). Children's SES background moderated the link between phonological awareness and brain activity in areas associated with reading (left fusiform and perisylvian regions; Noble, Wolmetz, Ochs, Farah, & McCandliss, 2006).

How early in life could these brain–behavior relationships to language begin to develop? As stated, infants from lower SES homes showed lower frontal baseline EEG power than those from higher SES homes (Tomalski et al., 2013). The SES effect was specifically in a frequency band (gamma) linked to later cognitive and language abilities (Benasich, Gou, Choudhury, & Harris, 2008; Brito, Morales, & Noble, 2016; Gou, Choudhury, & Benasich, 2011). At birth, full-term infants showed no significant associations between EEG power during active sleep and SES variables (i.e., parental education, family income; Brito, Fifer, et al., 2016). Individual differences in EEG power in gamma frequencies within the frontal and parietal regions of the brain, however, correlated with memory and language skills at 15 months of age. Altogether, SES disparities in brain activity may arise during the postnatal experience, and variations in gamma activity may contribute to individual differences in cognitive trajectories, independent of SES.

Although studies link SES and language skills, less is known about the precise pathways through which SES shapes language development. Many possible mechanisms could explain SES gaps in language ability. Overall, children from lower SES homes tend to experience less linguistic, social, and cognitive stimulation and more stressful events, including abuse and neglect, food insecurity, and environmental toxins (Bradley & Corwyn, 2002; Brooks-Gunn & Duncan, 1997; Hackman & Farah, 2009; Hart & Risley, 1995). These experiences are likely to have specific effects on distinct brain structures, leading to disparities in neurocognitive skills and achievement. Two contextual factors may moderate links between SES and language outcomes: the home language environment and exposure to multiple languages.

Home Language Environment

Differences in children's language outcomes trace, in part, to SES-related differences in language input within the home. Quality of maternal speech fully explained the difference in expressive vocabulary growth between children from lower vs. higher SES families (Hoff, 2003). Children from lower SES families encounter less language and engage in fewer complex conversations relative to their more advantaged peers, both in the home and in their communities (Hart & Risley, 1995; Hoff, 2006). Children in low-income homes heard 30 million fewer words than children in more affluent families by the time the child reached the age of 3 years (Hart & Risley, 1995). This inequality in language input, the "word gap," links to later disparities in language and cognitive outcomes (Fernald et al., 2013). Quality of home environment, but not SES, predicted 9-month phonemic discrimination ability (a foundational skill of language development), even after controlling for 9-month language skills (Melvin et al., 2017). Home language environment during the first year of life, independent of SES, is vital to language perception and may indicate a window of opportunity for intervention.

Increasing both the amount and diversity of language within the home can positively influence language development, regardless of SES. Repeated exposure to words and phrases increases the child's opportunity to learn and remember (McGregor, Sheng, & Ball, 2007). The complexity of grammar, the responsiveness of language to the child, and the use of questions all aid language development (Bornstein, Tamis-LeMonda, Hahn, & Haynes, 2008; Huttenlocher, Waterfall, Vasilyeva, Vevea, & Hedges, 2010). Besides frequency of language input, how caregivers communicate with children also affects children's language skills. Children from higher SES families experience more gestures by their caregivers during parent–child interactions; these SES differences predict vocabulary differences at 54 months of age (Rowe & Goldin-Meadow, 2009). Parent–child interactions provide a context for language exposure and mold the child's language development. Specific characteristics of the caregiver, including affect, responsiveness, and sensitivity predict children's early and later language skills (Murray & Hornbaker, 1997; Tamis-LeMonda, Bornstein, Baumwell, & Melstein Damast, 1996). Maternal sensitivity partially explains links between SES and both children's receptive and expressive language skills at age 3 years (Raviv, Kessenich, & Morrison, 2004). These differences also appear across culture (Mistry, Biesanz, Chien, Howes, & Benner, 2008). Maternal supportiveness partially explained the link between SES and language outcomes at 3 years of age, for both immigrant and native families in the United States.

Exposure to Multiple Languages

Half the world's children world grow up in multilingual environments (de Houwer, 1995), and one in five children in the United States live in households where another language besides English is spoken (Federal Interagency Forum on Child and Family Statistics, 2011). Theoretically, children are considered simultaneous bilinguals if they learn both languages from birth, or sequential bilinguals if they learn one language after they have sufficiently acquired their first. In practice, however, variations in language exposure, language use, age of acquisition, and language context all contribute to the spectrum of multilingualism.

Monolingual and multilingual language acquisition is shaped by sensitive periods and by both predisposition and experience. Exposure to multiple languages early in life means more information or cues within the environment for the infant to manage. Increased information processing extends or delays the closing of a sensitive period of language development: This promotes mapping between the sound structures of the languages being acquired (Flege, Munro, & Fox, 1994). Exposure to multiple languages may capitalize on developmental neuroplasticity by delaying the closing of a sensitive period, which may enable changes in brain structure and connectivity (Werker & Hensch, 2015). Brain structures differ between monolinguals and bilinguals (e.g., Abutalebi et al., 2011; Della Rosa et al., 2013; Garbin et al., 2010). Although neuroplasticity occurs during both early and late second-language acquisition, the point in development or acquisition rate may affect brain structure or connectivity (Klein, Mok, Chen, & Watkins, 2014; Mohades et al., 2015).

As communication is central to the human experience, linguistic and nonlinguistic processing share many links, so exposure to multiple languages confers differences in cognitive and brain processes. As such, a bilingual advantage appears on some nonlinguistic cognitive tasks across the life span (e.g., Bialystok, Craik, & Luk, 2008; Brito & Barr, 2012; Carlson & Meltzoff, 2008; Costa, Hernández, & Sebastián-Gallés, 2008). Most tasks demonstrating differences between monolingual and bilingual children emerge within attention and cognitive control (Bialystok, 1999; Poulin-Dubois, Blaye, Coutya, & Bialystok, 2011). While underlying mechanisms await evidence, processing multiple languages early in life may enhance information processing efficiency: Bilinguals must discriminate between and minimize interference across languages. Parents of bilingual children probably do not speak more to their children than do parents of monolingual children; therefore, bilingual children must acquire both languages while experiencing reduced input to each. This linguistically challenging environment may increase attention and processing capabilities.

Variations in cognitive skills and brain structure have been attributed to dual-language exposure (Costa & Sebastián-Gallés, 2014), but bilingual differences are not always found (de Bruin, Treccani, & Della Sala, 2015; Paap & Greenberg, 2013). Also, most studies have not been able to stratify participants by both SES and bilingualism when examining divergences in brain structure and cognitive skills. Analyzing the Pediatric Imaging, Neurocognition, and Genetics (PING) data set, joint and independent effects of SES and bilingualism affected both brain structure and language/cognitive skills (Brito, Morales, et al., 2016). Matching monolingual and bilingual children with similar sociodemographic characteristics linked socioeconomic factors to both brain structure and language/cognitive skills across all ages, whereas bilingualism affected brain structure only during late childhood. Unlike past studies, bilingualism did not affect any cognitive skills (reading, vocabulary, working memory, inhibitory control, or cognitive flexibility) but that may have been due to the rudimentary measure of bilingualism. However, bilingualism did yield differences in brain structure, independent of SES background. SES and bilingualism may independently affect brain and cognitive development.

Children from dual-language homes receive reduced linguistic input to each of their languages already, so bilingual children from lower SES backgrounds may be at risk for language impairments because they may not receive sufficient input in either language. Multilingual environments vary, and that impacts both language acquisition and cognitive development. When children hear a language less than 25% of the time, they tend not to acquire that language (Pearson, Fernandez, Lewedeg, & Oller, 1997). Given sufficient language input in both languages, bilingual children acquire language at similar rates to monolingual children (Genesee, Paradis, & Crago, 2004). Language development for bilingual children, as well as the intensity of brain responses to each language, directly relates to the quantity and quality of speech they hear in each language (Garcia-Sierra et al., 2011; Place & Hoff, 2011; Ramirez-Esparza, Garcia-Sierra, & Khul, 2016). Lexical, grammatical, and vocabulary development by bilinguals depends on the exposure to each language and the language context (Oller & Eilers, 2002; Pearson et al., 1997).

Of 11.2 million school-aged bilingual children in the United States, an estimated 6 million come from poor or near-poor homes (Federal Interagency Forum on Child and Family Statistics, 2011). Disentangling the effects of SES and bilingualism on cognitive and language trajectories is crucial for identifying mechanisms of risk and resilience for lower SES minority children. Apparent gaps in school readiness come from dual-language exposure and SES. But how much does each factor explain the disparity? Both elements are risk factors for English-language skills (Hernandez, 2004; Oller & Eilers, 2002), but the contribution of exposure to English remains unclear. Children from lower SES families or language-minority households start school with lower English-language ability than their middle to higher SES monolingual counterparts. Like monolinguals, early differences in English skills for dual-language children contribute to deficits in many aspects of academic achievement, and these small differences only widen as children grow older.

Conclusions and Recommendations

Early language skills best predict school readiness and later school success (Hoff, 2013). Furthermore, they develop cognitive skills and foster socioemotional regulation through social interactions (Vallotton & Ayoub, 2011). SES predicts language outcomes, and this association persists across diverse ethnicities, cultures, and heritage languages. Although robust, the relation between SES and language is not a simple causal pathway, given substantial within-SES variability in home language exposure, which influences children's language development. More research is needed to understand the causal relations among SES, pathways, and language outcomes. A richer understanding of the multiple mechanisms fundamental to SES disparities will help interventions promote factors that contribute to language development and buffer against poverty.

As reviewed, the home language environment significantly impacts language development, and language trajectories are indeed malleable. Comprehensive interventions can support positive language environments during early childhood. For example, the *Play and Learning Strategies Intervention* (PALS: Landry, Smith, & Swank, 2006, Landry, Smith, Swank, & Guttentag, 2008); trained low-income mothers to respond positively and predictably to their children's communication signals. Children in this intervention increased vocabularies, initiated more conversations, and produced more vocalizations during parent–child interactions, compared with the control group.

But most quality interventions carry high costs, high attrition, and impractical scalability, which may prohibit systematic implementation. Unconditional cash transfers are a simple intervention that could potentially alleviate socioeconomic disparities in cognitive and academic trajectories (Noble, 2017).

Language interventions could also scale to the population level by using community resources (e.g., *Reach Out and Read* in pediatric primary care settings) or innovative technologies (e.g., mobile phones). For example, the Maternal and Child Health Bureau of the Health Resources and Services Administration (HRSA) recently completed a challenge to support innovative solutions that can help promote the early language environment and address the word gap. The challenge aimed to develop a low-cost, scalable technologically based intervention that drives parents and caregivers to engage in more back-and-forth interactions with their young children. The winners of this federal challenge, *Háblame Bebé*, created an educational phone app that empowers Hispanic caregivers by training them, through interactive activities and videos, on how to use evidence-based strategies in their heritage language and by promoting early bilingual language development (HRSA Word Gap Challenge, 2017).

Policies and programs must also accommodate children from range of cultural and linguistic backgrounds. Children learning two languages do so in different contexts (e.g., Spanish at home, English in the community) or with different language partners (e.g., Spanish with dad, English with mom and grandmother), and these differences may lead to variations in language acquisition and knowledge. Children growing up in bilingual or minority-language households must hear their caregivers speak their native heritage language. Proper phonological development depends on children hearing native fluency in their environment. Insufficient exposure to high-quality language (proper pronunciations, correct grammar, etc.) can lead to language and literacy delays (Hoff, 2006). Characterizing different children's language experiences, and how they vary across social contexts, will illuminate how to approach interventions and policies for children from bilingual or minority-language families.

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