

Introduction

Although all families interact and communicate with their children, there are vast differences in children's early learning environments. It is nearly impossible for a baby to grow up without any exposure to language; however, many children live in environments that lack sufficient language-rich exposure (3). The quality of interactions that young children form with their parents affects all aspects of a child's intellectual, social, emotional, and physical developmental outcomes. Early exposure to language has been shown to lay the foundation for cognitive ability, healthy mental development, conflict resolution, self-regulation, literacy, school readiness, and educational achievement (4).

Early exposure to language-rich interactions between adults and children form the basis of language nutrition. Language nutrition is the term created to describe the use of language that is sufficiently rich in engagement, quality, quantity, and context in order to nourish the child socially, neurologically, and linguistically (7). Language nutrition nourishes a baby's brain similar to how food nourishes their body (3). Evidence indicates that both the quantity and quality of words spoken to a child in the first three years of their life predicts a child's literacy skills and language more strongly than socioeconomic status, parent level of education, and race or ethnicity (7). Language is critical to brain development. Through repeated, responsive, language-rich interactions with babies, parents and caretakers will have a lasting impact on their brain development (4). Healthcare providers can impact language nutrition by educating and giving parents the tools to communicate with their baby effectively, starting before birth throughout infancy, and well into their childhood.

Science behind language nutrition

A child's environment and early experiences have an enormous impact on how the brain develops. During the first three years of life, the brain undergoes dramatic developments and more neural connections are formed at this time than at any other time in life. If this early development is not

nurtured, the brain's architecture is adversely affected and young children are at risk for falling behind in their learning and development (4).

Studies suggest that newborn infants' brains are primed to learn language. Babies are able to perceive and react to sound as early as 24 weeks gestation and begin to learn language in utero by 35 weeks gestation (7). Research has shown that the quantity of speech spoken to children as early as 32 weeks corrected gestational age has resulted in neurocognitive benefits (7). The first 1000 days of life are a critical time for brain development. Early language experiences with a nurturing caregiver fuel the development of neuronal connections at an astounding rate of one million per second. The rate of brain growth linked to skill formations in language, literacy, spatial reasoning, math, and self-regulation during this time will never be matched again (5).

Infant and toddler brains are born ready for linguistic input, and this input allows their brains to develop new neural pathways in response to the language they are exposed to. As they get older and continue to use language more, these pathways strengthen (3). A study with very preterm infants used daily exposure to auditory stimulation in the form of maternal voice recordings and heart rate for three hours per day for a month. Results showed greater region-specific plasticity and larger structural volume of the auditory cortex. The structural changes in brain volume suggest that early language exposure has profound effects on the maturation areas of the brain responsible for learning and language processing (2). An additional newborn intensive care unit (NICU) study in Providence, Rhode Island demonstrated that preterm infants make an average of six to seven vocalizations at 32 weeks and an average of 10 to 12 vocalizations at 36 weeks. The vocalizations increased by four percent for every 100 additional words spoken to them by an adult (2). The more input a child receives, the stronger the neuronal connections grow, thus building a solid foundation for all future learning. Proper linguistic nutrition promotes the mental growth necessary for future success (3).

Serve and return

Because babies cannot talk at birth, their communication is limited. Therefore, a baby's communication often involves eye contact, facial expressions, crying, laughing, and touch (4). In the beginning stages of "serve and return," adults initiate shared-language experiences with their baby, and the baby later seeks interaction through babbling, facial expressions, and gestures. The adult responds by speaking and gesturing back at the child. The parent "serves" something to the baby in the form of a word, smile, or

hug, and the baby “returns” something back by babbling or an expression. This back-and-forth communication exchange between adults and babies is fundamental for their language and brain development, as well as for shaping brain connections (4). Responding to children utilizing nonverbal communication facilitates reciprocity. Paying attention to an infant’s cues such as babbling or pointing to something encourages language learning in a social context. Following the child’s lead and creating joint attention can increase child initiations and turn-taking. This strategy is most useful with infants and toddlers during the early stages of communication development (7).

In the last several years, nonprofit organizations, universities, cities, and communities have taken on the responsibility of improving children’s language development and reading abilities as a way to promote educational success and improve health outcomes. These efforts include educating on the importance of talking to babies, reading to young children, and using everyday words and conversations to promote language nutrition (2).

30 million word gap

Researchers have found that the number of words spoken to children differed dramatically across families of different socioeconomic statuses (SES). SES measures income, occupation, and education to reflect a family’s economic and social position in society (3). By four years old, the average child from a higher-income family hears a total of about 45 million words, while a child from a lower-income family may hear only 13 million words. This disparity is known as the “30 million word gap” (3,4). Factors contributing to this gap may be due to the fact that parents struggling financially are often unable to devote the amount of time desired; they may have to hold several jobs and rely on other caretakers for their children. When parents use different words and sentences in conversations, their children have higher rates of vocabulary growth, vocabulary use, and higher IQ scores at age three (4). The child on the lower side of the word gap may have difficulty learning new information which requires an understanding of language (3). As a result of missing out on valuable linguistic input as an infant, the student may never catch up to their peers.

Talk With Me Baby

The state of Georgia recognized the “30 million word gap and implemented an initiative called Talk With Me Baby (TWMB) in an effort to assist in closing the gap. Nurses are being utilized to help spread the

message that babies are listening before they are even born (3). Talk With Me Baby is a state-wide initiative to integrate language nutrition coaching into nursing practice and women, infant, and child (WIC) workforces. Talk With Me Baby recognizes that nurses are in a unique position to partner with expecting parents and new parents to teach, coach, learn, and reinforce language nutrition. Talk With Me Baby created a nursing education curriculum to utilize in the everyday role of nursing in obstetrics, labor and delivery, and pediatrics. Nurses are able to provide individualized education for parents to implement activities in their everyday life to build social, emotional, and language skills for their baby (2). Talk With Me Baby is an innovative movement that engages nurses to educate parents about the positive health, academic, and economic outcomes that result from just talking to babies early on (2). Talk With Me Baby believes that this partnership with nurses has the potential to help close the nation's educational achievement gap, thus improving children's literacy success and health.

Pequenos y Valiosos (Young and Valuable)

Pequenos y Valiosos is a national public action campaign that helps optimize learning in everyday moments for Hispanic children under the age of five. Information is delivered via Univision platforms, radio and network programming, social media, and local community outreach to encourage reading, singing, and talking to children (2).

Video Interaction Project

The Video Interaction Project incorporates one-on-one sessions with a child development specialist into low-income pediatric primary care visits for children aged two weeks through 36 months. Parents are videotaped interacting with their child for 30 to 45 minutes. The specialist then reviews the tape with the parents and provides feedback as well as strategies for enhancing interactions with their child (2).

LENA (Language Environment Analysis)

LENA is a national nonprofit organization and their mission is to help communities accelerate language development in children from birth to age three. Their goal is to improve cognitive, social, and emotional health, as well as to close opportunity gaps in children (7). The LENA device is a small, child-safe recorder that children wear for one day at a time. The device uses the same type of low-power processors as hearing aids. LENA software processes the audio captured by the device into data about talk, which is presented in reports that can be shared with caregivers. After a full day of talk is captured

by the LENA device, the audio files are transferred to a cloud processing system that uses complex algorithms to analyze the audio file. These algorithms are used to identify and differentiate between adult speech, child speech, and television or electronic noise (7). The algorithms can also differentiate the speech of the child wearing the device from the speech of other children and from non-speech sounds such as cries. The software does this without knowing the language being spoken. It only looks at the sound frequencies and the spaces between sounds to determine whether noise is human speech. The software then generates objective feedback reports for caregivers on the quantity and quality of talk in their child's environment. LENA has fueled research breakthroughs in neuroscience and child development, thus enabling scientists to explore how conversation with children changes their brains, and how it is linked to long-term outcomes (7).

Thirty Million Words Initiative

The Thirty Million Word Initiative incorporates eight educational computer-based modules through one-hour home visits with a trained coach. Parent-child interactions are recorded for feedback purposes. LENA technology is used by the coach to provide feedback, which allows the parent to set goals and recognize progress. The goal of the Thirty Million Words Initiative is to strengthen the ability of parents' language to build a child's brain and narrow the achievement gap (2).

Baby Bookworm programs

Preterm infants typically spend the first several weeks in the NICU, where they are exposed to loud, high-frequency noise, rather than low-frequency maternal vocalizations like they normally would in utero. Studies suggest that language exposure only represents two to three percent of the auditory environment in the NICU (2). Language deprivation in the NICU may contribute to the higher risk for language delays and poor academic achievement in premature and critically ill infants. Hospital staff can foster early introduction to language by encouraging reading to infants. Researchers have learned that infants and children who hear five minutes or more of spoken language during a 16-hour period will have increased language development (1).

Baby Bookworm programs were initiated in neonatal intensive care units based on these findings as a way to increase spoken language to infants through reading. The mission of the Baby Bookworm programs is to partner with families to improve the language nutrition of patients in the neonatal

intensive care unit. Parents are educated on reading in proper decibel levels (appropriate tone and volume and the impact on the developing brain) and are provided with educational materials on the benefits of reading and how it impacts their child's long-term development (1). The patient's visitors are encouraged to read to the baby softly at the bedside when developmentally appropriate. Hospitals that utilize volunteer cuddlers may train them to read to infants as well. Depending on the patient's individual needs, parents may not have the opportunity to hold their infant. Participating in reading to their infant can help form a bond with their child during this difficult time. Parents of high-risk infants often have impaired attachment and increased stress compared to parents of term infants. Shared reading can help parents feel closer to their baby, as well as increase their sense of normalcy and control (2).

Shaping future learners

One advantage of intervening from birth is that this is often a time when new routines are being established in the home prior to the infant's arrival. If routines are established in ways that support parent-child interaction daily, parents can dedicate time in the newborn period and beyond to provide the foundation for the infant to learn and use new behaviors. These routines can also enhance attachment and can be enjoyable times for parent-child interaction. Early caregiving routines can provide exactly the type of environment into which simple, yet powerful parenting behaviors can be well-established. These routines then become the family foundation that supports early language development (7).

Each year, four million children enter kindergarten in the United States. Approximately 25 percent arrive in the classroom lacking the social, emotional, academic, and self-regulatory skills they need to thrive at school. The ultimate goal in remediating this disparity is to provide an opportunity for the child to become fully capable of independently creating their own language learning environment through their own conversational skills, to develop confidence in asking questions about their surroundings and the things that interest them, and ideally to develop a love for reading (7). Research shows that the quality of language, especially conversational interaction, is strongly linked to children's behavioral outcomes. Studies revealed that the same quality is associated with white-matter development in children's language brain circuitry. This suggests that early intervention programs should not only encourage parents to talk to their children, but to talk with their children to promote optimal brain development (6).

Suggestions to boost language nutrition

Parents should be encouraged to talk with babies during familiar routines. They can narrate daily activities such as changing diapers, feeding, or bathing. Parents can describe in detail what they are doing. Everywhere the parent and child go, they can talk about their surroundings, what they see in nature, objects, and people. During “tummy time” an adult can lay on the floor with the baby and talk about what can be seen from the infant’s point of view. Parents should attempt to read to a baby for as long as they tolerate, although reading the actual story isn’t always necessary. Instead they can describe the pictures, and have the child turn the pages if they like. As children get older, it is important to read at least ten minutes a day. If possible, families should try to keep at least 20 or more children’s books in the home. These can be personal books or library books.

When a baby coos, the adult should coo back; when the baby smiles, smile back. Adults can play games with the infant such as peek-a-boo. This helps the baby naturally develop language and conversation. Parents should be encouraged to use actual words with their baby and refrain from “baby talk.” New vocabulary can be introduced through singing, reading, and telling stories. Parents should talk to their baby in the language they are most comfortable using. Studies have shown this is more effective for the goals of language nutrition.

Parents and caretakers should be encouraged to avoid the use of television, educational videos, educational toys, or music videos as a way to teach language. Screen time should be very limited in young children and infants. Although certain musical videos, educational toys, and television programs can provide learning enrichment for school-aged children, there is no data to support that they are beneficial for infants or toddlers. Evidence suggests that these may adversely affect language development by limiting communication between parent and child (7).

Parents should be advised to be cautious using language to direct their child such as “no,” “sit down,” or “stop that.” While these words are meant to keep children safe and are important for managing behaviors, it is more beneficial for language learning to explain why the child should not be doing something. Negative statements tend to contain fewer words than positive statements. Negative statements and fewer words during the first 18 months hold children back from language processing and vocabulary skills. Every new word or positive statement is a chance to help build their vocabulary

skills. Parents' knowledge of child development and the importance of language exposure greatly affects the quality of a child's language environment and opportunity for learning (7).

How reading is connected to health

An individual's reading skill can be a very strong predictor of adult health status (3). Reading is the basis for school achievement, and reading skills and education can have an influence on career choices, as well as income. An individual's career and income may influence their access to healthcare. Being able to seek out information about medical conditions and health, as well as visit providers for preventative or sick visits, leads to better health for individuals and their family.

Implications for practice

The American Academy of Pediatrics (AAP) recognized the tremendous impact of early adult-child interactions, and has made early brain development a part of the AAP "Agenda for Children." A 2016 policy statement of the American Academy of Pediatrics recommends that pediatricians support parents "to provide a rich and responsive language environment" (5). The AAP identifies pediatricians as having a pivotal role in creating and implementing evidence-based strategies to promote parent-child interaction (5). The policy recommends integrating literacy promotion into the education and training of pediatric healthcare providers. It also recommends that pediatric healthcare providers incorporate education about early literacy development into well visits by advising parents about the importance of language nutrition, specifically language-rich social interactions, and how to implement developmentally appropriate activities with their child (2). Infant well visits tend to be heavily focused on feeding, the infant's weight, and general assessment. The neonatal and pediatric healthcare workforce can empower parents with knowledge of early cognitive development and how their words and interactions influence their children's healthy brain development. Effective teaching involves more than just telling parents to read, talk, and sing to their child.

Nurses care for babies during the first days of their lives and prepare parents for discharge to care for babies at home. The introduction to language nutrition should be a topic of conversation during this time, as it is an excellent opportunity to discuss, model, and provide examples for new parents to communicate with their infant.

Newborns are typically scheduled for several well-check visits during the first few months of life (2). Language nutrition should be reinforced during these visits along with discussions regarding developmental milestones. The goal is to increase the language nutrition provided by every parent/caregiver of every infant, especially those who may be at high risk for language delays, poor literacy, or low educational achievement (2).

A literacy toolkit can be found on the American Academy of Pediatrics website. Other resources include www.talkwithmebaby.org, www.talkingisteaching.org, www.thirtymillionwords.org, and www.providencetalks.org (2).

Conclusion

The ability to provide language nutrition is crucial for shaping the social, intellectual, learning, and health outcomes for young children. The single most important action a parent can take to positively influence their child's future education and health outcome is to talk with their children (7). Extensive research demonstrates that brain development is dependent upon early sensory experience (2). Ideally, babies should not only hear as many words as possible, but they should also hear as many different sentence structures as possible. Providing babies with proper language nutrition is straightforward and fairly accessible to all. Words are free regardless of occupation, income, socioeconomic status, resources, or education, which means closing the "30 million word gap" is within everyone's reach (3).

The trajectory of children's lives can be changed if parents or caregivers understand the importance of language, know how to engage their child in language-rich interactions, and realize that they have the potential to be their child's first and best teacher (2). Healthcare providers have the capacity to assist families in talking with their children in a way that promotes language-rich, cognitive, and social development. Many resources and toolkits are available to clinicians on how to implement language nutrition into practice as stated in the above module. It is imperative for front-line clinicians (nurses, doctors, pediatric nurse practitioners, and neonatal nurse practitioners) focusing on caring for parents and families to implement language nutrition education into their practice to every parent and caregiver of an infant, especially those at high risk for language delays, poor literacy, or poor educational achievement (2). These highly trusted professionals are in a unique position to influence the future of every family.

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