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RESEARCH ARTICLE

Sign Language and Multimodality as Indicators of Health for Deaf Newborns and Young Children: Guidance for Families and Medical Professionals

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ABSTRACT

Sign languages are complex and intact human languages essential to the development and health of deaf children and adults. Yet, still, many families and medical professionals think the optimal option for deaf children is to be raised with spoken language, usually including a cochlear implant. Cochlear implants, however, have variable outcomes with language acquisition. Medical professionals, especially pediatricians, need to update their knowledge and understanding of best practices to ensure they more appropriately support families to protect the overall health of their deaf child. The child who does not have a firm first language foundation is at risk of poor (neuro-) cognitive, psycho-social, and socio-emotional development. Developmental delays and life-long, irreparable damages can and should be prevented. Ultimately, securing a firm first language foundation is a matter of health. It is essential to back away from the concept of one-choice-fits-all and, instead, begin with exposing the deaf child to a visually accessible sign language in a multimodal and multilingual environment as soon as it is known that the child is deaf. With a sign language as the linguistic foundation, other practices automatically make more sense –including hearing aids and/or cochlear implants – and those other practices have a greater chance of success, even the development of spoken language(s) (including speech) and written language(s), which has been shown to be supported by the presence of visually accessible sign language(s) in the child's environment.

In order to aid pediatricians in advising parents, we have prepared a list of factors on which families of deaf newborns or newly-deafened young children need guidance, complete with discussion and citations of relevant recent work. We have been working as a team in this area for the past dozen years. Thus, we also list our publications. The goal here is to ensure deaf individuals' right to inclusion in society in terms of education, employment, health, cultural life and all other aspects of being human and of societal participation. The use of a sign language(s) allows deaf people to be included; the preclusion of a sign language carries the risk of low quality of life and of language deprivation.

Keywords: cognitive and psycho-social health of deaf children; language acquisition for deaf children; guidance for parents of deaf children and for doctors; sign language as a base for cognitive development; multilingual, multimodal education of deaf children

1 Introduction

Throughout we use the term *deaf* to refer to deaf and hard-of-hearing individuals. The general claims in this introduction are supported by papers our team has authored or contributed to.[1-14]

An enormous array of studies in the (neuro-) cognitive and linguistic sciences over the past 60 years have shown that, counter to misconceptions, sign languages are complex and intact human languages that are essential to the development and health of deaf children and adults. Deaf children are, overwhelmingly, born into hearing families and are often the only deaf person in their family. Many families and doctors know no other options for the family in raising a deaf child but to do it with speech and listening exclusively. This is no longer the option supported by evidence from recent practices and research. For example, and to the child's disadvantage, recent advice to parents has been characterized by an overreliance on technology. The fact is, cochlear implants do not transform a deaf child into a hearing child. Instead, cochlear implants lead to widely varying outcomes with language acquisition. The persistent fact is that many CI-implanted deaf children do not access spoken language well enough to acquire a firm foundation in a first language to support their communicative, psycho-social and cognitive needs. Further, while some factors are positively indicated in CI outcome, at the time a child is provided a CI there is no sure way to predict which child will have success. Best available data indicate wide variability in both success and what studies define as "success".

New understanding about language and (neuro-)cognitive development clearly indicates that the optimal and holistic approach is for the family to assist their deaf child in acquisition of a sign language in a multimodal and multilingual environment. Doctors need to update their knowledge and understanding of best practices and approaches to ensure they can explain and more appropriately support families to adopt this holistic approach. Without a firm foundation in a first language, children might run the risk of linguistic delay and deprivation, which carries a range of (neuro-)cognitive, psycho-social, and socio-emotional delays and in turn life-long, irreparable damages. A deaf person with these disadvantages is more likely to grow up impoverished, experience food insecurity, become involved in crime (often as a victim or as an unwitting accomplice), and have poor health outcomes. Deaf children who grow up without signing and are not comfortable in a hearing environment have more difficulty in forming strong family bonds; while those who do sign report being happier as adults. In fact, the importance of family signing (including sibling signing) to feeling like one is a true member of the family is stressed by older deaf people looking back on their childhoods; as is the importance of connecting with a deaf community[15]. Accordingly, securing a firm first language foundation is a matter of health that affects the educational, psycho-social, and economic lives of deaf children and adults. From a medical, social, and moral standpoint, it is essential to back away from the concept of one choice fits all and, instead, begin with

exposing the deaf child to a sign language in a multimodal and multilingual environment as soon as it is known that the child is deaf. With a sign language as the linguistic foundation, other practices and technologies make more sense and have more chances of securing multilingual and multimodal competencies. Even the development of speech has been shown to be supported by the presence of sign language in the child's environment[16].

In order to aid the medical profession in advising parents, we have prepared a list of key factors on which families of deaf newborns or newly-deafened young children need guidance, complete with discussion and citations of recent work that addresses each factor. We also recommend our own team publications with respect to all these factors[1-14]. This list by no means includes all the factors that need to be addressed but it is our attempt to focus on some of the most important. The goal here is to protect deaf individuals' well being and right to inclusion and participation in society in terms of education, employment, health, cultural life and all other aspects of being human. The use of a visually accessible sign language or multiple sign languages allows deaf people to be included; the preclusion of a sign language carries the risk of low quality of life (e.g. isolation) and of language deprivation.

2 Essential factors for parents and doctors to consider

2.1 Language development

Early detection/identification of deafness is essential. From birth through early childhood, language acquisition is a natural process in which infants' access to language is critically important. Language comes in two modalities, auditory-vocal and visual-gestural (spoken languages and sign languages). Children are born ready to acquire language in whichever modalities it comes in that is available and accessible to them. When the auditory-vocal modality is not accessible or not fully accessible to deaf children, visual language exposure as soon as deafness is detected is necessary.

A major responsibility of parents of a deaf newborn is to ensure the child has a firm first language (L1) foundation. L1 acquisition begins immediately upon birth – that is, upon entrance into a language community. When language is accessible, infants will respond to it in the first days and weeks of life. Within months, babies will smile and laugh when addressed. They will show passive knowledge of individual lexical items. Soon they will be articulating individual lexical items in such a way that non-family members can understand them. By a year, a child has a significant amount of language development under their belt (Appendix A). The first three years of life are critical to a child developing a firm L1 foundation[17-20]. This period and the following years, thus, matter pivotally. Gaps or delays in exposure to sign language while waiting to see if other approaches work can constitute significant impediments to language development. For example, waiting to see if a deaf child will gain sufficient linguistic input from a cochlear implant or hearing aid and speech carries heavy risk. Exposure to an accessible language in the visual-gestural modality, that is, a natural sign language,

ensures language development in the same patterns and trajectory as exposure to spoken language[21]. A natural sign language is one that has evolved over generations from a community of deaf signers.

First language acquisition occurs naturally when a child is surrounded by comprehensible communication in a visually accessible language. Sign languages (there are more than 200 around the world) are readily accessible to all children (including tactile forms for deafblind children). Spoken language is accessible to hearing children, but not equally accessible to all deaf children because of variation in the quality and amount of usable input that residual hearing and technological aids allow. There are many reasons to raise a deaf child with a sign language but avoiding language delay or deprivation is the most obvious one[22-26].

With or without aids (hearing aids or cochlear implants), spoken language is often inaccessible to a deaf child, putting the child at risk of cognitive and psycho-social harms[27-29] and severe academic delays[30]. The human brain that is not nourished by language does not develop in the same way nor process information in the same way as the language-nourished brain, and these changes to the brain are architectural and lasting – they are changes that late exposure to an accessible language will not be able to undo[31-36].

The family must consistently engage in and use a sign language in the presence of the deaf child. This means that families need assistance in learning a sign language and must connect to the deaf community as soon as possible. Acquiring a language requires immersion in an environment where the child is constantly and richly exposed to it. Families need to provide immersion in signing as soon as they know their child is deaf[37]. It is advisable to begin sign language lessons as soon as it is feasible and to reach out to the local deaf community so that the whole family can participate in activities where the child will be surrounded by clear signing models[9,13]. Deaf children who grow up with strong deaf peers and deaf community support are more likely to have positive attitudes toward their hearing family and friends in adulthood.

There are instructional programs (some of which are digital) that can assist in family learning[38-39]. The parents will need to learn along with their child. But signing with the child and enriching that signing with whatever other visual means available can result in language fluency and expressiveness on a par with hearing peers[40-42] and promotes the kind of strong family relationships that allow development of a healthy psycho-social identity[43]. Parents should not feel self-conscious about using sign as they are learning, because the alternative is worse, i.e. the lack of two-way communication between infant and caretaker is linked to poor health outcomes during the deaf person's lifespan[44]. Resources for parents in schools, colleges, deaf community service centers, and online are available, all of which require a level of initiative[45-47].

Because of variable access to spoken language, using spoken language alone puts the deaf child at risk, whereas using both a

sign language and a spoken language in the child's environment will create a multilingual environment. If parents and their child sign, they will become bilingual, as they will learn to read text and write in the ambient spoken language as well as communicate in a sign language[48]. If speech development is a goal of the family and child, being in a sign language environment is an advantage, as stated earlier.

2.2 Cognitive development

With respect to the cognitive health of deaf children, a firm first language foundation is unquestionably the most important factor[49]. Signing assures an intact first language but the family goal may often be for their child to acquire both a sign and a spoken language. Multimodality in communication contributes to the development of language and cognition in all children – the interplay of the two different modalities, two different languages in play and joint activity, are important among families of deaf children. All kinds of language use and interaction are important, and the two languages will often overlap and interact sometimes in the same sentence in a rich communicative environment. Deictic gestures, iconic gestures, gestural emblems, affective expressions on the face and body, 'show and tell', and literary events such as signing with pictures, movies or print, are all exactly what a deaf child needs. Just as families play around in communicating with hearing children, they should play around and be creative in communicating with deaf children. The child who is surrounded by clear, comprehensible communication input experiences a significant amount of incidental learning. That is, the child, through conversations and seeing and/or hearing many linguistic events in the social and cultural world, is given the opportunity to develop important cognitive abilities such as Theory of Mind[50], meaning making, and linguistic expansion abilities in both languages. If the hearing members of the family use only speech with each other in the presence of the deaf child, the child is excluded from the communicative exchange and has no chance of incidental learning. This is one more reason why it is essential to use signing as much as possible around the child and to bring the child into situations where everyone is signing. With signing all around, the child will have more chances at incidental learning, as well as have early and timely achievement of Theory of Mind and executive functioning[51-53]. Sign fluency also supports numeracy in deaf children. A deaf child's basic mathematics skills are significantly associated with their general linguistic fluency, whether it be in a sign language or a spoken language[54]. Working memory is supported by early language experience that involves memorization and performing actions. Just as reciting nursery rhymes and chants and moving in a circle while singing "Ring around the rosie" help the hearing child develop good working memory (which are important for later reading skills), sign language nursery rhymes and chants are beneficial for deaf children[55]. (Examples of these rhymes can be found at sign2me.com and elsewhere[56-57].)

2.3 Early literacy development

Learning to interact with language forms ideally begins early in the home, long before school. To develop the precursors of reading ability, children should receive constant exposure to things sometimes not associated with reading, *per se*. The frequency and amount of talk with and around the child is important because it contains literary structures that are sometimes overlooked. Direct and indirect speech, for example, are forms that appear in talk before the child is even aware of representations of dialogue in print. They also appear in sign languages frequently and in interesting ways for the child. Portraying two characters talking to each other in a sign language involves embodying each character in turn, signing their lines with body shifts and use of space to show who is talking[58]. Done solely in voice, the exchange is often missed by deaf children in spoken language stories because some of role-playing is conveyed via voice inflection, which the deaf child may have difficulty catching. No matter which language is used, whether sign or spoken, the actions of the parents as they engage with their child form the basis for narrative literacy and thus have a great impact on literacy development and reading.

There is much to learn from deaf parents interacting with their deaf child as they read print or even go through picture books[59-61]. Deaf parents interact with print with their child in ways that benefit the child and that hearing parents may not be aware of. As toddlers, deaf babies are exposed to many literary events, from storytelling to actual handling of print books. They see their parents sign near or on objects, they see the depiction of the size and shape and manner of the world in signs, they see their parents sign directly on the pages of books, they see their parents using their face in both mimicry and linguistic forms, and they receive multiple small but important cues from their parents regarding the significance of objects, behaviors, and meaning-making events everyday. Deaf babies with early sign language exposure in daily interactions learn to shift their gaze between the mother's face and the printed page or from toys to the mother's face with great facility[62]. In a rich sign language environment, babies will be able to split their attention, understand language input and other input at the same time, and they will not be confused in such interactions. The facility with which deaf babies learn these skills is inhibited with speech, especially when speech comprehension is not clear enough through hearing. In short, learning to read is about developing such control and focus at an early age.

Literacy development begins in early childhood and involves not just learning to read but also learning to learn. Learning to read depends on the development of narrative structure, a sense of self as storyteller, and an understanding that the printed page offers a story or narrative or information that can be extracted. Emergent literacy acts include interaction with print but also with all language forms, including sign language parameters (handshape, movement of the hands, location of the hands), morphology (internal word structure), and

narrative structures. In this regard, two factors above others correlate strongly with reading ability: exposure to print and sign language fluency. In the same studies that indicate this correlation, it is telling that without sign language fluency, exposure to print does not correlate as strongly with reading ability[18,63]. Deaf preschoolers who sign at home do better academically than those who do not sign at home[64].

A firm first language foundation turns out to be critical for a developed Theory of Mind[65], which helps with learning. One way to develop both language and Theory of Mind at the same time is to engage in play that involves role-playing, particularly with others[66]. An enormous amount of learning for the preschooler is done through play, whether the child is hearing[67] or deaf[68]. Much of that play develops language and literacy skills[69]. Deaf children need to be involved in games with other children, particularly other deaf children, instinctively helping each other to learn and building each other's communicative competence.

As mentioned earlier, shared reading activities using bimodal-bilingual video-books not only teach story-form but also provide varied opportunities for the child and the adult to interact linguistically about a wide range of information[70-71]. Additionally, these video-books are an opportunity for the child to see and learn narrative structures in sign languages, which are different in many ways from narrative structures in spoken languages[72-74]. Besides learning the alphabet and fingerspelling skills in a sign language[75], deaf children should learn about narrative forms that are part of the deaf tradition, such as handshape stories in which a single handshape is used to tell an entire story[76]. Through such activities, the deaf child will learn about the structure of their sign language[77], and they will become aware of the importance of literary processes, such as assembling and disassembling units of meaning within language. Doing so in sign language also helps to develop healthy identities as deaf signers[78].

2.4 Technologies that enhance and assist

Another important factor in the development of two languages in a multilingual, multimodal environment is the interaction of sign language with print and visual technologies. This is a powerful and successful combination for language and cognitive development. There are a range of video and digital tools that can help deaf children with their overall communication skills and needs. Video games can help young deaf children gain signing skills[79], and digital translation systems that allow translation from speech to sign and from sign to speech are being developed[80]. Multimedia software that integrates narrative text with sign language videos, picture, and concept maps has been found to improve reading comprehension[81] and can allow interactive storytelling[82]. We stress the value of video-books designed for parents to share with their deaf infants, preschoolers, and older children. These video-books encourage deaf children and hearing parents to interact with each other in sign and at the same time help deaf children learn information about the

world, develop a Theory of Mind, learn how to make inferences; that is, they develop important cognitive and preliteracy skills.

As the deaf child becomes older and engages with television, captioning/subtitling on television and social media is another important life-long means of accessing spoken language and allowing the child the same access to information about the world as hearing children have. While captioning is important at an early age, it becomes even more when the deaf child begins early childhood education, preschool or elementary school. Captioning helps provide motivation to learn to read and use reading to learn[83-84].

Listening technologies are widespread but have great variability in utility and benefit. Hearing aids benefit some deaf children more than others. The same is true of cochlear implants. Hearing aids amplify sound and can be used by children who have nerve deafness in one or both ears (sensorineural hearing loss). When indicated, hearing aids can be fitted very early. With consistent and frequent use, they can make spoken language accessible to varying degrees. However, there are times when hearing aids cannot or should not be used[85]. For example, they can be damaged by water and should not be used while bathing or swimming. They should not be used during sleep time, nursing time, or cuddling time, because they can become uncomfortable when pressed in any way and, thus, interfere with healthy sleep, feeding, and bonding patterns. Further, when pressed or if ill-fitted, they can make a whistle that is annoying to both child and adult and thus interfere with speech access. When one considers how much time the hearing aid is off in light of how essential it is not to delay language acquisition, it is at best an aid to language acquisition but not sufficient in itself. Many signers use a hearing aid and it is known to be important to them to have both their sign language and their aid(s). Another problem with hearing aids is that the deaf child or adolescent may at times exercise a choice to take it off or turn it off. This is not an issue if language development occurs via comprehensible input in sign language.

Cochlear implants are distinct from hearing aids; technically, they do not amplify sound in the way that hearing aids do. Instead, they transform sound into electrical impulses delivered directly to the cochlea. One must weigh multiple considerations in evaluating the suitability of a deaf child for the implant procedure. When indicated, cochlear implants can be implanted in babies, with varying age limitations in different countries, but usually not earlier than one year of age. There are risks with the surgical procedure, which we have written about elsewhere[3]. Bilateral implants are being done with some deaf children. In children, speech performance with CI on one side is enhanced greatly by a hearing aid in the other ear[86-87].

An essential fact is that language acquisition should proceed with sign language immediately and not be delayed while waiting for technology to be available, affordable, or more advanced. The child must not be left without language until the CI is implanted or the hearing aid secured. Faith invested in such

technologies often leads to indecision and misinformation and ultimately delayed input in either a sign language or a spoken language.

Moreover, CI use requires daily training for years, with the support of family members as well as a rehabilitative therapist. Despite all the best efforts by parents and medical professionals, results remain highly variable. Generally, some devices seem better than others; some surgical sites seem superior to others; children in families with a higher socio-economic status seem to do better than others. There is no guarantee: no one can predict which implanted children being raised with speech only will be able to function well in a hearing environment via speech and a CI only[88]. Importantly, the children who do best with a CI are those who had a firm language foundation before implantation – and a sign language can supply that[89].

These listening technologies are reported by deaf adults to be of benefit to them in lipreading and, for some, provide a feedback loop for monitoring their own speech. This is a very individual result, however, as it happens for some and not for others. Despite the variable speech production or reception benefits of hearing aids and cochlear implants, they can make the child alert to environmental sounds and provide needed orientating information. Some deaf people profess to enjoy music with the aid or implant.

In sum, both hearing aids and CIs can aid in delivering speech to deaf children, but they cannot be relied upon in themselves to provide the clear comprehensible communication input that is crucial for language development. Some children with cochlear implants cannot identify spoken words and phrases, are unwilling to try to speak, and find a lot of speech incomprehensible[90-91]. Even children who do exceptionally well with a cochlear implant use speech-reading and context to decipher what is said to them and do not depend alone on the auditory information that cochlear implants provide. For this reason, the stance of "trying" out these technological devices and waiting to see if the child has success with them before introducing a sign language is untenable; it risks delaying the child's development and brings potential permanent harms [92].

2.5 Schooling and education

Multilingual, multimodal education with multimedia-based educational materials is the best of all worlds for a deaf child[93]. In multilingual, multimodal classrooms, students and teachers are engaged in a continuation of the two-language interaction in the home that we have described as benefitting deaf children the most. Early schooling in a sign language environment has benefits that may enhance later school success. The ideal environment includes deaf signing peers and fluently signing teachers. Teaching and learning are facilitated when the language of instruction is sign language but, as with all schools around the world, a spoken language is also the language of the school. In bilingual education, the two languages are treated equally and interact frequently; both are taught and learned at the same time, at

different times, in different subjects; and the goal is always for the deaf child to develop academic language in both the sign language and the spoken language of the school. Academic language is the particular language of schooling, the language of enquiry and reporting, of reasoning and making reasoned arguments, and of composing, editing, reviewing, re-editing, and sharing academic work. Deaf students in a bilingual, bimodal school setting learn to do these activities in both languages, and they can transfer what they learned to do in one language to the other[94].

Deaf children learn and reinforce sign language skills with deaf peers[95]. In a preschool setting, deaf signing teachers are major supporters of first language acquisition and role models for the children, as well as educators of other content[59,96]. Fluently signing teachers have a range of instructional techniques that improve deaf children's reading abilities[97]. Signing teachers can engage in dialogic reading with the children, which helps in comprehension particularly in the sciences[98]. When content is presented in a sign language, deaf children have more opportunities to participate actively in learning[99]. Deaf signing teachers of deaf students have particular conventions of language use during instruction; they utilize different teacher talk than hearing teachers and make use of ways that deaf families and their deaf children engage in the home, thus, bringing culturally and linguistically natural sign language instruction to their classrooms[100].

In the context of a bimodal-bilingual signing environment, even speech and listening instruction can be done more effectively. In such an approach, therapy and interventions are not confused with education. If time is set aside for therapy, the bilingual, bimodal approach is maintained in therapy. Speech and listening instruction that is therapeutic in nature is based on sign language and in authentic situations where deaf people find themselves in the multilingual world. Time is devoted to learning or improving new skills but should not be confused with the school subject matter curriculum nor distract from it. To repeat, while time can be carved out for instruction in speech or listening skills, the language of instruction for content should be a sign language. Deaf children benefit from being taught reading skills[101] and writing skills in a bilingual environment, in which deaf children are seen as second language learners of the ambient spoken language[94,102-103].

Historically, deaf students find themselves mainstreamed in classrooms often with no other deaf peers. This situation has not led to resounding success for deaf people in most cases; notions of what inclusion means and practices to carry out those notions vary in ways that can interfere both with academic success and a healthy identity[104]. What is crucial to wellbeing and academic success is the ability to communicate fully and closely with teachers and classmates. Without this, the deaf child cannot participate actively. In some countries there are laws that protect the deaf child's right to access to information in the classroom. If so, the deaf child might have a note taker, a sign language interpreter, a

live captioner, or some other form of assistance. Laws, however, tend not to consider the psycho-social situation of the child. Nothing can replace the value of direct communication in clear comprehensible language. Parents may have to encourage not just their child but also their child's teachers to find ways to promote such communication[105]. Indeed, parents may have to talk with the principal and encourage the entire school to understand how they can truly offer education for deaf students in the manner that the UN Convention on the Rights of Persons with Disabilities intended[106-107].

In some key ways, the multilingual, multimodal deaf classroom is very different from schooling in a mainstreamed setting. If the student desks are arranged in rows, for example, the deaf student will quickly be precluded from the classroom discussion. However, if the desks are arranged in a circle, so that everyone can see each other's face, there is a deaf-friendly situation, one that welcomes the deaf student into the discussion. If a child uses a sign language interpreter, there is necessarily lag time built in – the deaf child will receive the message slightly after the hearing children, making participation very difficult. This does not happen in a multilingual, multimodal environment. Visual acuity and facility is maintained in a signing environment, which aids speaking and listening when activities involve a spoken language.

It's important for deaf students' development of self worth, social and emotional maturation, and mental health that there be opportunities for authentic interactions among the students, including spontaneous ones[108]. Ideally, situations in which children find themselves sharing or partnering in an event pave the way for friendship, and having a friend at school may make the difference between wanting to go to school or not.

3 Language Milestones

Once a deaf child starts to fall behind in hitting developmental milestones, the situation can become chronic and often parents, educators, and other professionals find it difficult to help the deaf child catch up. Diligent and frequent language assessments that evaluate the deaf child in authentic language, cognitive, and communicative situations are necessary to prevent lagging. A visual language approach, as suggested here, should help to place and maintain a deaf child on a trajectory and a path that will remain what is considered a normal one, comparable to hearing peers. Such authentic assessments must be frequent, and every effort must be made to support the deaf child in meeting the milestones from the first few months of life into young adulthood. There are several valuable charts of milestones for language development in infants and toddlers on the Internet[109]. In Appendix A we offer, for convenience, a table with milestones for the first two years of life. Parents should also consult helpful discussions of vocabulary development after the toddler period[110-111], and of narrative development as the child grows[112-113].

4 Conclusion

The role of sign languages in early language acquisition and their impact on the cognitive development of deaf children is much better understood today than it was even a decade ago: sign languages provide deaf children an accessible path to essential language input. Medical professionals – pediatricians, pediatric nurses, audiologists, psychologists, cochlear implant surgeons, hearing and speech counselors and therapists, rehabilitation therapists –and others who support families with deaf children should better inform parents based on current information in order to help them take those actions in raising their deaf children that will allow for a fulfilling and productive life. We argue for the whole family to learn a sign language as soon as it is known that the baby is deaf, and, further, to use multimodal communication with the deaf child in order to build strong family bonds and ensure two-way communication as soon as possible. We urge families to share books with deaf children, retelling them in a sign language, using video books with signing as much as possible, exposing the child to sign language literature, and having rich, playful interaction with the child during story time. We enourage families to seek technologies that assist the family in gaining signing skills and to seek truly multilingual, multimodal education opportunities for their children. Families need to keep track of language and cognitive milestones and advocate for their child when necessary with educational and medical professionals. Immediate proactive measures engaging the child and family members in multimodal language interactions where sign language communication is an essential component are critical; anything less risks delay with potential lifelong harm to the health of deaf children and adults.

Appendix A: Milestones

The behaviors relevant to language development that your baby may exhibit in the first year of life are listed in the upper half of Table 1. By 12 months old, your baby will probably have one to three signs and/or words.

The behaviors relevant to language development that your baby may exhibit in the second year of life are listed in the lower half of Table 1. By 2 years old, your baby will probably have a vocabulary of 50-100+ signs or words, primarily labels for people, food, animals, toys, and action words and will have begun to use simple two-word or two-sign phrases (e.g., baby cry, more milk, my cup, no juice).

Table 1: Milestone language-development behaviors in the first two years of life

Milestone language-development behaviors in the first year of life		
0-3 months	4-6 months	7-12 months
Looks around and is attentive to people's faces. Smiles when they see you. Shows awareness of the environment Recognizes and responds to a person's voice or to movement or light.	Begins to babble with hands and/or voice. May use babbling to get your attention. Copies your movements involving arms, head, hands, and face. Responds to changes in the tone of your voice and/or changes in your facial expressions. Expresses feelings by cooing, gurgling, and crying when alone or when playing with you. Looks at you or vocalizes when you sign or say their name.	Points to self and to things. Imitates and expresses their first words or signs, such as mine, more, milk, mommy, daddy. Makes onomatopoeia (sound) words such as *choo choo, swish*, and *buzz* babbles with inflection/facial expressions similar to adults and tries to imitate turn-taking conversation. Demonstrates joint attention (e.g., parent and child look at the same object). Can tell what different facial expressions mean. Uses gesture or vocalizations to protest and express emotions. Responds to a request (e.g., come here). Understands words for common items (e.g., cup, shoe, juice) and family names. Responds to the word no most of the time. Looks at people's faces and at the environment attentively. Turns their head and looks in response to sounds or attention-getting behaviors (e.g., hand waving, lights on/off, foot stomping).

Milestone language-development behaviors in the second year of life	
Expressive language	Receptive language
Uses exclamatory expressions (e.g., uh-oh, no-no). Repeats the last word used by an adult. Communicates wants and needs through single words. Uses signed or spoken names to refer to self and others. Begins to use pronouns (e.g., me, my, mine). Begins to use two-word phrases (e.g., my milk, mommy shoe). Asks to be read to. Labels their own drawings/scribbles with 1-2 spoken words or signs. Asks simple questions (e.g., what that?, where mommy?). Takes 1-2 turns in a conversation.	Recognizes their own name when it is spoken or signed. Recognizes the names of family members when they are signed or spoken. Understands simple commands (e.g., come here, give it to me, sit down). Understands a few simple question forms (e.g. who, what, where, yes/no). Points to at least 5 body parts on self or doll when asked. Points to pictures named on a page. Attends to and enjoys simple stories or rhymes. Recognizes the first letter of their name. Recognizes their favorite book by its cover. Pretends to "read" books. Begins to understand how books are used (e.g., turns several pages at a time, holds book right side up).

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