Infants and Children with Hearing Loss Need Early Language Access

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Introduction

Around 96% of children with hearing loss are born to parents with intact hearing¹, who may initially know little about deafness or sign language. Therefore, parents need information and support in making decisions about the medical, linguistic, and educational management of their child. Some of these decisions are time-sensitive and irreversible and come at a moment of emotional turmoil and vulnerability (when some parents grieve the loss of a normally hearing child).² Clinical research has shown that the deaf child’s poor communication skills can be made worse by increased level of parental depression.³ Therefore, the importance of reliable and up-to-date support in parents’ decisions is critical to the overall wellbeing of the child.⁴ In raising and educating the child, parents are often offered an exclusive choice between an oral environment (including assistive technology, speechreading, and voicing) and a signing environment; a heated controversy surrounds this choice, and has since at least the late 19th century with the International Congress on the Education of the Deaf in Milan, 1880.⁵ While families seek advice from many sources, including, increasingly, the Internet,⁶ the primary care physician (PCP) is the professional medical figure the family interacts with repeatedly.⁷
The present paper aims to help family advisors, particularly the PCP and other medical advisors, in this regard. We argue that deaf children need to be exposed regularly and frequently to good language models in both visual and auditory modalities from the time hearing loss is detected and continued throughout their education to ensure proper cognitive, psychological, and educational development. Since there is, unfortunately, a dearth of empirical studies on many of the issues families must confront, professional opinions backed by what studies do exist are the only option. We here give our strongly held professional opinions and stress the need for improved research studies in these areas.

Background Figures

According to figures reported in 1989 by the National Institute on Deafness and Other Communication Disorders (NIDCD), 1 in 1000 infants is born totally deaf,\(^8\) while an additional 1 to 6 per 1000 are born with hearing loss of different levels.\(^9\) Additional instances of congenital hearing loss become evident later in childhood.\(^10\) This makes hearing loss one of the most common birth disorders in America.\(^11\) The largest single form of hearing loss is sensorineural disorders, with more than half caused by genetic factors, affecting 17 million Americans.\(^12\) In fact, the prevalence of hearing loss is greater than that of several other conditions screened for in every state, including phenylketonuria, hypothyroidism, and sickle cell anemia.\(^13\) According to the American Speech-Language-Hearing Association (ASHA), as of 2009, 47 states plus the District of Columbia had enacted legislation to provide Universal Newborn Hearing Screening, following the 1993 National Institute on Deafness and Other Communication Disorders (NIDCD) recommendation that all infants be screened within the first three months of life, though we still need full compliance.\(^14\) In 2004, 93% of the 4 million babies born were screened
for hearing loss. Huge strides have been made in early identification, but the task is not
completed until screening programs are enacted in all fifty states.

Present Situation and Guidelines

Despite these facts, many PCPs have very limited experience caring for children with
hearing loss, and probably received little to no training in deaf issues in medical school or
residency; the result is that a PCP’s advice has often been based on misperceptions about
deafness and deaf people. The situation seems to be improving, however. A recent pilot study
shows that today's PCPs know sign languages have all the communicative possibilities of spoken
languages and many are aware of the existence of signing communities of Deaf people.

Nevertheless, PCPs express a lack of confidence in discussing follow-up procedures and
intervention needs for newborns with hearing loss because of their lack of familiarity with deaf
issues.

Historically, the medical profession has viewed deafness from a pathological perspective:
the deaf person is considered impaired and in need of a cure. Today the stance of the medical
profession as evidenced through the American Academy of Pediatrics Policy Guidelines is more
sophisticated, yet it falls short of being truly adequate.

There are several published policy statements, all recommending early screening; early
intervention; close and continued monitoring of the child's communicative, language, motor,
cognitive, and social-emotional development; and protection of infant and family rights through
informed choice, decision-making, and consent. These recommendations frequently concern
almost exclusively audiological input via habilitation and vocal output, although more recent
policy statements emphasize cognitive language development and the importance of nurturing
and communicating with the child regardless of modality.
These policies consistently state the importance of family decision-making regarding raising the child orally versus raising the child with a sign language, because the success of early hearing detection and intervention (EHDI) programs depends on families working in partnership with professionals as a well-coordinated team. The recommendation throughout is that families receive unbiased information so they can make an informed decision, and then PCPs act in accordance with that decision. There are two major problems with this recommendation. One is that information given to the families is often inaccurate, incomplete, and/or equivocal. Sign is presented as the last resort, to be used when oral approaches have failed, and parents are incorrectly told that sign can be turned to at any age because it is so “easy.” Even the best websites offer less than optimal information. The National Institutes of Health, for example, has a website explaining what American Sign Language is and how children need to learn language early, but it stops short of recommending that every deaf child be exposed to sign language in particular from birth on. Their language is typical of American websites and it contrasts sharply with that of the websites of many other countries, such as that of DEAFSA, formerly known as the South African National Council for the Deaf, which says, “Sign Language is the first and natural language of the Deaf person.” Such equivocation on American websites cannot compete with the pressure for oral deaf education to the exclusion of sign language, which is escalating in this era of Universal Newborn Hearing Screening and cochlear implantation (CI). The second problem is that current research in cognitive science, linguistics, psychology, and education makes it clear that these decisions are critical to the physical and mental wellbeing of the deaf child; thus it is a medical responsibility to advise the parents properly, just as a PCP or other physician would do in the case of a diagnosis of diabetes or any other medical condition.
Being equivocal is not being unbiased; it is abnegating responsibility, with detrimental results on the decision-making process for the parents.

Success in meeting the language and educational needs of American deaf children thus far has been limited; according to the Joint Committee on Infant Hearing (JCIH), this is due to continued late detection of hearing loss (often not before 30 months of age), a shortage of skilled professionals to help in habilitation, and lack of funding for programs and assistive technology, among other such matters. However, even children whose hearing loss is detected early have a high rate of communicative and educational problems. The general tendency in America of using only one modality of language with deaf children isn’t adequate.

Every indicator about EHDI points to one conclusion: early intervention is critical for language development although it may have little effect on speech production. Thus we need good advice to families immediately upon detection of hearing loss; they must be told the advantages of both sign language and oral language exposure.

Moving Toward New Guidelines

Advantages of Sign Language Acquisition

For language development, deaf children should be exposed to good language models in a signed language as soon as deafness is detected. There is no advantage to delaying exposure to sign language, and language development research has shown that early exposure to sign language reduces the risks of linguistic deprivation, which is frequently associated with cognitive impairment and psychosocial isolation. In the next section we will explain why deaf children need exposure to speech, as well, but here we concentrate on sign language.

While children easily acquire any accessible natural human languages (spoken or signed) to which they are regularly exposed, first language acquisition must take place before the
critical period, which may be as early as five years old, or they may well have difficulties
becoming fluent in any language – they will be linguistically deprived. Developmental
psychology research has shown correlation between reduced language abilities and social
difficulties. Language development is critical to memory organization, mastery of cognitive
skills such as numeracy and literacy, and many other aspects of cognitive development. High
proficiency in a language permits the child to engage in social interactions with family and peers,
and cognitive development is enhanced from environmental stimulation; successful social
interaction calls for higher-order cognitive processing called executive functioning (EF), and EF
is significantly positively associated with language ability. It is, therefore, critical that the deaf
child become a fluent signer. Further, in the absence of a signing environment, deaf children
tend to develop a gestural system of communication with those around them, anyway; it is far
better in terms of both cognitive development and communicative range to give them bona fide
language. This recommendation is further supported by a neuroimaging study that reported
greater activation in language-specialized regions of the brain in signers when they viewed sign
language as opposed to non-linguistic gestures. Finally, language is language, regardless of the
modality; research shows that facility with one language helps in acquiring another language –
integration and differentiation processes within a linguistic system and across different linguistic
systems aid language development in general, thus learning sign can help a child master a
spoken language.

Even for the child who has auditory aids (hearing aids or CI) and seems to be doing well
with them, early learning of sign language, in particular, offers additional benefits. First, young
hearing children develop language through not only auditory but visual cues as well; the same is
true for young deaf children. Developmental neuroscience research has shown that rapid synaptic
formation for lower-order somatosensory and visual cortices, which happens during the first four months and begins to level off after eight months, paves the way for higher order association cortices. Deaf infants should benefit from early sign language exposure since the strengthening of sensorimotor pathways involved in sign language development (i.e. forming linguistic handshapes and movements to convey meanings of words or sentences) may facilitate early development of spatial attention and receptive understanding of the communication modality that is visual in nature. Infant spatial attention has been shown to play a crucial role in early language development, whether spoken or sign, as well as to promote healthy parent-infant attachment. A deaf infant’s lack of or reduced visual communication access during the first 4-12 months risks delayed language development, cognitive delays, and the subsequent social and emotional effects of these deficits. With visual attention and language mapping in place, the deaf child’s brain is likely to be better equipped to acquire spoken language through auditory communication with assistive technologies and effectively switch between a signed language and a spoken language.

Second, expressive language milestones are achieved earlier in gesture-based communication systems than spoken language. Visual clues can help promote spoken language production: hearing children who are sighted produce labials such as the [b] in ball before other sounds, where the movement of the lips is visually apparent, but blind children do not. Similar findings hold for a variety of other sounds. Since sign language experience helps promote development of neural pathways associated with visual attention abilities, sign language experience should prepare the deaf child to notice visual cues helpful in producing speech.

Findings such as the ones cited in the prior two paragraphs are likely the reason for the growing number of sign language classes for hearing infants and their hearing parents. It would
be absurd to suspect that positive effects of learning sign language on early cognitive
development and language acquisition should be limited to only hearing infants of hearing
adults. It is both ironic and detrimental that signs are often denied to deaf infants, who need
every advantage in self-expression given the amount of frustration they can face in early
language encounters.\(^{44}\)

Third, sign language acquisition has educational benefits. Many studies have shown that
deaf children who sign, regardless of other factors (such as whether their parents are deaf or
hearing and whether or not they have assistive hearing devices and/or oral training), achieve
better in school than those who don’t sign.\(^ {45}\) A recent study concludes that ASL skill above other
possible factors correlates strongly with reading achievement, suggesting that the linguistic basis
of reading can be bimodal as well as bilingual.\(^ {46}\)

As for cognitive benefits associated with sign language experience, signers are faster and
more accurate in mental rotation tasks\(^ {47}\) as well as better at discriminating unfamiliar faces than
nonsigners.\(^ {48}\) Research also showed that signers have better visual-spatial cognition and
movement perception than nonsigners.\(^ {49}\)

*Speech input: advantages and limitations*

If the deaf child has specific characteristics which correlate strongly with the success of
hearing aid use or of CI, then relevant auditory habilitation can benefit the child’s developmental
plan, but it must not be to the exclusion of sign language.

There are important benefits for the deaf child of exposure to speech. First, research
points to a strong correlation between a deaf person's phonological awareness and academic
achievement (in particular, reading skills),\(^ {50}\) although one is not required to access sound to have
such awareness (given that phonological awareness is of rules, not of sounds).\(^ {51}\) Second, the
ability to function communicatively, even to a minimal extent, in a hearing environment may expand career and personal opportunities. The absence of such minimal ability could even leave the deaf individual defenseless in emergencies.

Speech alone, however, is not sufficient language input for the deaf child. Although CI is available for children with bilateral severe to profound hearing loss that is unresponsive to amplification and it typically shows strong success with children implanted before 18 months, individual variation is pervasive. For instance, research findings reveal that successful CI outcomes best correlate with higher socioeconomic status (SES) and parental speech characteristics, specifically mean-length of utterance. In contrast, a persistent 21% of implanted children receive no linguistic benefits from CIs (instead perceiving only noise). For the 79% of implanted children who range from receiving minimal to substantial linguistic input from CI (that is, from being able to recognize alarm bells and fire engine sirens but not speech sounds, to being able to use the telephone), the device still neither restores nor effects normal hearing. Even a skilled CI recipient gets no benefit when the implant malfunctions or when the external apparatus must be removed, such as for sports events or sleeping (which can be interrupted by an emergency requiring communication). Thus, their communication abilities need to be supplemented by contextual clues and speechreading, which makes language a constant task requiring focused attention and substantial effort. All these children need and deserve a language they can use with ease, just as hearing children do.

Further, there is a growing body of evidence that CIs as a technology present no advantage to the deaf child over hearing aids (HA) and other forms of assistance with respect to the development of cognitive functions such as EF abilities; CI and HA children's EF is not as well developed as hearing children’s. Although the authors did not report measures of language
proficiency in these deaf children, who have hearing parents, it is possible that these deaf
cchildren have reduced language proficiency relative to the hearing counterparts and this reduced
proficiency may have had some effect on EF performance in the study.\textsuperscript{57} Another study on deaf
children with CI reported positive correlation between increased implant use and EF ability
(behavioral inhibition).\textsuperscript{58} Here, we contend that it is not the CI technology that provides the child
with better EF abilities. Rather, it is the intensive habilitation and active parental involvement
that provide the desirable outcomes for successful CIs.\textsuperscript{59} The longer that the child uses the
implant and receives intensive habilitation support from experienced specialists as well as
parental involvement at home, the more the child is able to attain higher proficiency in the
language that he/she is exposed to. Such outcomes are commonly observed in families of higher
SES.\textsuperscript{60}

Renowned author and neurologist Oliver Sacks nicely summarizes that language is the
"glue that binds us to others and allows us to "enter fully into our human estate and culture."	extsuperscript{61}
One would need to be proficient in both expressive and receptive language or have access to
appropriate accommodation to be able to fully participate in a community. An HA or CI user
may be proficient in a spoken language and yet struggle in listening and understanding the
teacher and other students in a classroom. The cognitive demand, even among school-aged
children with mild hearing loss, can result in fatigue, whereby the child struggles to cope with
the overload and is unable to sustain attention and process information equivalently with hearing
peers, with detrimental effects on learning and often on behavior in the classroom.\textsuperscript{62} Moreover,
children implanted early initially show great language gains that are not maintained; soon
implanted children fall behind their hearing peers.\textsuperscript{63} A common danger is that a teacher facing a
child with assistive technology who has conversational competence assumes that the child is
fully able to receive and process all academic materials through that language; instead, the child may be unable to cope with the abstractions, technicalities, and complexities involved in academic language and classroom discussions, thus the risk of underachievement is high.\textsuperscript{64} Further, studies of the cognitive development of deaf children in Australia and America show that those with CIs perform no better than those with ordinary HAs, rather, language ability (typically in sign) is consistently the key to better cognitive development.\textsuperscript{65}

In sum, the linguistic needs of the deaf child call for language exposure in both modalities.

\textit{Advantages of Bilingualism}

Bilingualism is an advantage to typically developing children; likewise, it is an advantage to children with permanent hearing loss, beyond the points raised earlier. In particular, sign language exposure does not hinder spoken language development nor any other cognitive development; to the contrary, many cognitive, social, and educational benefits follow from bilingualism.\textsuperscript{66} In fact, in a Dutch longitudinal study, both the sign language and the spoken language of bilingual deaf children displayed more syntactic complexity than that of their monolingual peers.\textsuperscript{67}

Bilingual research with hearing speakers has consistently shown that proficiency in two or more languages results in better mental flexibility and cognitive control that persists through late adulthood and may delay the onset of dementia by as much as four years.\textsuperscript{68} Bilingualism in both hearing and deaf people leads to more creative thinking, particularly in problem solving,\textsuperscript{69} and to more creative verbal processes.\textsuperscript{70} Due to the beneficial effect of bilingualism on the frontal lobe, hearing bilingual children perform better than their monolingual peers in tests of spatial ability and general reasoning.\textsuperscript{71} Similarly, deaf adult bilinguals outperformed monolingual
peers on an attention switching task. Research on bilingualism shows that children who find ease in classroom discussion through the use of a language that is comfortable for them do better academically. Since spoken language is not typically used with ease by deaf children, this is one more reason to offer the deaf child the chance to be bilingual by exposing them to sign.

The rationale for raising and educating deaf children bilingually draws from principles of bilingual and multilingual communication around the world. Bilingualism in signed and spoken languages, as it is used by a significant population of deaf and hearing adults around the world, is a practical goal in deaf education. It develops naturally in many families with deaf parents and hearing children without known deleterious effects. Just as millions of hearing children grow up speaking two or more languages which are structurally quite different (such as Chinese and English) without worry that the child will be at a disadvantage in learning one if they speak the other, there has been no evidence that hearing children growing up with a sign and a spoken language are at any educational disadvantage. Raising the child bilingually, as we propose here, goes hand-in-hand with a bilingual/bicultural education, which is effective, as discussed in the next section, and ethical. Dual proficiency in sign language and spoken English affords the deaf child with an added benefit of adapting to both signing and non-signing peer groups with greater ease, which can result in better overall socio-emotional and behavioral development.

Bilingual education

As early as twenty years ago evidence was available that the bilingual/bicultural approach to the education of the deaf child is superior to a strictly oral one; and new evidence is constantly being presented. As the evidence amasses, more and more countries adopt this model in state run schools; within Europe alone we find it in Denmark, France, Germany, Great Britain, Sweden, and Switzerland. Many other European countries which have not
yet wholly adopted the bilingual/bicultural approach have such schools (often the object of
research), including The Netherlands,\(^\text{87}\) Norway,\(^\text{88}\) and Spain.\(^\text{89}\) Comparative research on deaf
education within Europe finds the bilingual/bicultural programs to produce superior language,
literacy, and social skills and such research is being used to advance the cause in additional
countries.\(^\text{90}\) Bilingual education programs for deaf children are springing up all over the world.\(^\text{91}\)

To this date there is no comprehensive study of the various bilingual/bicultural education
programs for the deaf in any country, although one is presently being undertaken in Europe.\(^\text{92}\)

Bilingual/bicultural educational programs differ in pedagogical approach; all stress the
importance of sign as a language for exchange of academic ideas, but some support voicing of
spoken language, as well, while others pair sign with the written language of the country.\(^\text{93}\)

Regardless of approaches, bilingualism in deaf education shows more promise than education in
a single modality for children with and without CI\(^\text{94}\) and is definitely the wave of the future.
Indeed, we have an international megatrend toward bilingualism for deaf children, among the
strongest scientific factors in its favor being research in sign linguistics and bilingualism, and
among the strongest hindrances being the old view of deafness as a medical condition with a
technological solution.\(^\text{95}\) The medical profession in America now has the information to lead the
way in helping correct that misconception in our country and promote the linguistic, educational,
social, and personal well-being of deaf children by providing unbiased information and
appropriate contacts; and if it does so, the educational profession and media may follow suit.

Recommendations

Given the risks of not raising the deaf child with the opportunity to be bilingual and the
benefits of the alternative, the ethical principles of non-maleficence and beneficence would argue
that PCPs advise the families of deaf children accordingly.\(^6\) The alternative can create disability where none need be.\(^7\)

If deaf children are raised with good linguistic models in both a sign and a spoken language, they will have:

1. the assurance of acquiring language and thus being able to participate in all those things we call “humanity”
2. at least one language in which to feel at ease when communicating: one language that does not place undue cognitive load resulting from constant special effort
3. the benefit of exposure to two cultures and expanded social opportunities
4. maximal advantage of visual clues in learning language skills, both receptive and expressive
5. the potential to do better at school and to develop superior visuospatial cognition
6. the benefits of bilingualism for higher-order cognition and mental flexibility

The ideal situation is for families (parents and siblings alike) to begin learning sign language as soon as they find out their child has a hearing loss. It is not sufficient to learn sign language along with the child; the families should be out in front. But even if the families are unwilling or unable to do this, the child must be exposed regularly and frequently to good signing models from birth on.

**Checklist of What the PCP Can Do**

a. Ensure every newborn completes hearing screening prior to discharge from nursery
b. Ensure that follow up screening and hearing testing be carried out for children who do not pass the initial screening
c. Identify red flags/warning signs
   i. Unresponsive to sound
ii. Developmental delay
iii. Language delay
iv. Social isolation
v. Parental depression (particularly when the deaf child is younger than 36 months and delayed in language and cognition areas)
d. Repeat hearing screen if needed; consider trial of antibiotics if effusion present
e. Collect and disseminate accurate information on deaf issues
f. Support parents and listen to their concerns
g. Encourage parents to explore and try all options
h. Refer to appropriate healthcare specialists: audioligists, ear-nose-throat (ENT) specialists, developmental and behavioral specialists
i. Refer to community support groups: deaf advocacy groups, local deaf and hard of hearing community centers, local and/or state deaf services bureaus
j. Be an advocate for the child
k. Ensure accessible education and language development; encourage Individualized Education Plans (IEP) and 504 Education Plans
l. Provide families who want to learn sign language with relevant information

Useful websites

For families:

http://handsandvoices.org/
http://www.babyhearing.org/index.asp
http://idea.ed.gov/
http://www.wfdeaf.org/
http://asltinktank.org/

For professionals:

http://www.infanthearing.org/
http://gri.gallaudet.edu/
http://aappolicy.aappublications.org/cgi/reprint/pediatrics;120/4/898.pdf
For both families and professionals:

http://www.nidcd.nih.gov/

http://www.cdc.gov/ncbddd/ehdi/FAQ/questionsUNHS.htm#programs

http://www.asha.org/

For introduction to sign:

http://www.lifeprint.com/

http://www.aslpro.com/

http://www.handspeak.com/

http://www.funbrain.com/signs/index.html

http://www.asl.ms/
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