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## Infants and Children with Hearing Loss Need Early Language Access

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### Abstract

Around 96 percent of children with hearing loss are born to parents with intact hearing,<sup>1</sup> who may initially know little about deafness or sign language. Therefore, such parents will 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).<sup>2</sup> Clinical research indicates that a deaf child's poor communication skills can be made worse by increased level of parental depression.<sup>3</sup> Given this, the importance of reliable and up-to-date support for parents' decisions is critical to the overall well-being of their child.<sup>4</sup> In raising and educating a child, parents are often offered an exclusive choice between an oral environment (including assistive technology, speech reading, and voicing) and a signing environment. A heated controversy surrounds this choice, and has since at least the late 19th century, beginning with the International Congress on the Education of the Deaf in Milan, held in 1880.<sup>5</sup> While families seek advice from many sources, including, increasingly, the internet,<sup>6</sup> the primary care physician (PCP) is the professional medical figure the family interacts with repeatedly.<sup>7</sup>

The present article 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, one in 1000 infants is born totally deaf,<sup>8</sup> while an additional one to six per 1,000 are born with hearing loss of different levels.<sup>9</sup> Additional instances of congenital hearing loss become evident later in childhood.<sup>10</sup> This makes hearing loss one of the most common birth disorders in the United States.<sup>11</sup> The largest single form of hearing loss is sensorineural disorders, with more than half caused by genetic factors that affect 17 million in the U.S.<sup>12</sup> 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.<sup>13</sup> According to the American Speech-Language-Hearing Association, as of 2009, 47 states plus the District of Columbia enacted legislation to provide universal newborn hearing screening. This followed a recommendation in 1993 by the National Institute on Deafness and Other Communication Disorders that all infants be screened within the first three months of life. We still need full compliance on these recommendations.<sup>14</sup> In 2004 in the U.S., 93 percent of the 4 million babies born were screened for hearing loss.<sup>15</sup> Huge strides have been made in early identification, but the task will not be completed until screening programs are enacted in all 50 states.

## PRESENT SITUATION AND GUIDELINES

Despite these facts, many PCPs have had very limited experience in 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 is often based on misperceptions about deafness and deaf people.<sup>16</sup> The situation seems to be improving, however. A recent pilot study reports that today's PCPs realize that sign languages have all of the communicative possibilities of spoken languages and many are aware of the existence of signing communities of Deaf people.<sup>17</sup> Because of their lack of familiarity with deaf issues, many PCPs express a lack of confidence in discussing follow-up procedures and intervention needs for newborns with hearing loss.<sup>18</sup>

Historically, the medical profession has viewed deafness from a pathological perspective: the deaf person is considered impaired and in need of a cure.<sup>19</sup> Today the stance of the medical profession, as evidenced by the policy statements of the American Academy of Pediatrics, is more sophisticated, yet it falls short of being truly adequate. There are several published policy statements, and all recommend:

- Early screening
- Early intervention
- Close and continued monitoring of all aspects of a child's development, including:
  - Communicative
  - Language
  - Motor
  - Cognitive
  - Social-emotional

- Protection of the infant's and family's rights through informed choice, decision making, and consent.<sup>20</sup>

These recommendations often concerned, almost exclusively, audiological input through habilitation and vocal output. More recent policy statements emphasize the development of cognitive language and the importance of nurturing and communicating with a child, regardless of the modality used.

These policies consistently state the importance of family decision making regarding raising a child orally versus raising a 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.<sup>21</sup> The recommendation throughout is that families receive unbiased information so they can make an informed decision, and then PCPs are to act in accordance with that decision. There are two major problems with this recommendation. One is that the information given to 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."<sup>22</sup> Even the best websites offer less than optimal information. The National Institutes of Health, for example, has a website explaining what American Sign Language (ASL) 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.<sup>23</sup> The language is typical of U.S. websites and contrasts sharply with that of websites in many other countries, such as that of DEAFSA, formerly known as the South African National Council for the Deaf, which states, "Sign Language is the first and natural language of the Deaf person."<sup>24</sup> Such equivocation on U.S. 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).<sup>25</sup> 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 well-being of a deaf child. Thus, it is the PCP's medical responsibility to advise parents properly, just as PCPs or other physicians 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 U.S. deaf children thus far has been limited. According to the Joint Committee on Infant Hearing, 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 a lack of funding for programs and assistive technology, among other things.<sup>26</sup> Even children whose hearing loss is detected early, however, have a high rate of communicative and educational problems.<sup>27</sup> The general tendency in the U.S., of using only one modality of language with deaf children, isn't adequate.

Although it may have little effect on the production of speech,<sup>28</sup> every indicator about EHDI points to one conclusion; early intervention is critical for the development of language.<sup>29</sup> Thus we need to give 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 the development of language, 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 research on the development of language has found that early

exposure reduces the risks of linguistic deprivation, which is frequently associated with cognitive impairment and psychosocial isolation.<sup>30</sup> 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,<sup>31</sup> the acquisition of a first language must take place before the critical period, which may be as early as five years old. If not, children may well have difficulties becoming fluent in any language — they will be linguistically deprived.<sup>32</sup> Research in developmental psychology has found a correlation between reduced language abilities and social difficulties. The development of language is critical to the organization of memory, mastery of cognitive skills such as numeracy and literacy,<sup>33</sup> and many other aspects of cognitive development.<sup>34</sup> High proficiency in a language permits a child to engage in social interactions with family and peers, and cognitive development is enhanced by environmental stimulation. Successful social interaction calls for a higher order of cognitive processing, called executive functioning, which has been significantly positively associated with language ability.<sup>35</sup> It is, therefore, critical that a 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.<sup>36</sup> 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 reports greater activation in language-specialized regions of the brain in signers when they view sign language, as opposed to non-linguistic gestures.<sup>37</sup> Finally, language is language, regardless of the modality. Research reports that facility with one language helps in acquiring another language. Integration and differentiation processes within a linguistic system and across different linguistic systems aid development of language in general,<sup>38</sup> thus, learning sign can help a child master a spoken language.

Even for a child who has auditory aids (hearing aids or CI) and seems to be doing well with them, the early learning of sign language, in particular, offers additional benefits. First, young hearing children develop language through not only auditory but visual cues; the same is true for young deaf children. Developmental neuroscience research indicates 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.<sup>39</sup> Deaf infants should benefit from early exposure to sign language, since the strengthening of sensorimotor pathways involved in the development of sign language (that is, forming linguistic hand shapes 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. Spatial attention in infants has been found to play a crucial role in the early development of language, whether spoken or sign, as well as to promote healthy parent-infant attachment.<sup>40</sup> A deaf infant's lack of, or reduced access to, visual communication during the first four to 12 months risks delayed development of language, cognitive delays, and the subsequent social and emotional effects of these deficits.<sup>41</sup> With visual attention and language mapping in place, a deaf child's brain is likely to be better equipped to acquire spoken language through auditory communication with assistive technologies and is more likely to be able to effectively switch between a sign language and a spoken language.

Second, expressive language milestones are achieved earlier in gesture-based communication systems than in spoken language.<sup>42</sup> Visual clues can help promote production of spoken language; hearing children who are sighted produce labials such as the [b] in *ball*, in which the movement of the lips is visually apparent, before they produce other sounds, but blind children do not. Similar findings hold for a variety of other sounds.<sup>43</sup> Since experience in sign language helps promote development of neural pathways associated

with visual attention abilities, experience with sign language should prepare a deaf child to notice visual cues that are helpful in producing speech.

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

Third, the acquisition of sign language has educational benefits. Many studies report 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.<sup>45</sup> A recent study concludes that skill in ASL, above other possible factors, correlates strongly with achievement in reading, suggesting that the linguistic basis of reading can be bimodal as well as bilingual.<sup>46</sup>

As for the cognitive benefits that are associated with experience with sign language, signers have been found to be faster and more accurate in mental rotation tasks<sup>47</sup> as well as better at discriminating unfamiliar faces than nonsigners,<sup>48</sup> Research also reports that signers have better visual-spatial cognition and movement perception than nonsigners.<sup>49</sup>

### Speech Input: Advantages and Limitations

If a deaf child has specific characteristics that correlate strongly with the success of the use of a hearing aid 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 a deaf child in exposure to speech. First, research points to a strong correlation between a deaf person's phonological awareness and academic achievement (in particular, reading skills);<sup>50</sup> although one is not required to access sound to have such an awareness (given that phonological awareness is of rules, not of sounds).<sup>51</sup> 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 a deaf individual defenseless in an emergency.

Speech alone, however, is not sufficient language input for a deaf child. Although CI is available for children who have bilateral severe to profound hearing loss that is unresponsive to amplification, and it typically shows strong success with children implanted before 18 months,<sup>52</sup> individual variation is pervasive.<sup>53</sup> For instance, research reports that successful CI outcomes best correlate with higher socioeconomic status and parental speech characteristics, specifically mean-length of utterance.<sup>54</sup> In contrast, a persistent 21 percent of implanted children receive no linguistic benefits from CI (instead, they perceive only noise).<sup>55</sup> For the 79 percent 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 recipient of CI receives no benefit when an implant malfunctions or when an external apparatus must be removed, such as for sports events or sleeping (which can be interrupted by an emergency that requires communication). Thus, their communication abilities need to be supplemented by contextual clues and speechreading, which makes language a constant task that requires focused attention and substantial effort. All these children need, and deserve, a language that they can use with ease, just as hearing children do.

Further, there is a growing body of evidence that CI, as a technology, presents no advantage to a deaf child over a hearing aid (HA) or other form of assistance with respect to the development of cognitive abilities such as executive function. Executive function has been found to be less well developed in children with CI or HA than it is in hearing children.<sup>56</sup> Although the authors did not report measures of language proficiency in the deaf children who had hearing parents, it is possible that the deaf children had reduced language proficiency, relative to their hearing counterparts, and this reduced proficiency may have had some effect on their executive function performance in the study.<sup>57</sup> Another study of deaf children with CI reported a positive correlation between increased use of CI and executive function ability (behavioral inhibition).<sup>58</sup> Here, we contend that it is not the CI technology that provides the child with better executive function abilities. Rather, it is the intensive habilitation and active parental involvement that provide desirable outcomes for successful CI.<sup>59</sup> The longer that a child uses an implant and receives intensive habilitation support from experienced specialists, as well as parental involvement at home, the more a 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 socio-economic standing.<sup>60</sup>

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.”<sup>61</sup> One needs to be proficient in both expressive and receptive language or have access to appropriate accommodation to be able to fully participate in a community. A child with CI or HA may be proficient in a spoken language, and yet struggle in listening and understanding a teacher and other students in a classroom. Such cognitive demands, even among school-aged children with mild hearing loss, can result in fatigue. When a child struggles to cope with the overload and is unable to sustain attention and process information equivalently with hearing peers, there are detrimental effects on learning and often on behavior in the classroom.<sup>62</sup> Moreover, children who receive CI early initially show great language gains that are not maintained; these children soon fall behind their hearing peers.<sup>63</sup> A common danger is that a teacher who faces a child with assistive technology and conversational competence assumes that the child is fully able to receive and process all academic materials through that language, and thus offers no special aids. In actuality, the child may be unable to cope with the abstractions, technicalities, and complexities involved in academic language and classroom discussions, and the risk of underachievement is high.<sup>64</sup> Further, studies of the cognitive development of deaf children in Australia and the U.S. report that children with CIs perform no better than those with ordinary HAs; rather, language ability (typically in sign) is consistently the key to better cognitive development.<sup>65</sup>

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

### **The 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, exposure to sign language does not hinder the development of spoken language nor any other cognitive development; to the contrary, many cognitive, social, and educational benefits follow from bilingualism.<sup>66</sup> 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.<sup>67</sup>

Bilingual research with hearing speakers has consistently found that proficiency in two or more languages results in better mental flexibility and cognitive control, which persists through late adulthood and may delay the onset of dementia by as much as four years.<sup>68</sup> Bilingualism in both hearing and deaf people leads to more creative thinking, particularly in

problem solving,<sup>69</sup> and to more creative verbal processes.<sup>70</sup> 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.<sup>71</sup> Similarly, deaf adult bilinguals outperformed monolingual peers on an attention switching task.<sup>72</sup> Research on bilingualism reports that children who used a language that was comfortable for them in classroom discussion did better academically.<sup>73</sup> Since spoken language is not typically used with ease by deaf children, this is one more reason to offer the deaf children the chance to be bilingual by exposing them to sign.

The rationale for raising and educating deaf children bilingually draws on principles of bilingual and multilingual communication from around the world.<sup>74</sup> 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 that are structurally quite different (such as Chinese and English) without worry that the children will be at a disadvantage in learning one language if they speak the other, there has been no evidence that hearing children who grow up with sign and spoken language are at any educational disadvantage.<sup>75</sup> Raising a child bilingually, as we propose here, goes hand in hand with a bilingual/bicultural education, which is effective,<sup>76</sup> as discussed in the next section, and ethical.<sup>77</sup> Dual proficiency in sign language and spoken English affords a deaf child with the 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.<sup>78</sup>

## Bilingual Education

As early as 20 years ago, evidence was available that a bilingual/bicultural approach to the education of the deaf child is superior to a strictly oral one,<sup>79</sup> and new evidence is constantly being presented.<sup>80</sup> As the evidence amasses, more and more countries adopt this model for their state-run schools; within Europe alone we find it in Denmark,<sup>81</sup> France,<sup>82</sup> Germany,<sup>83</sup> Great Britain,<sup>84</sup> Sweden,<sup>85</sup> and Switzerland.<sup>86</sup> Many other European countries that have not yet wholly adopted the bilingual/bicultural approach have such schools (that are often the object of research), including the Netherlands,<sup>87</sup> Norway,<sup>88</sup> and Spain.<sup>89</sup> Comparative research on deaf education within Europe found that bilingual/bicultural programs produced superior language, literacy, and social skills, and similar research is being used to advance the cause in additional countries.<sup>90</sup> Bilingual education programs for deaf children are springing up all over the world.<sup>91</sup>

To this date there has been no comprehensive study of the various bilingual/bicultural education programs for the deaf in any country, although one is presently being undertaken in Europe.<sup>92</sup> Bilingual/bicultural educational programs differ in pedagogical approach; all stress the importance of sign as a language for the exchange of academic ideas, but some support voicing of spoken language as well, while others pair sign with the written language of the country.<sup>93</sup> Regardless of the approach, bilingualism in deaf education shows more promise than education in a single modality for children with and without CI<sup>94</sup> and is the wave of the future. Indeed, it might be said that there is an international megatrend toward bilingualism for deaf children, and among the strongest scientific factors in its favor is the research in sign linguistics and bilingualism. Among the strongest hindrances is an “old view” of deafness as a medical condition that has a technological solution.<sup>95</sup> The medical profession in the U.S. now has the information to lead the way in helping correct that misconception here, and to promote the linguistic, educational, social, and personal well-being of deaf children by providing unbiased information and appropriate contacts. If it does this, the educational profession and media may follow suit.

## RECOMMENDATIONS

Given the benefits of raising a deaf child with the opportunity to be bilingual, and the risks of not doing so, the ethical principles of non-maleficence and beneficence support PCPs who advise the families of deaf children accordingly.<sup>96</sup> The alternative can create disability where none need be.<sup>97</sup>

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

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. The 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 visuo-spatial 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 a child; families should be out in front. But even if the families are unwilling or unable to do this, a child must be exposed regularly and frequently to good signing models from birth on.

## APPENDIX 1

### A Checklist of What Primary Care Providers Can Do

1. Ensure every newborn completes hearing screening prior to discharge from nursery.
2. Ensure that follow-up screening and hearing testing are carried out for children who do not pass the initial screening.
3. Identify red flags/warning signs:
  - Unresponsive to sound
  - Developmental delay
  - Language delay
  - Social isolation
  - Parental depression (particularly when a deaf child is younger than 36 months and delayed in language).
4. Repeat hearing screen if needed; consider trial of antibiotics if effusion present.
5. Collect and disseminate accurate information on deaf issues.
6. Support parents and listen to their concerns.
7. Encourage parents to explore and try all options.



8. Refer to appropriate healthcare specialists; audiologists, ear-nose-throat specialists, developmental and behavioral specialists.
9. Refer to community support groups; deaf advocacy groups, local deaf and hard-of-hearing community centers, local and/or state deaf services bureaus.
10. Be an advocate for the child.
11. Ensure accessible education and language development; encourage Individualized Education Plans (IEP) and 504 Education Plans.
12. Provide families who want to learn sign language with relevant information.

## APPENDIX 2

### Useful Websites for Professionals

<http://www.infanthearing.org/>

<http://gri.gallaudet.edu/>

<http://www.ahrq.gov/clinic/uspstf08/newbornhear/newhheares.pdf>

<http://aappolicy.aappublications.org/cgi/reprint/pediatrics;106/4/798.pdf>

<http://aappolicy.aappublications.org/cgi/reprint/pediatrics;120/4/898.pdf>

### Useful Websites for Families

<http://handsandvoices.org/>

<http://www.babyhearing.org/index.asp>

<http://idea.ed.gov/>

<http://www.wfdeaf.org/>

<http://aslthinktank.org/>

### Useful Websites for Families and Professionals

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

<http://www.cdc.gov/ncbddd/ehdi/FAQquestionsUNHS.htm#programs>

<http://www.asha.org/>

### Useful Websites Regarding 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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