Promoting Consistent Auditory Experience in Children Who Wear Hearing Aids

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Audiologists can have a direct impact on development in the children they serve by following evidence-based recommendations for identification of hearing loss and verification of aided audibility.

Children who are hard of hearing who wear hearing aids have a brighter future than ever before, thanks to the widespread adoption of universal newborn hearing screening, early amplification, and intervention. However, if a parent of a newborn who is hard of hearing asked for evidence that hearing aids could help to improve their child's communication outcomes, what evidence could we cite?

The benefits of early amplification and intervention have been widely reported (Moeller et al, 2007; Sininger et al, 2010), but few studies have attempted to disentangle the effects of amplification on developmental outcomes from the other components of early intervention. Demographic factors, such as a child's degree of hearing loss, socioeconomic status, and the presence of additional disabilities may limit outcomes, but these factors are not easily influenced by intervention. Our goal, as part of the multicenter Outcomes of Children with Hearing Loss (OCHL) study, was to demonstrate the specific benefits of amplification for children who are hard of hearing, in addition to the effects of demographic factors that are known to influence outcomes.

Our primary hypothesis was based on previous research with children who have cochlear implants. Although there is still some debate about the optimal age for cochlear implantation, the general consensus is that earlier ages of implantation and the subsequent aided auditory experience produce more favorable outcomes, (e.g., Niparko, 2010). However, we know that children who wear hearing aids differ from children who wear cochlear implants in timing of identification and at least two other important ways that could affect their development. Once fit with amplification, children with cochlear implants tend to wear their device more consistently than children who wear hearing aids (Walker et al, 2012). Additionally, the amount of audibility provided by hearing aids tends to vary considerably based on the child's degree of hearing loss and how well the hearing aids match prescriptive targets (McCreery et al, 2013).

The combination of hearing aid use and the amount of aided audibility are proposed to reflect the quantity of auditory input that a child who wears hearing aids is likely to receive over time. We predicted that children who had better aided audibility through their hearing aids and a greater number of hours of hearing aid use would have better outcomes due to increased auditory experience, while controlling for other factors such as socioeconomic status and degree of hearing loss. This prediction is supported by previous work by Bagatto et al (2011) and Stiles et al (2012) that demonstrated how children with less auditory input had poorer outcomes than children with more consistent use or better aided audibility.

In the OCHL study, we examined a wide range of auditory and communication outcomes over a five-year span. This included annual measurements of the aided audibility provided by each child's hearing aid. Hearing aid use was measured using parent report, and use time from data logging was documented in cases where the child's hearing aids had that capability. Surveys from parents and from each child's audiologist and early intervention providers were also collected to help determine what parental and professional practices may influence outcomes. Multivariate statistical approaches were used to ensure that complex relationships between variables were reflected in the results. For example, children who have greater degrees of hearing loss tend to wear their amplification for a greater number of hours per day. Children with greater degrees of hearing loss also tend to have poorer outcomes. Only examining the simple relationship between hearing aid use and outcomes might have led to the counterintuitive conclusion that children with greater hearing aid use had poorer outcomes.

Although much of the work is in progress, our research team has published several papers in the past two years summarizing the preliminary findings of our study. Overall, children with better aided audibility have better outcomes than children with poorer aided audibility, even when degree of hearing loss is controlled (Tomblin et al, 2014). Although audiologists are currently unable to improve a child's thresholds through intervention, our research suggests that the practice of fitting children's hearing aids in close proximity to prescriptive targets can maximize the amount of audibility a child receives for a given degree of hearing loss. Because children's ear canal acoustics and hearing thresholds can change as they grow, frequent audiological assessment and hearing aid verification can likewise maximize a child's auditory access as they develop.

Children cannot benefit from amplification that is not worn. In addition to differences across degree of hearing loss, our study also found that the amount of hearing aid use increased as children got older and depended on the listening situation (Walker et al, 2012). Infants' data-logging, for example, averaged less than four hours of hearing-aid use per day, which increased to an average of almost 10 hours per day by the time children entered kindergarten. Although hearing aid use during all waking hours would be ideal for maximizing auditory experience, parents of infants may experience greater challenges related to a child's temperament and behavior, which could limit full-time hearing aid use compared to the parents of older children. Data demonstrating how hearing aid use changes over time can be useful for helping parents to understand the challenges that nearly all families face in establishing hearing aid use during infancy. Audiologists can encourage parents by counseling that hearing aid use is expected to increase over time, and may depend on the child's age and degree of hearing loss.

Findings from the OCHL study and other research demonstrate the positive effects of amplification on auditory and communication development in children who are hard of hearing. Audiologists can have a direct impact on development in the children they serve by following evidence-based recommendations for identification of hearing loss and verification of aided audibility. Supporting consistent hearing aid use can ensure that the benefits of amplification are fully realized.

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References

Bagatto MP, Moodie ST, Malandrino AC, Richert FM, Clench DA, Scollie SD. (2011) The University of Western Ontario Pediatric Audiological Monitoring Protocol (UWO PedAMP). *Trends in Amplification* 15(1):57–76.

McCreery RW, Bentler RA, Roush PA. (2013) Characteristics of hearing aid fittings in infants and young children. *Ear Hear* 34(6):701–710.

Moeller MP, Hoover B, Putman C, Arbataitis K, Bohnenkamp G, Peterson B, Stelmachowicz P. (2007) Vocalizations of infants with hearing loss compared with infants with normal hearing: Part I–Phonetic development. *Ear Hear* 28(5):605–627.

Niparko JK, Tobey EA, Thal DJ, Eisenberg LS, Wang NY, Quittner AL, CDaCI Investigative Team. (2010) Spoken language development in children following cochlear implantation. *JAMA* 303(15):1498–1506.

Sininger YS, Grimes A, Christensen E. (2010) Auditory development in early amplified children: Factors influencing auditory-based communication outcomes in children with hearing loss. *Ear Hear* 31(2):166.

Stiles DJ, Bentler RA, McGregor KK. (2012) The speech intelligibility index and the pure-tone average as predictors of lexical ability in children fit with hearing aids. *J Speech Lang Hear Res* 55(3):764–778.

Tomblin JB, Oleson JJ, Ambrose SE, Walker EA, Moeller MP. (2014) The Influence of Hearing Aids on the Speech and Language Development of Children With Hearing Loss, *Otolaryngol Head Neck Surg* 140(5):403–409.

Walker EA. Walters K, Dunn C. (2012) Predictors in daily amplification use in children with cochlear implants or hearing aids. Poster presented at the 12th International Conference on Cochlear Implants and Other Implantable Auditory Technologies, Baltimore, MD.

Walker EA, Spratford M, Moeller MP, Oleson J, Ou H, Roush P, Jacobs S. (2013). Predictors of hearing-aid use time in children with mild-to-severe hearing loss. *Lang Speech Hear* 44(1):73–88.