Update on Outcomes of Children with Hearing Loss (OCHL) Study: Factors Influencing Follow-up to Newborn Hearing Screening for Infants who are Hard-of-Hearing

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Part I: Timing of Diagnosis and Intervention for Children with Hearing Loss

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Introduction

- The Outcomes of Children with Hearing Loss (OCHL) study is an NIH-funded, multi-center study designed to explore the developmental outcomes of children who are hard of hearing (mild to severe hearing loss).
- Outcomes data on communication, academic, and psychosocial skills are gathered in an accelerated longitudinal design.
- Data on service provision is collected, including type, dosage, and specialty of provider.
- Normal-hearing control group

Participants from a large geographic area with three research teams

Distribution of severity of hearing loss for all OCHL participants recruited to date.

- How do family and child-specific factors such as socio-economic status (SES) and severity of hearing loss affect timely diagnosis and follow-up?
- How consistently are hard-of-hearing children receiving appropriate care and follow-up within the best-practice 1-3-6 timeline (JCIH; AAP; NIH)?
- What reasons are given by families for delays between various steps in the EHDI process?
Methods

• At the initial OCHL visit, parents completed an intake interview that documented several benchmark steps toward the diagnosis of HL and the receipt of early intervention
• For the subgroup of children who did not pass newborn hearing screening (n = 193), we explored effects of child and family variables on timeliness of follow-up steps. Linear regression models investigated the relationships among the independent predictor variables (gender, site of testing, SES, and severity of HL) and each of the dependent variables (ages at each follow-up benchmark).

Results

• Of the independent variables, only mother’s education was found to be significantly related to the ages of first diagnostic audiologic evaluation (p = 0.0123), hearing loss confirmation (p = 0.0013) and hearing aid fit (p = 0.0445).
• There was no significant relationship between the predictor variables and the age at which the child entered early intervention.
• Similarly, there was no relationship between the predictor variables and the time that elapsed between confirmation of hearing loss and entry into early intervention.

Reported reasons for delays

• Multiple rescreenings (up to 10) or retesting
• Family assured that failed screen was caused by something other than permanent hearing loss
• Family told by primary care physician to wait until behavioral testing was possible
• Family or physician did not believe child had a hearing loss due to observable responses to sound
• Difficulty obtaining appointment for ABR, medical clearance for hearing aids or hearing aid fitting
• Recurrent otitis media

Conclusions, Part I

• Many families accessed care following newborn screening within recommended time frames. Specific barriers were identified, and these appear to be addressable through improved systems, services and educational efforts.
• In a group of children who are hard-of-hearing, higher maternal educational levels were significantly associated with earlier confirmation of hearing loss and fitting of amplification. Severity of hearing loss was not.
• Public awareness campaigns about newborn hearing screening and the importance of good hearing for speech and language development must continue to be developed, with particular emphasis on underserved communities.
• There remains confusion on the part of providers and families about the presence of hearing loss in infants and toddlers who display awareness of sound. Educational resources and training should address this specific gap in understanding.
Part II
The characteristics of hearing aid fittings in infants and young children

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Research questions
- What is the quality of hearing aid fittings for children in the study?
  - Speech intelligibility index (audibility)
  - RMS error to target (fidelity of treatment)
- What factors limit the quality of hearing aid fitting?
  - age
  - etc

Hearing loss and audibility
- For years, we have looked at thresholds as a predictor of future speech, language, academic, psychosocial, etc., success;
- What we hypothesized in this large study was that access to speech was more likely to predict the child’s success in life.

Hearing loss and audibility
- HOW to quantify that access raised some challenges;
- We opted to consider the Articulation Index/Speech Intelligibility Index.
- (That is, we counted the dots)

Each dot represents ~1% of the information contributing to speech clarity.
The number of dots that are audible predict how well one understands quiet speech from a six foot distance.
The dots are unevenly distributed, with many more of them filling in the gray zone between 1000 and 3000 Hz than in the 250 to 500 Hz area.
Count the Dots

26% AI Understand 90% Sentences

Hearing loss and audibility

- We opted to use a formula that has a standardized approach (ANSI) to see how much of the average speech signal is audible through the child’s hearing aid; that is referred to in our study as the SII

SII = Sum of weighted audibility of all frequency bands
Hearing loss and audibility

- We opted to use a formula that has a standardized approach (ANSI) to see how much of the average speech signal is audible through the child’s hearing aid; that is referred to in our study as the SII.
- We were also interested in how the aids were fit…prescriptive?

Hearing loss and audibility

- What we found was that ~99% of the fitting audiologists checked DSL as their intended fitting target.
- (Keep in mind that just because the computer says you are fitting to DSL, only real ear measures can confirm it!)

How close to the target?

- Optimal fitting of hearing aid (< 5dB RMS error)
- OK fitting of hearing aid
- “crappy” fitting of hearing (< .25 SII)
Part II

The characteristics of hearing aid fittings in infants and young children

Submitted to
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Audibility

Most children have good audibility (Mean .70) Between ears (r = .691, p < .001); some children have very limited audibility

Fit-to-target (RMS error)

Red box = Limited RMS error

Some remaining issues/nonissues

- Whether the aids were fit to DSL or to NAL prescriptions not really an issue (as both strategies aim to optimize);
- Whether hearing aids used frequency compression or not did not impact speech or language outcomes.