

## The LOCHI Studies and What They Teach Us

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The National Acoustics Laboratory in Australia under the supervision of Dr. Teresa Ching has conducted the Longitudinal Outcomes of Children with Hearing Impairment (LOCHI) study over a period of years. In Australia, all children with hearing loss are followed by Australia Hearing, so collecting data on performance of children with hearing loss is easier. All children receive evidence based audiology and habilitative services. Children are monitored carefully over time. Audiology tests are well organized. Hearing aids are fit using prescriptive targets and are monitored to be sure that they are meeting prescribed targets. All children receive hearing aids and cochlear implants as needed with no cost to families (wow! – ideal). All have complete language, literacy, and social skills evaluations in addition to audiological evaluations.

Because all children throughout the country are monitored by the same agency, it is possible to really evaluate many aspects of development for children with hearing loss. Every child is monitored. There is no selection bias in research. Children will be monitored over a long period of time and should provide outstanding data to help us understand what makes a child successful.

### LOCHI Data

468 children are participating in the LOCHI studies. 305 use hearing aids and 163 use cochlear implants. Some of the cochlear implant students are bilateral and others bimodal. Here is what has been learned so far.

1. Fit technology early and fit it right – not a surprise. Although this appears obvious, it is important that we recognize that this is really critical. The LOCHI data shows that for children with severe hearing loss, outcomes decrease by 0.3 SD when hearing aid fitting is delayed from 6-12 months and another 0.3 SD when delayed to 24 months. Similar results are observed for children with moderate hearing loss. These data confirm the need for accurate early fitting of technology and should push EDHI providers to encourage parents to fit technology early and to use it full time. Children fit later are delayed and the time cannot be made up. The LOCHI data also demonstrated that is critical to verify the output of hearing aids using RECD and probe microphone measurements. Meeting target gains is critical.
2. Cochlear implantation needs to happen early. Children who received CI's early performed better. A delay of 6-12 months resulted in a decrease of 0.7 SD in language outcomes with an additional 0.4 SD reduction for children implanted from 12-18 months and another 0.3 SD for children implanted between 18-24 months. This data makes the best case so far for implanting children before their first birthday. CI teams, auditory verbal practitioners, speech-language pathologists and educators, need to push to get children who are not doing well implanted early.
3. Monitoring language outcomes – A significant goal of the LOCHI studies was to try and determine prognostic factors that could be used to predict how children with hearing loss are progressing to enable them and us to identify intervention that might be needed early to improve

progress. They identified the PEACH as an excellent tool to provide the necessary information. The PEACH (Parents Evaluation of Aural/Oral Performance of Children with Hearing Loss) questionnaire was found to be a good predictor. The PEACH is designed to evaluate how children with hearing loss communicate in every day situations. Testing showed that children who had poorer Peach scores before 12 months of age had poorer outcomes at 5 years of age. This may actually be good information. If we can identify children at risk early on, it may be possible to modify intervention so that we can improve outcomes.

4. ANSD – Of the 40 children with ANSD in the LOCHI studies, there was no significant difference in language outcomes at 5 years of age when compared to other children with hearing loss. This is very exciting and hopeful information. It means that, with appropriate management, children with ANSD can have good outcomes. The NAL uses speech-evoked cortical responses to determine if hearing aids should be fit on children with ANSD, and to determine if they are likely to benefit. If it is determined that they are not likely to benefit, they are moved quickly to cochlear implants. Results are reported to be excellent if hearing aids are fit by 6 months and cochlear implants fit by 12 months.
5. Language stimulation – The LOCHI study confirmed what was found in the earlier Hart and Risley study in 1995. Children whose mothers have higher education have better language outcomes. The reason for this is not clear. Perhaps mothers with higher education levels are talking to their children more. Perhaps mothers with less income do not understand the need for intensive language stimulation, or perhaps their lives are overwhelming and they cannot manage the additional stimulation needed by their children with hearing loss. What is clear is that EDHI programs need to recognize that language stimulation is critical and help families provide more and more.
6. Literacy – The value of good literacy skills cannot be underrated. Children who do not have good literacy skills have problems learning and are underemployed. The LOCHI study demonstrated that phonologic awareness made a significant contribution to a child's ability to read. The study controlled for variations in receptive vocabulary, cognitive skills and other demographic variables. The ability to both break down words (breakdown book into /b/, /u/, /k/) and rhyme words (cat, bat, hat, mat) are critical for literacy. Children with difficulties in phonologic awareness had difficulties in literacy. Providing early intervention skills to improve phonologic awareness can significantly improve literacy.
7. Communication mode – Certainly a hot topic. Three fourths of the LOCHI families chose spoken language and the remaining chose total communication. The LOCHI researchers had no direct tie to any communication mode so the results should be considered reliable and unprejudiced. The language outcomes for children using spoken language were significantly higher than those using total communication. Since more than 95% of the children were born to hearing parents the families natural mode of communication was spoken language so they were more easily able to provide spoken language stimulation to their children. Families who chose sign language were learning a new language while trying to provide language stimulation to their children.
8. 37% of children in the LOCHI study had additional disabilities. Children with additional disabilities had poorer language outcomes compared to children with no other disabilities. While this data is not surprising, it is critical. It is a reminder that all children with hearing loss need to be followed by a multidisciplinary team of professionals who can evaluate children for additional disabilities and provide whatever additional services are needed. The team should include speech-language pathologists familiar with language and literacy issues for both normal hearing and hearing impaired children, as well as physicians, psychologists physical and occupational therapists, and teachers. The group needs to work as a team planning for children in order for children to succeed.

## **Conclusion**

What have we learned? We need to thank Dr Teresa Ching and the staff of the National Acoustics Laboratory for doing this excellent work. They have helped us to understand how important it is to move quickly to provide children with appropriately fit technology and habilitation. Fit hearing aids early and be sure they meet real ear goals. (I would add that we should validate test results in addition to using real ear. We need to use behavioral testing to assure that children are hearing what they need to hear. Monitor progress using the PEACH or another similar questionnaire. If a child is not making sufficient progress with hearing aids, fit cochlear implants early. Help parents learn to talk talk talk talk talk. Develop literacy skills early. We owe it to children with hearing loss to assure that they can be whomever they want to be.

