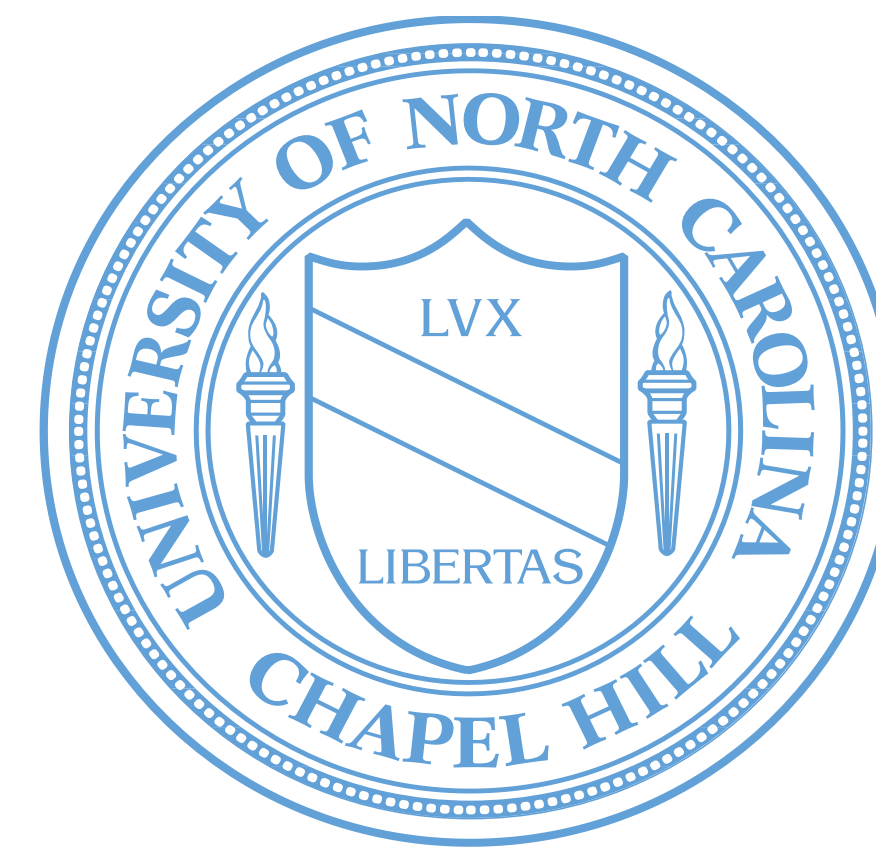


Cochlear Implantation In Children Under 12 Months: A Systematic Review



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Background

Cochlear implantation is indicated for children with significant hearing loss who demonstrate limited benefit from a conventional hearing aid trial. Although the FDA only permits implantation in children 12 months of age or older, off-label implantation has occurred in children under 12 months of age. While some studies do not find statistically significant results due to small sample sizes (Miyamoto et al., 2008), others offer support for implantation in the population in question by demonstrating significant speech and language benefit as compared to children implanted over 12 months of age (Dettman et al., 2016).

The present systematic review was completed as a project for SPHS 701 Introduction to Research Methods, under the guidance of Drs. Linda Watson and Jessica Steinbrenner. Our aim is to assess the efficacy of cochlear implantation in children under 12 months of age with regard to speech and language outcomes using the most current literature on the topic. Previous systematic reviews completed on this topic include Forli (2011) and Bruijnzeel (2015).

Aim

To assess whether cochlear implantation in children under 12 months of age affects speech and language outcomes compared to children implanted over 12 months of age.

Methods

Databases:

- CINAHL
- PubMed
- Psych Info

Inclusion Criteria:

- Studies between 1990 – 2017
- Participants included infants implanted <12 months
- Participants received follow up evaluations assessing receptive and/or expressive language

Reliability:

- We retrieved 128 articles from the three databases.
- Forty-two articles passed the abstract and title screening
- These were evaluated by two independent reviewers
- Interrater reliability was 96%
- A total of 12 articles were included for the systematic review

Results

Chart 1: Data extraction results

Author & Year	N <12 Months	N >12 Months	Evidence Level	Expressive Language	Receptive Language
Ching (2009)	12	23	4a	✓	✓
Colleti (2005)	10	0	4b	✓	
Cuda (2014)	16	14	4a	✓	
Dettman (2016)	11	36	4a	✓	✓
Dettman (2007)	19	87	4a	✓	✓
Holman (2013)	16	13	4b	✓	✓
Leigh (2013)	35	85	4a	✓	✓
Lesinski (2004)	27	89	4a	✓	✓
May-Mederake (2012)	11	17	3a	✓	✓
May-Mederake (2013)	4	N/A	4b	✓	✓
Miyamoto (2009)	8	83	3a	✓	✓
Nicholas (2013)	27	42	4a	✓	✓

Quality appraisal was completed individually by all three researchers. Any discrepancies in final evidence levels were discussed and agreed upon. The final results of the evidence appraisals indicated seven 4a, two 3a, and three 4b articles.

As seen in **Chart 1**, data was extracted from 12 articles. Most of the articles did not include statistics, including standard deviations, attrition rate, power, and effect size. May-Mederake (2012) included p-values regarding performance between those implanted before 12 months of age, between 12 and 18 months of age, and between 18 and 24 months of age. There was a significant difference in performance on sentence comprehension tasks between the groups implanted under 12 months and between 12 and 18 months with the under 12 months groups showing better performance. No significant differences were found for performance comparisons between the other groups on various tasks. Ching (2009) and Cuda (2014) both evaluated expressive language and found very large effect sizes (>1.3) in their retrospective cohort studies between children implanted before 12 months and between 12-24 months of age.

Although most articles did not include statistical analyses, there was a discussion regarding outcomes as seen on receptive and expressive language tasks. These discussions, along with the two systematic reviews and the decision analysis article, were utilized to answer our research question. Based on our review, it appears that cochlear implantation under 12 months provides an advantage in terms of language development and speech production. Potential sensitive periods exist for those implanted before 12 months, especially for grammatical and speech development. In fact, these infants typically exemplify scores on par with their normal-hearing peers.

All studies analyzed for this systematic review support the trend toward earlier implantation in pre-lingually deafened children.

Conclusions

In many of these studies, the sample size was too small for the authors to draw statistical conclusions. In the future, studies with larger sample sizes would be beneficial so that statistically significant data can be obtained. There is also a need for longer follow-up studies. The benefit seen for children implanted before 12 months as opposed to those implanted after 12 months may even be apparent into the adult years.

Based on the results of this systematic review, cochlear implantation prior to 12 months of age is justified. The benefit of having access to sound prior to 1 year of age is evident and no adverse events have been reported.

In order for cochlear implantation for children under 12 months of age to be approved by the FDA, a larger study is needed. Ideally, a multi-center, longitudinal study with a large sample size mandated by the FDA would provide the necessary findings for the FDA to change the labeling on cochlear implant devices to reflect the benefit of routine implantation of infants under 12 months of age.

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