HOPE Cochlear™ (Re)Habilitation Resources

Knowledge Needs of Early Intervention Professionals

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Cochlear™

AGENDA

- Recent Research on Factors Impacting CI Outcomes
- Early Intervention Professionals' CI Knowledge: What are the gaps?
- Improving CI outcomes via EI advisement and service delivery

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Spoken Language Development in Children Following Cochlear Implantation

Niparko et al., Journal of the American Medical Assoc. Vol. 303, No.15, 1498 – 1506, April 21, 2010

Study Design and Objectives

- Childhood Development after Cochlear Implantation (CDaCI) study: a prospective, 3 year longitudinal study to assess spoken language development and identify factors influencing language development in young severe-to-profound hearing impaired (SNHL) children following cochlear implantation

- 6 large US cochlear implant centers enrolled a total of 188 SNHL children and 97 normal hearing children from 2 private pre-schools who served as the reference group

Study Design and Objectives

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- Children implanted before 5 years of age, stratified by age at implantation
  - Younger than 18 months (n = 72, 38%)
  - 18 - 36 months (n = 64, 34%)
  - Older than 36 months (n = 52, 28%)

- Three year follow-up period completed from 2005 through 2008

Main Outcome Measures

- Assessment battery administered at 6, 12, 24, 36 months following implant activation
- Child's language age determined from expressive and comprehension scales of the Reynell Developmental Language Scales
- Speech Recognition Index
  - Developed for use in study
  - Summarizes child's scores on various speech recognition measures
  - Tracks performance via growth curve analysis
- Videotaped parent-child interactions
  - Interactions coded for various parent-child interaction attributes

Results

- Children implanted early (< 18 months) showed **significantly faster rates of development** of spoken language than the 2 older groups
  - During follow-up, most children implanted early showed improvement rates that were similar to the hearing controls, the gap in development did not widen

- Cochlear implantation after 18 months is associated with slower development and more variability in both expression and comprehension abilities
  - During follow-up, gaps tended to widen between children implanted later and hearing controls

Results

- Higher parent-children interaction scores significantly associated with faster increases in comprehension

- Lower rates of language development after CI associated with longer periods of hearing loss with or without amplification pre-operatively
  - Longer periods of hearing loss contributed to later age at implantation
  - Children with longer periods of amplification pre-operatively will be older when they are implanted

Summary

- Cochlear implantation is associated with significant improvements in comprehension and expression of verbal language
- Performance of children implanted early was closer to that of normal hearing controls
- Older age at implantation is associated with larger differences between chronological and language ages
- Importance of parent-child interactions following CI
- Increasing the length of hearing aid use in SNHL children may be detrimental to language development after CI because of child's older age
  - Early intervention extremely important to outcomes
  - Very important to monitor performance with hearing aids, do not delay implantation if child is not making progress

Will They Catch up? The Role of Age at CI in the Spoken Language Development of Children with Severe to Profound Hearing Loss

Nicholas & Geers. *Journal of Speech, Language, Hearing Research*. Vol 50, 1048-1062, 2007.

Results

- Subjects: 76 children implanted between 12 – 36 months (+/- 2 mos.) and in oral program
- Expected Preschool Language Scale scores of children implanted at youngest ages reached those of hearing age peers by 4.5 years of age
- Children implanted after 24 months did not catch up

Summary

- Children who received CI early (between 12 & 16 months) more likely to achieve age-appropriate spoken language

Other Studies on Impact of Age on CI Outcomes

- Geers A et al. Long term outcomes of cochlear implantation in the preschool years. *Int J Audiol*. 2008; 47(suppl 2):S21-S30.
- Zwolan TA et al. Pediatric cochlear implant patient performance as a function of age at implantation. *Otol Neurotol* 2004;25:112-20.

Geers A and Hayes H. “Reading, Writing, and Phonological Processing Skills of Adolescents with 10 or More Years of Cochlear Implant Experience.” *Hear and Hearing*, Jan/Feb 2011.

Study Design

- Battery of reading, spelling, expository writing and phonological processing assessments
- Administered to 112 CI-HS students ages 15.5 to 18.5 years who had participated in a reading assessment in early elementary grades (CI-E) at ages 8 to 9.9 years
- Comparisons made to control group of normally hearing peers

Reading Results in HS

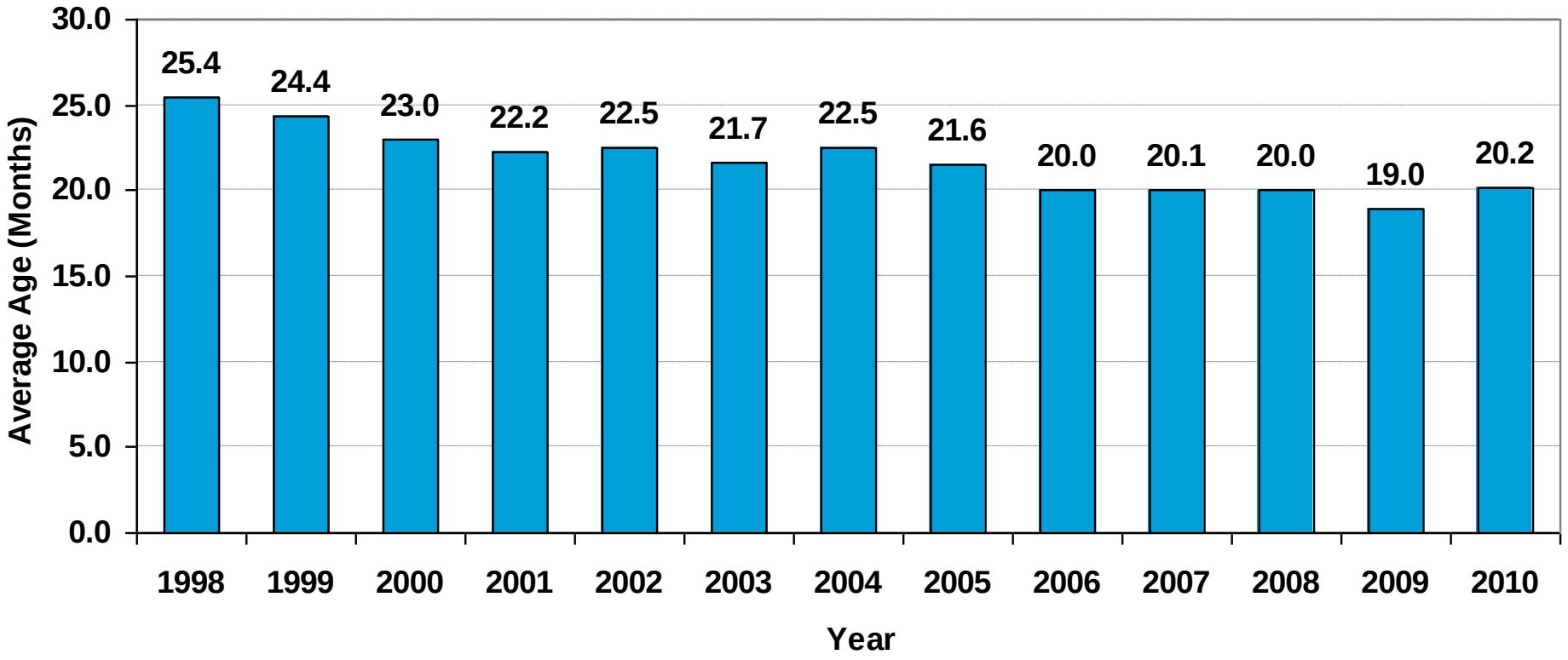
- **Commensurate Performers** perform within range of typically developing peers: 36% of CI-HS scored at 9th grade or above
- **Capable Performers** do not catch up to peers but demonstrate academic progress: 46% scored between 4th and 8th grade levels
- **Challenged Performers** are making slow and laborious progress: 17% scored below 4th grade level

What factors accounted for the differences in this study?

- Duration of deafness (duration from birth to CI or for those not prelingual, from deafness to CI)—shorter did better
- Gender (girls did better)
- Performance Intelligence Quotient
- CI characteristics (users of newer technology did better)
- Phonological processing skills—accounted for 38% of variance

- Age at time of CI (or deafness duration) is a common finding in all of the recent studies
- 18 months or younger is the critical age
- Brain plasticity factors impact a child's ability to fully make use of the sound access provided by a cochlear implant

Average Age of Implantation for Children Under 3 Years of Age
as of July 31, 2010



Source: National estimates based on the Cochlear Americas registration database.

What do parents report?

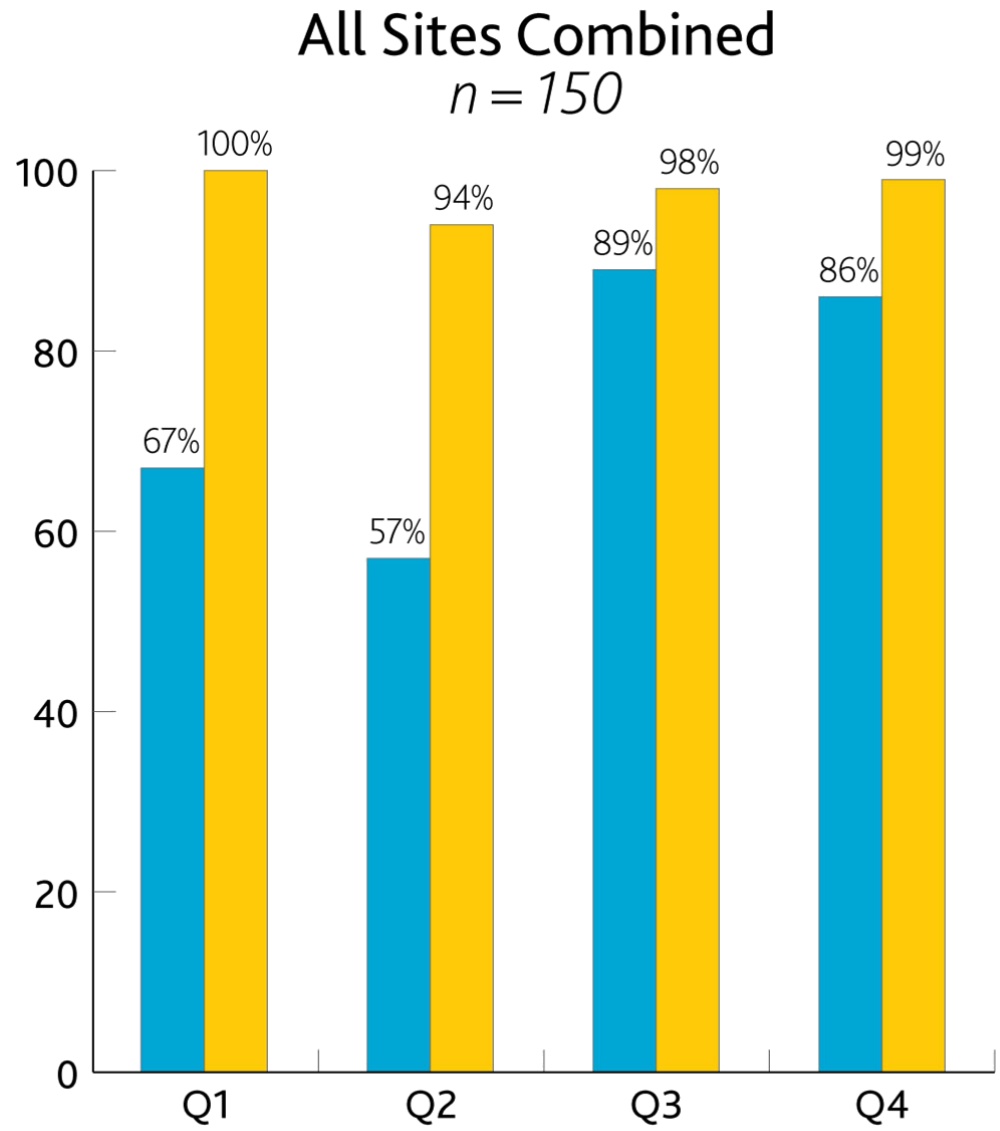
- Parents of children who received cochlear implants emphasize importance of receiving comprehensive, unbiased information from EI professionals
- Majority of parents whose children received a CI indicated they were not told of child's possible candidacy by their EI professional
- 31% indicated CI information provided by EI while the majority received information from other sources

Source: Sorkin & Zwolan, Otol Neurotol, 2008:29;137-142.

Assessment of Knowledge Gaps

- National training programs for EI professionals conducted presenting basic constructs and tools to facilitate auditory skills in young children with hearing loss
- One day workshops conducted across the country Jan-April 2010 in 5 sites
- Questionnaire measured participants' knowledge of factors that may impact on children's CI outcomes
- 8 questions posed pre and post to attendees

Knowledge Needs



Four of the 8 questions asked relate to factors that may impact on a child's outcomes. Results are summarized for each site (below), listing % correct pre- and post training. The four questions (with correct answers in blue) are:

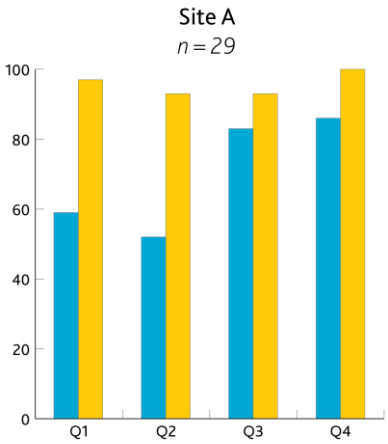
Question 1: The youngest age at which a child with a profound hearing loss may receive a cochlear implant, based on FDA criteria (5 choices: 24, 12, 6, 36, 18 months)

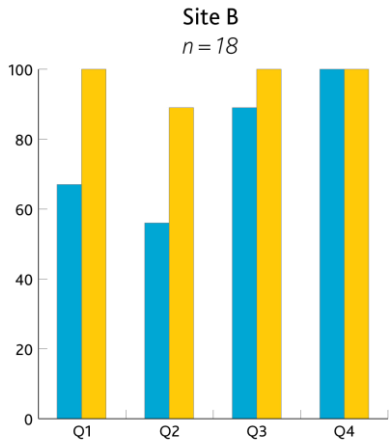
Question 2: Studies found that children who are implanted at or prior to this age, on average, have the best spoken language outcomes (5 choices: 24, 36, 18, 6, 12 months)

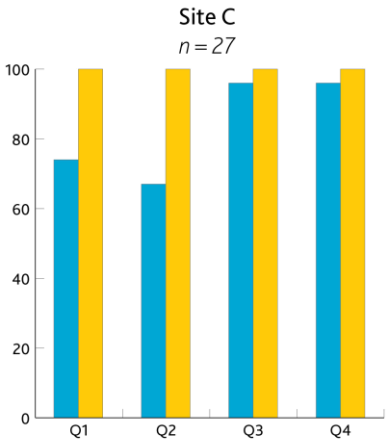
Question 3: It is not necessary for a young child who will be early implanted to utilize hearing aids (or FM system) prior to receiving their cochlear implant (true or false)

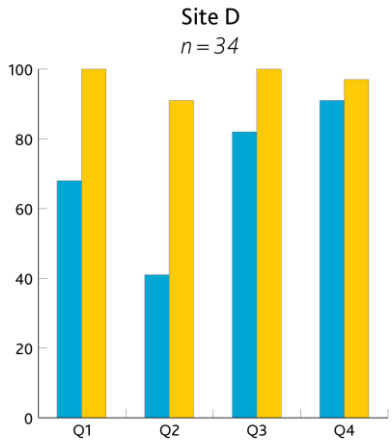
Question 4: To maximize spoken language outcomes, families should begin auditory therapy with their young deaf child (4 choices: correct answer is as soon as the child is identified as having a hearing loss)

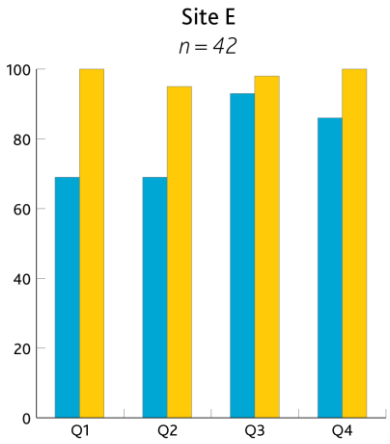
Knowledge Needs











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Key Factors in CI Outcomes in Studies Reviewed

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Niparko Study

- **Age at CI (18 months or less)**
- Quality of parent interactions with child

Geers Study on Literacy

- Phonological processing skills
- **Duration of deafness (or age at CI)**
- Gender (girls did better)
- Performance Intelligence Quotient

Improving CI Outcomes Via EI Advisement

- CI clinics report many families begin child's CI process after age 2 after having been advised to fit hearing aids and "wait and see" or "wait until they feel ready"
- Starting late is common and is reflected in data on average age at CI (20.2 months in 2010)
- Provide full CI information from the outset and encourage parents to visit a CI clinic to determine their interest in CI at or before child's 6 month birthday
- Provide support and encourage participation in parent-centered therapy and/or an educational programs that encourage parents to promote spoken language development throughout the child's day