Outcomes of Children with Hearing Loss: A Study of Children with Mild to Severe Hearing Loss

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Supported by NIDCD R01 DC009560

EHDl: Partnering for Progress 2011
Background

- Most outcome studies focus on children who are deaf
- Reduced body of literature concerning children with mild to severe HL
  - Sample sizes are small or mix D/HH children
  - Lack of control of amplification histories/audibility
  - Few studies attempted a population sample
  - Varied measurement strategies; earlier generation technologies
- Need to understand sources of individual difference in outcomes
Domains of study

- Speech Production
- Language Skills
- Academic Abilities
- Hearing & Speech Perception
- Psychosocial and Behavioral
- Interventions (clinical, educational, audiological)
- Background characteristics of child/family

Child and Family Outcomes

EHDI: Partnering for Progress 2011
Participants

<table>
<thead>
<tr>
<th>Centers</th>
<th>HH</th>
<th>NH</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boys Town</td>
<td>117</td>
<td>40</td>
</tr>
<tr>
<td>Iowa</td>
<td>85</td>
<td>48</td>
</tr>
<tr>
<td>North Carolina</td>
<td>104</td>
<td>24</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>306</td>
<td>112</td>
</tr>
</tbody>
</table>

• Ages 6 months – 6; 11
• English spoken in the home
• No major secondary disabilities
• Permanent Mild to Severe Hearing Loss
• PTA of 25-75 dB HL (500, 1k, 2k, 4 kHz)
Speech and Language Outcomes: Birth to Three

• Standardized measures
  - Vocabulary
    - MBCDI
  - Receptive/Expressive Language
    - Mullen Scales

• Newer, nonstandard measures
  - Infant Vocal Interview
  - Open and Closed Set Test
Expressive Vocabulary at Age Two - MBCDI

Mean 90.83 (12.74)

38.3% ≤ 84

n = 60
1 & 2 years: Mullen Scales--Receptive

X = 43.3  
(9.7) 
n = 28

X = 44.1  
(15.3) 
n = 61

BEPTA  
r = -.425**

BESII  
r = .453**
Vocal Development Landmarks

**Interview**

**PROVISION OF VOCAL EXAMPLES AND PAIRED COMPARISONS**

- To avoid use of technical terms
- To ensure that parent and clinician “on same page”
- To calibrate examiners

**USES STANDARD INTERVIEW FORMAT AND PP SLIDES WITH AUDIO FILES**

EHDI: Partnering for Progress 2011
Item 1-4 (pre-canonical)

Breathing in

Breathing out
Item 2-3 (canonical)
Paired samples t tests:  $p < .001$
A MEASURE OF PERCEPTION-PRODUCTION
APPROPRIATE FOR ~18 MONTHS – 2 YEARS+
DEVELOPED BY ERTMER, MILLER & QUESENBERRY, 2004
10 ITEMS, REALISTIC PICTURES
PROMPTED PRODUCTION FOLLOWED BY PICTURE IDENTIFICATION

dertmer@purdue.edu
Two-year olds: O&C

*Between groups: \( ps < .05 \)  Mann Whitney U

**\( ps < .013 \)  Spearman’s Rho

<table>
<thead>
<tr>
<th>Subtest</th>
<th>NH (n = 28)</th>
<th>HH (n = 66)</th>
</tr>
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<tbody>
<tr>
<td>Aided SII/BEPTA</td>
<td>.349*</td>
<td>-.326*</td>
</tr>
<tr>
<td>MBCDI-WS</td>
<td>.737**</td>
<td></td>
</tr>
<tr>
<td>Mullens Ex</td>
<td>.747**</td>
<td></td>
</tr>
<tr>
<td>Mullens Rec</td>
<td>.735**</td>
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EHDI: Partnering for Progress 2011
Questions

- What are general descriptive characteristics of this HOH population?
- How do subject-specific variables (site, gender, income, parents education, severity of hearing loss) affect timely diagnosis and follow-up
  - Ages of ID, HL confirmation, HA fit, entry into EI?
- What are the reasons for delays between identification and confirmation? Between confirmation and hearing aid aid fit?
- How are these HOH kids meeting the national 1-3-6 goals when moving through the EHDI process?
Distribution of better ear PTA
Ages of confirmation of hearing loss and age of hearing aid fitting

169 who did not pass NHS (median)
Ages of confirmation of hearing loss, hearing aid fitting and difference by site

Median data in months

Mean data in months

Legend:
- Boys Town
- Iowa
- UNC
- All Sites
Ages of confirmation of hearing loss, hearing aid fit and difference (169 who did not pass NHS): Effect of Mother’s education

**Mother's education (median)**

- High school or less
- Some college
- Bachelors
- Post graduate

**Mother's education (mean)**

- High school or less
- Some college
- Bachelors
- Post graduate

- Age of confirmation
  - p = 0.0442
- Aid Fitted
  - p = 0.0197
- Difference between confirmation and fitting
  - NS
Ages of confirmation of hearing loss, hearing aid fitting and difference (169 who did not pass NHS): Effect of father’s education
Age of confirmation of HL for each level of mothers education: 7 month difference between highest and lowest levels of education

<table>
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<tr>
<th>Biological Mother's Education</th>
<th>Age of hearing loss confirmed</th>
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<tr>
<td></td>
<td>Mean</td>
</tr>
<tr>
<td>High School or less</td>
<td>11.40</td>
</tr>
<tr>
<td>Vocational school/some college</td>
<td>8.20</td>
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<td>College</td>
<td>4.68</td>
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Age of confirmation of HL for each level of mothers education:
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Are we meeting EHDI goals? (% subjects and ranges in months)

<table>
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<th>Percentage</th>
<th>Description</th>
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<tr>
<td>% screened by 1 mo</td>
<td></td>
</tr>
<tr>
<td>% first diagnostic test by 3 mos (.25-55)</td>
<td></td>
</tr>
<tr>
<td>% confirmed by 3 months (.5-60)</td>
<td></td>
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<tr>
<td>% HA fit by 6 mos (2-62)</td>
<td></td>
</tr>
<tr>
<td>% EI entry by 6 mos (n=159, 0-57)</td>
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Age hearing loss confirmed by age of first diagnostic test

Identified at UNHS (n=169)
n=163 who had both Age of Fit and Age HL Confirmed.
100 were confirmed by 3 mos (61.3%)
27 were confirmed from 3.5-6 mos (16.5%)
36 were confirmed at 7+ mos. (22.1%)
Of 127 who were confirmed from 0-6 mos, 100 (78.7%) were fit by 6 mos.
Mean time between HL confirmation and HA fit by age of confirmation

But MEDIAN time between confirmation and fit is 1 month for all age groups
% into EI before 6 months by age of confirmation

- Confirmed 0-3 mos (n=101): 84.3%
- Confirmed 3.5-6 mos (n=26): 73.1%
- Confirmed 7+ mos (n=29): 6.9%

Other reasons for EI?
Subjects who did not fail NHS (includes delayed onset HL)

Not identified with UNHS: All ages (n=48)
Characteristics of Hearing Aid Fitting

What is the quality of hearing aid fitting for children in the study?

- Audibility
  - How much of long-term speech spectrum is audible
- Fit-to target
  - How close fittings are to stated to prescriptive formula
What factors limit the quality of hearing aid fitting?

- Age
  - Do we have accurate thresholds on which to base the hearing aid fitting?
- Verification method
  - Real-ear verification, measured or average RECD
- Knowledge/skills of audiologist doing the hearing aid fitting
- Consistency of use
  - Parent report/data-logging
Challenges in evaluating hearing aid fitting

- Only evaluating hearing aid when children are in clinic
  - If hearing loss progressed following last study visit, no knowledge of when that happened

- Many study subjects now using frequency lowering devices
  - Created challenging in attempting to use SII as measure of audibility
Early Services

• Service Provider Surveys
  o Once each year child enrolled in study
  o Online response entry
  o Completion of survey rewarded

• Based on 86 unique professional responses
  ▪ Iowa
  ▪ Kansas
  ▪ Missouri
  ▪ Nebraska
  ▪ North Carolina
  ▪ Virginia
Educational Level

- Bachelor's: 22%
- Master's: 76%
- Doctorate: 1%
- Other (Ed.S.): 1%

Partnering for Progress 2011
Certification in Employment Area

- Yes: 96%
- No: 2%
- No Answer: 2%
Years Providing Early Services

Years in Early Intervention

<table>
<thead>
<tr>
<th>Years Range</th>
<th>Count</th>
</tr>
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<tbody>
<tr>
<td>0 to 5</td>
<td>36</td>
</tr>
<tr>
<td>6 to 10</td>
<td>14</td>
</tr>
<tr>
<td>11 to 15</td>
<td>9</td>
</tr>
<tr>
<td>16 to 20</td>
<td>8</td>
</tr>
<tr>
<td>21 to 25</td>
<td>6</td>
</tr>
<tr>
<td>26 to 36</td>
<td>14</td>
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Partnering for Progress 2011
Location of Early Service Provision

- Home: 76%
- Child Care Environments: 10%
- Center-Based E I Settings: 6%
- Therapist's Office: 3%
- Other Settings: 5%

Partnering for Progress 2011
Caseloads Reported

- 1 to 15: 49%
- 16 to 30: 30%
- 31 to 45: 13%
- 46-60: 8%
Children with Mild to Severe Hearing Loss on Caseloads

- Total Caseload
- Mild-Severe
- Profound

Legend:
- 1 to 15
- 16 to 30
- 31 to 45
- 46-60
How Much Intervention?

**Intervention Minutes per Month**

Sessions per month range from .5 to 6

4 x/month most common in NC

Multiple providers more common in NE and IA
Indicate your Level of Comfort Related to …

- Assessing
  - Speech development
  - Language development
  - Appropriate communication approach

- Developmental Strategies
  - Incorporating Language into daily routines
  - Play based language development
  - Vocabulary development
  - Developing oral language

- Establishing Parent-Professional Partnerships
  - Promoting early literacy
  - Carryover of language activities at home
  - Carryover of speech activities at home

- Managing Hearing Aids and FM
  - Inserting earmolds
  - Ling 6 Sounds Test
  - Troubleshooting instruments
  - Using FM effectively

None  Very Little  Moderate  Expert  Not Applicable  PNA
Professionals’ Report of “Comfort Level”

Assessment

- Speech
- Language
- Communication Approach

None | Very Little | Moderate | Expert | Not Applicable | Prefer NA

Partnering for Progress 2011
Articulation at 3, 5, & 7 years: GFTA

![Graph showing articulation scores](image)

- >85: SII=0.79, PTA=46.0
- <85: SII=0.68, PTA=52.5
Creating Parent-Professional Partnerships

Partnering for Progress 2011

Promoting Early Literacy
Carryover Speech Goals
Carryover Language Goals

Promoting Early Literacy
Carryover Speech Goals
Carryover Language Goals

None Very Little Moderate Expert Not Applicable PNA
Frequency of Communication with Child’s Audiologist

- **Monthly**: 26%
- **Weekly**: 22%
- **6-8 Times per Year**: 7%
- **2-3 Times per Week**: 7%
- **4 Times per Year**: 30%
- **Daily/Anytime**: 4%
- **12-24 Times per Month**: 4%
OCHL Team Members

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Thanks

And thanks to so many parents, schools and professionals!!

Any questions?