Welcome to the 2016 Expert Series

Impact of auditory access on speech and language development

Dr. Meredith Spratford

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Course Objectives

1. Describe factors that may limit cumulative auditory experience for children who are hard of hearing.
2. Explain why some children who are hard of hearing remain at risk for delays in phonology & morphology skills, even after early identification and intervention.
3. Integrate research results regarding hearing aid use consistency and audibility into clinical counseling practice.

Introducing Dr. Meredith Spratford

Impact of auditory access on speech and language development for children who are hard of hearing

Meredith Spratford, AuD, CCC-A
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Acknowledgements

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NIDCD Working Group: Research Gaps

NHANES II & III Prevalence: Ages 6-19 yrs

Severe & profound: 61,000

MH & moderate: 907,000

Corahue (2007); Eisenberg et al. (2007); Tomblin & Hebbeler (2007)

New Practices – New Outcomes?

- Universal Newborn Hearing Screening (UNHS)
- Birth to three Early Childhood Education programs
- Technological advances in amplification
Goal: Explain individual variability

[Video 1]  [Video 2]

Domains of study

Approaches to understanding outcomes
OCHL outcomes model: auditory-linguistic access

Factors that influence relationship between PTA and outcomes.

Accelerated Longitudinal Design

Inclusion criteria:
- English spoken in home
- No significant cognitive or motor delays
- Permanent bilateral mild to severe HL (25 – 75 dB HL)
- No cochlear implants
Participants

<table>
<thead>
<tr>
<th></th>
<th>CHH</th>
<th>CNH</th>
<th>Both Groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>317</td>
<td>117</td>
<td></td>
</tr>
<tr>
<td>Gender</td>
<td>114 male, 144 female</td>
<td>54 male, 63 female</td>
<td>Matched on income &amp; maternal education</td>
</tr>
<tr>
<td>Hearing</td>
<td>M= 48.88 dB HL, 75% without amplification</td>
<td>&lt; 20 dB HL</td>
<td>Higher than typical US sample</td>
</tr>
<tr>
<td></td>
<td>76% identified from NHS</td>
<td>9.7% attrition</td>
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</tbody>
</table>

What happens after NHS?

Only 32% of 193 children who referred UNHS met all benchmarks on time. Holte, et al. 2012

Earlier ID (NHS) milestone steps by PTA

Walker et al. submitted
Mother’s level of education → follow-up timing

Later ID milestone steps by PTA

Later-ID: intervention before hearing test

12/16 enrolled in early intervention before their first diagnostic hearing evaluation.

“On average, [later-identified] children received early intervention for over one year (14.17 months) before receiving a hearing test.”
Examining language outcomes by hearing status

Tomblin et al. 2015

Conclusion: CIH are at risk for depressed language development

Open access on: www.ochlstudy.org
http://journals.lww.com/ear-hearing/toc/2015/11001

Speech & Language Over Time

[Video 3]
Audibility: Speech Intelligibility Index

How much I can hear through my hearing aids depends on:
- Degree of hearing loss
- Distance, noise

Audibility: age effects

McCreery & Stelmachowicz, 2011

Audibility: high frequency speech access

- Children need a broader bandwidth than adults for optimal speech understanding.
- Ability to amplify may be limited by:
  - Hearing aid
  - Audiometric thresholds
  - Low speech energy at high frequencies
Consequences of limited bandwidth

Fricative and affricate acquisition is delayed even for children who were early identified and amplified.

Moeller et al., 2007

Age 4: lexical and morphology development

Tomblin et al., 2015

Audibility influences language growth

Tomblin et al., 2015
Children's audibility could be better fit

Verification methods used by fitting audiologists in OCHL study

Accuracy of Verification methods

Probe microphone real ear measures
RMS error= 5.67 dB (SD = 3.95 dB)

Functional gain (aided soundfield)
RMS error=7.62 dB (SD = 4.67 dB)
Longitudinal audibility influenced by threshold change & quality of HA fitting

Better thresholds & match-to-target
Worse thresholds & match-to-target

McCreery et al., 2015

Clinical implications: Audibility

- Can’t:
  - Control threshold change
  - Alter child’s middle ear status
- Can:
  - Monitor threshold changes
  - Verify with real-ear probe mic measures
  - Measure RECD when not possible to do REAR on ear.
  - Adjust gain to match prescriptive targets

Fittings that are consistently matched to target are more likely to have high audibility over time!

OCHL HA use time measurements

- Objective: Datalogging
- Subjective: Parent report
  - Weekday & weekend use estimations
  - Situational consistency ratings
  - Challenges to HA use

TOTAL USAGE
Time: 11.5 Hours Per Day
HA use improves over time, but still variable

- Maternal education level influenced longitudinal trends in HA use
- Degree of hearing loss influenced use in school-age children

Measuring hearing aid use consistency

Put an X in the boxes below to indicate how consistently your child uses HAs in the situations listed:

<table>
<thead>
<tr>
<th>Situation</th>
<th>Never (0)</th>
<th>Rare (1)</th>
<th>Sometimes (2)</th>
<th>Often (3)</th>
<th>Always (4)</th>
<th>N/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
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<tr>
<td>Pre-School/School</td>
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<td>Day Care</td>
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<tr>
<td>Meal Time</td>
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<tr>
<td>Playing Alone</td>
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<tr>
<td>Book Sharing</td>
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<tr>
<td>Playground</td>
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<tr>
<td>Public (store, zoo)</td>
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</tbody>
</table>

Consistency of use lower for mild HL

Audibility has similar relationship with outcomes for children with mild and moderate-to-severe HL.
Full-time HA users with mild HL have better vocabulary & morphology than non-users

How can audiologists encourage HA use?

- SES (Walker et al. 2013, Walker et al. 2015)
- Issues with managing hearing aids (Munoz 2014)
  - Frustration
  - Confusion
  - Lack of confidence
- Perception of benefit with hearing aid

More efficacious parents \( \rightarrow \) more HA use!

12-month old with moderate HL: 4 hrs/day

Use is “difficult ALL the time” due to him being tired, grabbing HAs.

<table>
<thead>
<tr>
<th>Situation</th>
<th>Never (0)</th>
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<th>Sometimes (2)</th>
<th>Often (3)</th>
<th>Always (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12. Day Care</td>
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<tr>
<td>13. Meal Time</td>
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<tr>
<td>14. Playing Alone</td>
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<td>15. Book Sharing</td>
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<tr>
<td>16. Playground</td>
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<tr>
<td>17. Public (store,</td>
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<td>restaurant)</td>
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</tbody>
</table>
12-month old with moderate HL: 8 hrs/day

Longitudinal HA use influenced by maternal ed

HA use influences language growth
Clinical implications

• May not see immediate results from wearing HA!
  • Counsel on realistic expectations & stress importance of auditory access in the long run.
• Support and teach families to regularly wear devices & check audibility to ensure good access to speech.
  • Target situations of low use.
  • Emphasize quality over quantity.

Summary: Protective Factors

• Milder degree of hearing loss
• Better audibility
• Well-fit amplification
• Early hearing aid fitting
• Amplification worn consistently
• Higher quality language input
• More resourced homes

How would you counsel on auditory access? 4-yr olds

<table>
<thead>
<tr>
<th></th>
<th>BEPTA (dB HL)</th>
<th>HA use (hrs/day)</th>
<th>Datalogging (hrs/day)</th>
<th>BESEI</th>
<th>Age, HA fit (mos)</th>
<th>LNT-Hard/PBK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boy</td>
<td>57.5</td>
<td>7.5</td>
<td>0.7</td>
<td>.74</td>
<td>19</td>
<td>84%/94%</td>
</tr>
<tr>
<td>Girl</td>
<td>42.5</td>
<td>12</td>
<td>10</td>
<td>0.89</td>
<td>4</td>
<td>96%/94%</td>
</tr>
</tbody>
</table>

Malleable Factors
Low SES/rural

**Issues:**
- Health literacy discrepancy between provider & parent
- Benefit of HAs not perceived or appreciated
- Low HA use
- Later ages of service delivery
- Transportation may be unreliable

**Solutions:**
- More hands-on practice
- Collaborative buy-in from providers to reinforce HA use
- Link to brain development, reading, making friends
- Show benefit with simulations
- Creative, frequent outreach—telehealth, text messaging, community linkages (WIC, VNA, midwives, promotoras)

Speech and language outcomes comparison at age 7

7-year old male, mod-severe HL, HA fit at 40 mos
- BELOW AVERAGE SPEECH & LANGUAGE

7-year old female, mod-severe HL, HA fit at 40 mos
- AVERAGE SPEECH & LANGUAGE

High use contributes to better sp/lang outcomes

<table>
<thead>
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<th>Never (0)</th>
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<th>Sometimes (2)</th>
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<th>Always (4)</th>
<th>N/A</th>
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<tbody>
<tr>
<td>School</td>
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<td>Church</td>
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<td>Library</td>
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<tr>
<td>Doctor</td>
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<tr>
<td>Dentist</td>
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<tr>
<td>Teacher</td>
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<td>Peer</td>
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<tr>
<td>Parent</td>
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</tbody>
</table>

Typically does not wear: pool, fireworks & concerts—too loud

Challenging times: None, she wants them on all the time.
How would you counsel on auditory access?
7yr olds—late ID with mild HL

<table>
<thead>
<tr>
<th></th>
<th>BEPTA (dB HL)</th>
<th>HA use (hrs/day)</th>
<th>BESII</th>
<th>Age HA fit (mos)</th>
<th>PBK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Boy</td>
<td>37.5</td>
<td>15</td>
<td>0.859</td>
<td>47</td>
<td>96%</td>
</tr>
<tr>
<td>Girl</td>
<td>37.5</td>
<td>2.1</td>
<td>0.894</td>
<td>56</td>
<td>92%</td>
</tr>
</tbody>
</table>

- **Late ID/HA fit** (DesJardins 2005)
  - **Issues**
    - Less involved in early intervention
    - Less self-efficacious with HA management
  - **Solutions**
    - Reinforce “catch-up” possible if wearing HAs
    - Hands-on practice (watch, do, teach)
    - Family-centered practice, focus on home-based services
    - Collaborative buy-in from 0-3 provider to integrate HA use into daily routines

Parental “disconnect” with mild HL—what would change with early ID and EI?
Degree of HL: Mild/minimal

• Issues:
  • Parents perceive limited difficulty
  • Changes with amplification may be subtle—may not observe immediate benefit

• Solutions:
  • Demonstrate HA benefit with simulations
  • Avoid misleading labels → "educationally significant"
  • Look at language development!

How will I adapt my practice based on…

• Family's socioeconomic status
• Child's degree of HL
• Age ID/HA fit
• Age re: HA use
• Characteristics of intervention
• Language outcomes

Thank you!

• Meredith.Spratford@boystown.org
• www.ochlistudy.org

Free access to OCHL supplement in Ear & Hearing
References


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