How do we measure the early speech development of babies with hearing loss?

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Overview

- The Hearing House
- Background
- Assessments
- Study method
- Results
- Putting this into practice
The Hearing House

- Auditory-verbal therapy:
  - 0 – 5 years - The Hearing House
  - 5-19 years - KDEC
- Audiology (0 – 19 years)
- Family support (0-19 years)
- Preschool (3 – 5 years)
Babies with Hearing Loss in NZ

Deafness Notification Database Report 2014 (Digby, Purdy & Kelly, 2015)

- Diagnosed hearing loss

- Average age of diagnosis
  10 months (2010) ..... 5 months (2014)

- Fitted with hearing aids prior to 6 months
<table>
<thead>
<tr>
<th>Year</th>
<th>Referred to THH</th>
<th>Received CI/s</th>
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<tbody>
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<td>2008-09</td>
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<tr>
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<td>7</td>
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<tr>
<td>2014-15</td>
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Formal assessments used by THH therapists

- **The Rossetti Infant-Toddler Language Scale** (Rossetti, 2006)
- **Early Learning Accomplishment Profile** (Glover, Preminger, Sanford, 2002)
Study

• Early Speech Development of Babies with Hearing Loss

• To investigate a new assessment tool and compare it to other established tools

• To monitor changes in early speech development

• To investigate early speech development between babies with hearing loss and typically developing babies
Method

- N=27 (n=12 babies with hearing loss, n=15 typically developing (TD) babies)
- Babies with hearing loss recruited from THH, DHBs, and word of mouth
- TD babies recruited from local coffee groups and word of mouth
- Assessed at 8-12 week intervals, 2-3 times
- Assessed either at home, THH or via skype
Babies Ages at Each Assessment Session

<table>
<thead>
<tr>
<th></th>
<th>Assessment 1</th>
<th>Assessment 2</th>
<th>Assessment 3</th>
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<tbody>
<tr>
<td>Babies with Hearing</td>
<td>n = 12</td>
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<tr>
<td>Loss</td>
<td>M = 5.33</td>
<td>M = 7.67</td>
<td>M = 9.78</td>
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<tr>
<td></td>
<td>SD = 2.10</td>
<td>SD = 2.35</td>
<td>SD = 1.86</td>
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<tr>
<td></td>
<td>Mdn = 5</td>
<td>Mdn = 7</td>
<td>Mdn = 9</td>
</tr>
<tr>
<td>Age Range = 3-10</td>
<td>Age Range = 5-13</td>
<td>Age Range = 8-13</td>
<td></td>
</tr>
<tr>
<td>TD Babies</td>
<td>n = 15</td>
<td>n = 14</td>
<td>n = 13</td>
</tr>
<tr>
<td></td>
<td>M = 5.73</td>
<td>M = 7.86</td>
<td>M = 10.15</td>
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<tr>
<td></td>
<td>SD = 2.37</td>
<td>SD = 2.48</td>
<td>SD = 2.64</td>
</tr>
<tr>
<td></td>
<td>Mdn = 6</td>
<td>Mdn = 8</td>
<td>Mdn = 10</td>
</tr>
<tr>
<td>Age Range = 1-10</td>
<td>Age Range = 3-12</td>
<td>Age Range = 6-15</td>
<td></td>
</tr>
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</table>
Amplification Used by Babies with Hearing Loss

Types of Amplification Used by the Babies with Hearing Loss at each Assessment Point

Types of amplification used by the babies with hearing loss. Left = first assessment, Middle = second assessment. Right = third assessment.
Method – Assessment Tools


- **The Rossetti Infant-Toddler Language Scale** (Rossetti, 2006)

- **Infant Monitor of vocal Production** (Cantle Moore, 2004)
Rationale behind the IMP

• A tool that looks at the relationship between perception, processing, and production – central to early speech development (Kuhl, 2004)

• Monitors the baby’s progress through early vocal behaviours that are needed for emergence of speech (Nathani et al., 2006)

• Parents are able to identify their child’s regular and new behaviours as parents are with their children 24/7 (Dale et al., 1989)

• Parental report and professional assessment results are comparable (Camaioni et al., 1991)

• Parents can identify specific examples of their baby’s vocalisations (Oller, 2011)
The IMP

• A systematic and longitudinal assessment
• Looks at biological and environmental influences
• Parental observation of baby’s early vocal development
• Uses conversational interview techniques
• Parents want to see changes early on
SAEVD-R Levels for Individual Babies

SAEVD-R levels for individual babies with hearing loss \( (n = 11, \text{ left, solid bars}) \), and TD babies \( (n = 15, \text{ right, hashed bars}) \).
Progress using the Rossetti, Language Expression subtest over time for the babies with hearing loss (left), and TD babies (right). Legend for y axis: 0=0mths, 1=0-3mths, 2=3-6mths, 3=6-9mths, 4=9-12mths, 5=12-15mths.
Mean scores for Rossetti Language Expression for both groups at each assessment session. Error bars indicate standard errors of the means.
Changes in IMP Ceiling Scores over Time

Changes in IMP Ceiling Scores over time for babies with hearing loss (left), and for TD babies (right).
Mean Ceiling Scores for the IMP for both groups at each assessment session. Error bars indicate standard errors of the means.
Babies with hearing loss (left, solid bars) and TD babies (right, hashed bars). Percentage of Robustness is grouped into three categories (high=71-90%, medium=51-70%, low=below 50%).
Mean Percentage of Robustness for the IMP

Mean Percentage of Robustness for the IMP for each group at each assessment session. Error bars indicate standard errors of the means.
Correlations between IMP Ceiling Score and SAEVD-R Level at the first assessment session for both groups.
Correlations between IMP and Rossetti Language Expression over the three assessment sessions. (A, B, C)
The IMP – Structure

• 16 questions

• First administration at 3-6 months

• Baseline – pre-assessment question looks at oral-motor skills

• The first questions cover exploratory play e.g. what sounds do you hear baby make with his voice?

• Second stage – Transition to audition-production loop

• Red flag – if the baby does not make this transition
  • Hearing experience (Smedley & Plapinger, 1988)
  • Processing (Rance & Barker, 2008)
  • Oral motor (Davis & Velleman, 2000)

• Final stage – Integrity of the audition-production loop e.g. variety of babble (Iyer & Oller, 2008), and emerging first word approximations.
3. Expressive vocalizations

*Ask parent:* What sounds do you hear *☆ make with his voice?  
(Are sounds described as guttural, squealing, cooing? What is the infant doing? Does parent ascribe meaning?)

Comment.................................................................

<table>
<thead>
<tr>
<th>Never</th>
<th>Rarely</th>
<th>Sometimes</th>
<th>Often</th>
<th>Always</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</table>

< 50% >  
Other than crying

10. First consonant-vowel (CV) combinations

*Ask parent:* Have you heard *☆ join 2 different sounds together?  
(Does parent describe CV combinations? Are consonant sounds varied? e.g. mah, gah. Are vowel sounds varied? e.g. bah, boh)

Comment.................................................................

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– Produces CV –

[Scoring: Rarely 1-2 different combinations  
Sometimes 3-4  
Often 5-6  
Always 6+ different combinations]
14. Speech-like “chatter” / jargon

Ask parent: Have you heard a pattern of sound that remind you of familiar phrases—“oh go ga...”?
(Does the rhythm and variety of sound give the impression of speech?
Does intonation give the impression of question/comment?)

- Produces varied CV jargon -

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[Scoring: Rarely 1-2 different combinations
Sometimes 3-4
Often 5-6
Always 6+ different combinations]

[Mark each example CV production on chart below Q.16]

Example phrases. ..........................................................................................................................................

Examples CV production. ..................................................................................................................................
The IMP in Practice - Measurements

- Scale of typical vocal behaviours – Ceiling
- Frequency and variety of vocalisation – Percentage of Robustness
  - 5 point Likert Scale – Never, rarely, sometimes, often, always.
- Draw line from CA to Ceiling, and CA to HA
- Angles on the IMP graphic – Angle between 45 and 90 degrees indicates typical vocal development.
Example of a scored IMP Sequential Scoring Graph for a TD Baby

Example of a scored IMP Sequential Scoring Graph, showing vocal development progress over five months for a TD baby. Red line from chronological age to hearing age. Blue line from chronological age to question ceiling.
Example of a scored IMP Sequential Scoring Graph, showing vocal development progress over four months for a baby with hearing loss. Red line from chronological age to hearing aid age. Blue line from chronological age to question ceiling.
Example of a scored IMP Sequential Scoring Graph, showing vocal development progress over four months for a baby with hearing loss. Red line from chronological age to hearing aid age. Green line from chronological age to cochlear implant age. Blue line from chronological age to question ceiling.
The IMP in Practice - THH

• Administered on all babies referred - between 3 and 6 months

• Part of ongoing assessment and monitoring protocols – administered every 3 months after switch-on/aiding until baby achieves a ceiling of 15 or 16.

• Being used with babies with ANSD.

• Continuing to also use Rossetti and E-LAP
References

References


Thank You!

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