Special session: Intervention and outcomes of children detected with hearing loss

- Longitudinal outcomes of children with hearing loss: early vs later intervention ... Ching TYC
- Speech-language development of children identified through UNHS ... Mukari SZ
- Auditory threshold amelioration during the first year of life in severely/profoundly deaf children ... Trevisi P
- Communication development in early-identified children with mild and unilateral loss ... Fitzpatrick EM

Why LOCHI?

- UNHS aims to alleviate huge burden of disability
- 2008 US Preventive Services Task Force
  - "Moderate certainty that net benefit of screening all newborn infants for hearing loss is moderate"
  - Based on a single quasi-randomised trial
- Research on population outcomes scant

Aims

- Does UNHS and early intervention improve language outcomes, at a population level?
- What factors influence outcomes?
- Does early performance predict later outcomes?

Longitudinal Outcomes of children with hearing impairment (LOCHI):
5-year outcomes

Teresa YC Ching and the LOCHI team
National Acoustic Laboratories, HEARing CRC

In 2005, Longitudinal Outcomes of Children with Hearing Impairment …

Method

- About 460 families from 3 states,
  - ~ 53% received intervention before 6 months
  - ~ 20% with non-English speaking background
  - ~ 37% have additional disabilities

HEAL 2014, Como
Language use and communication mode at home

- Communication Mode
  - English 81%
  - Oral 75%
  - Mixed 24%
  - Manual 1%

We collect a range of information,

- Child
  - Age at fitting
  - Age at implantation
  - Birthweight
  - Gender
  - Hearing thresholds
  - IM: Prescription
  - Use of device
  - Additional disabilities
  - Auditory neuropathy
  - Alcohol
  - Cognitive ability

- Family
  - Communication mode
  - Involvement in intervention
  - Language used at home
  - Maternal education
  - Socio-economic status

- Intervention
  - Age at enrolment
  - Communication mode
  - Hours of intervention
  - Parental involvement

And measure children’s outcomes ...

- Expressive Communication
- Auditory comprehension
- Receptive vocab.
- Expressive vocab.
- Articulation
- Phonological dev
- Speech perception
- Spatial release from masking
- Phonological awareness
- Reading
- Spelling
- Math reasoning
- Working memory
- Orthographic learning
- Paired associate learning
- Lexical access
- Cognitive ability

At multiple intervals as they grow

Hearing devices at age 5 years

<table>
<thead>
<tr>
<th></th>
<th>No CI</th>
<th>One CI</th>
<th>Two CIs</th>
</tr>
</thead>
<tbody>
<tr>
<td>No HA</td>
<td>12</td>
<td>14</td>
<td>93</td>
</tr>
<tr>
<td>One HA</td>
<td>20</td>
<td>56</td>
<td>-</td>
</tr>
<tr>
<td>Two HAs</td>
<td>272</td>
<td>304</td>
<td>70 93</td>
</tr>
</tbody>
</table>
To analyse results,

- Combine 20 test scores into a global language score using factor analysis,
- Fit regression models separately for
  - Children using hearing aids
  - Children using cochlear implants

**Predictor variables**

- Age at first fitting
- Age at CI activation
- 4FA hearing loss
- Gender
- Birthweight
- Presence of additional disabilities
- Presence of auditory neuropathy
- Hearing aid prescription
- Non-verbal cognitive ability
- Maternal education
- Socio-economic status
- Communication mode in early intervention
Children with hearing aids

Effect of hearing loss, for different age at fitting

Effect of age at fitting, for different hearing loss

Maternal education

Communication mode in early education

Significant Predictors for 243 children with HA

<table>
<thead>
<tr>
<th>Predictor</th>
<th>$R^2 = 0.74$</th>
<th>Significance (p)</th>
<th>p-value</th>
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</thead>
<tbody>
<tr>
<td>Age first fit (lag)</td>
<td></td>
<td>0.003</td>
<td>0.11</td>
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<tr>
<td>4FA hearing loss</td>
<td>$R^2 = 0.69$</td>
<td>0.001</td>
<td>0.002</td>
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<tr>
<td>Log Age first fit x 4FA</td>
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<td>0.07</td>
<td>0.06</td>
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<tr>
<td>Cognitive ability/WNV</td>
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<td>&lt;0.001</td>
<td>&lt;0.001</td>
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<tr>
<td>Gender</td>
<td></td>
<td>0.18</td>
<td>0.19</td>
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<tr>
<td>Birthweight</td>
<td></td>
<td>0.73</td>
<td>0.08</td>
</tr>
<tr>
<td>Other disability</td>
<td></td>
<td>0.04</td>
<td>0.13</td>
</tr>
<tr>
<td>Maternal education (uni or school)</td>
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<td>&lt;0.001</td>
<td>0.01</td>
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<tr>
<td>Socio-economic status (dec)</td>
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<td>0.39</td>
<td>0.44</td>
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<tr>
<td>Communication mode (other or oral)</td>
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<td>0.007</td>
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<tr>
<td>ANSD</td>
<td></td>
<td>0.59</td>
<td></td>
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<tr>
<td>HA prescription</td>
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<td>0.64</td>
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</tbody>
</table>

Effect of hearing loss, for different age at fitting

Effect of age at fitting, for different hearing loss

Maternal education

Communication mode in early education

HEAL 2014, Como
Children with cochlear implants

Delaying CI switch-on decreases language ability

Yr 5 global language development ...

- Higher cognitive ability
- Lesser hearing loss
- Earlier age at HA fitting
- Earlier age of implantation
- Higher maternal education
- Oral communication mode
- Additional disabilities

HEARING TO READ

Phonological awareness (n = 144)
FROM EARLY TO LATER OUTCOMES,

If early PEACH were the only predictor,

It accounted for
22% of total variance - HA
17% of total variance - CI

SUMMARY

Does UNHS improve outcomes?

Yes!

Early age at hearing-aid fitting
Early age at cochlear implantation
Why does hearing loss affect language development?

- Early language ability was a significant predictor of language at 5 years.
- Early Functional performance in real life (PEACH) was a significant predictor of language at 5 years.

To do ...

- Streamline services to ensure early fitting and implantation
- Monitor early outcomes to identify children who may be “at-risk” of language impairment
  - Early functional performance
  - Objective evaluation of detection (+ discrimination)
- Devise evidence-based strategies for intervention

For information

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www.nal.gov.au

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