Inconsistency in Universal Newborn Hearing Screening Programmes: a Systematic Review

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Background

- HL, most frequent permanent congenital defect (Fujikawa et al. 2000) – conductive / sensorineural
- Risk factors for HL (most recent def.: JCIH, 2007)
- Prevalence of HL in newborns:
  - 2 - 5% - at risk (Norton et al. 2000)
  - 0.1 - 0.3% (Mehl et al. 2002)
- Tests: TOAE / aABR
- No newborn screening
  - diagnosis at ≈14M (Erenberg et al. 1999)
  - impaired language and learning (Rach et al. 1988) & increased behaviour problems, decreased psychosocial well-being, and poor adaptive skills (Davis et al. 1999)
Background

- US National Institutes for Health (NIH, 1993), American Academy of Pediatrics (AAP) (Erenberg et al. 1999), Joint Committee on Infant Hearing (JCIH, 1994) recommended universal screening and detection of newborns with hearing loss ≤3M, and intervention ≤6M.

- The AAP and JCIH recommendations (most recent: JCIH, 2007) "Universal Newborn Hearing Screening" (UNHS) programmes worldwide and include indicators and benchmarks for process quality assessment.
Aims

- **State of Art**: children with HL identified through UNHS
  - obtained better language outcomes at school age than those not screened (Nelson et al. 2008)
  - had significantly earlier referral, diagnosis and treatment than those not screened (Wolff et al. 2010)

- **AIM**: to evaluate published UNHS programmes using the AAP and JCIH benchmarks
Methods

- Systematic search of UNHS programmes.

Exclusion Criteria:
- non-English, no protocol description, equivocal assignment of results to the protocols, no false positive

Data Extracted:
- study design, duration, starting year
- participants (#neonates, #screened, #at higher risk, risk assess.)
- protocol (tests, audible threshold, uni- vs. bi-lateral HL, timing, environmental test conditions, personnel)
- quality indicators
Methods

Quality indicators and benchmarks (1/2)

UNHS Program

\[ \text{Scr}^{< \text{disc}} \rightarrow + \rightarrow \text{Scr}^{> \text{disc}} \rightarrow + \rightarrow \text{Diagn} \]

Follow-up rate \( \geq 95\% \)

Recruitment and Adherence

% newborns completing screening \( \leq 1M \) \( \geq 95\% \)
Methods

Quality indicators and benchmarks (2/2)

% Ref. at discharge
- 5-20% (OAE)
- 4% (ABR)

% Ref. def. aud. eval.
- <4%

False-positive rate
- ≤3%

UNHS Program

Clinical Effectiveness

% def. aud. eval. ≤ 3M
- ≥90%

HL Prevalence
- 2-5% (Risk)
- 0.1-0.3% (All)
## Results

<table>
<thead>
<tr>
<th>Source</th>
<th>Test [Type; N.]</th>
<th>Audiol. Risk Assess.</th>
<th>HL Extent</th>
<th>Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bevilacqua M, 2010</td>
<td>OAE 2</td>
<td>JCIH 2007</td>
<td>40dB HL unilateral</td>
<td>△△△ △ △</td>
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<td>Watkin P, 1996</td>
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<td>-</td>
<td>40dB HL bilateral</td>
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<td>Aidan D, 1999</td>
<td>OAE 2</td>
<td>JCIH 1990</td>
<td>40dB HL unilateral</td>
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<td>Habib H, 2005</td>
<td>OAE 2</td>
<td>JCIH 1994</td>
<td>26dB HL unilateral</td>
<td>△ △ □□ □ (NICU) □ □ □ □</td>
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<td>Lin H, 2007</td>
<td>OAE 2-3</td>
<td>-</td>
<td>- unilateral</td>
<td>□ △ □ □</td>
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<td>Korres S, 2008</td>
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<td>40dB HL unilateral</td>
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<td>Tatli MM, 2007</td>
<td>OAE 2</td>
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<td>Both 2</td>
<td>-</td>
<td>- unilateral</td>
<td>□ △ □ □ □ □ □ □ □ □ □ □ □</td>
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<td>De Capua, 2007</td>
<td>Both 3</td>
<td>JCIH, 2000</td>
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<td>Barsky-Firkser L, 1997</td>
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<td>WBB: 35dB HL NICU: 40dB HL bilateral</td>
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<td>ASHA 1988; ASHA 1989</td>
<td>35dB nHL bilateral</td>
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<td>Clemens CJ, 2000</td>
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<td>Admission to NICU</td>
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Limits

- Quality indicators and benchmarks established and updated by the AAP and JCIH since February 1999 while most of the studies initiated or concluded recruitment prior to that date. We tested feasibility of performing standardised evaluations of UNHS programmes.

- Articles only in English. 9 / 14 studies in our review from non-English-speaking countries.
Our systematic review found substantial variability, incomplete reporting, and performance gaps, in the scientific literature published to date.

Need to optimise reporting of:
- screening protocols and
- process performance

Future research:
- assessment of long-term outcomes of neonates with negative screening tests (false negative)
- causes for and interventions to reduce lost to follow-up
- standardisation of recommended quality indicators
Bottom Line

This research was possible also thanks to

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- Saverio SABINA
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