HEARING SCREENING
IN THE
NEONATAL INTENSIVE CARE UNIT

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Acknowledgements

- 40 State EHDI Managers
- 442 NICU representatives in 43 states
- Kate Bowman, BA, UNC – Chapel Hill
- Karl White, PhD, National Center for Hearing Assessment and Management, Utah State University, Logan, UT
Outline

- Background
- Results of 2006 Study
- Results of 2010 Study
- Challenges and Recommendations for Improvements
- Reports to States
- New and Developing Resources
Sensorineural HL in Infancy

- Prevalence SNHL
  - Well-babies: 1-3:1000 (0.1 to 0.3%)
  - NICU 10-20:1000 (1 to 2%)
  - ‘Milder’ degrees: ~ 0.6:1000 (0.06%)

- Because of the high prevalence of permanent HL in the NICU population, ABR screening has been provided in NICUs for many years.

- More recently OAEs have been used in the NICU, alone or in a combined ABR/OAE protocol.

Vohr et al, 1998; Stein, 1999; Prieve et al., 2000; Gravel et al, 2005
Auditory Neuropathy Spectrum Disorder (ANSD)

- A condition characterized by absent or abnormal auditory brainstem responses in the presence of intact cochlear hair cell function (Starr, Sininger, and Pratt, 2000).

- Prevalence is considerably higher than once thought
  - 7-10% of infants with SNHL (Rance, 2005); significantly higher in the NICU population (Berg et al, 2005)

- OAE screening will not identify AN (although some infants with ANSD have absent or abnormal OAEs)
NICU Care (AAP)

- Level I Nurseries provide basic care to well-infants;
- Level II Nurseries provide specialty care for infants at moderate risk of serious complications
- Level III Nurseries infants receive specialty and sub-specialty care including mechanical ventilation.
- There are ~120 Level-II NICUs and 760 Level-III NICUs in the United States (AAP). NICU infants represent approximately 10% of the newborn population or about 400,000 infants per year (JCIH 2007).
JCIH Year 2007: Screening in the NICU
JCIH 2007: *Definition of Targeted Hearing Loss*

Expanded from congenital bilateral and unilateral sensory or permanent conductive HL to include *neural* hearing loss (auditory neuropathy /dyssynchrony) in infants admitted to the NICU > 5 days.
JCIH 2007: *Hearing Screen Protocols*

- Separate protocols recommended for NICU and well baby nurseries
- NICU infants admitted >5 days are to have **ABR** included as part of their screen so that neural HL will not be missed
Rationale for Different Protocols: Why 5 Days? (JCIH 2008 ‘Clarification’)

- **Rationale for different protocols:**
  - NICU infants represent ~10% of the newborn population or approximately 400,000 infants per year.
  - Infants cared for in the NICU, in addition to being at increased risk for cochlear hearing loss, are at much greater risk of ‘neural’ (retrocochlear) hearing impairment (ANSD).
  - 25% of NICU infants are considered “low” risk (includes infants with diagnoses such as transient respiratory distress, observation for temperature instability, and negative sepsis workup) and are discharged by 5 days of age (National Perinatal Research Center).
Specific risk factors are often difficult for screeners to identify in the medical record so establishing a time criterion (>5 days) was considered easier to implement.

- May result in a few over-referrals to audiology (and screening with ABR that could have been performed with OAE) but presumably fewer misses.

- Implied by JCIH: Procedures may be modified if the NICU has well established criteria for review and/or screening for known risk factors.
JCIH 2007: Rescreening

- If an infant does not pass the ABR screening in the NICU, any subsequent inpatient rescreen should be conducted bilaterally even if only one ear failed the initial screening.
JCIH 2007: Referral

- For infants who do not pass automated ABR in the NICU, referral should be made directly to an audiologist for rescreening (vs general outpatient screening) and when indicated, receive comprehensive evaluation including ABR.
JCIH 2007: Readmissions

- For readmissions in the first month of life for all infants (NICU or well baby) when there are conditions associated with potential hearing loss (eg, hyperbilirubinemia requiring exchange transfusion or culture-positive sepsis), a repeat hearing screening is recommended before discharge.
2006 Study of NICU Screening Practices

Hearing Screening in the NICU: Current Practices and Future Needs

Jacobs, Roush, and White (2006)
2006 Study: Methodology

- **Survey Instrument**
  - Electronically distributed (via NCHAM)
  - 13 Questions
    - Number of Well-Baby and NICU Infants screened
    - NICU Screening Methods and Protocols
  - Anonymous once submitted

- **Distribution**
  - Mailed to State EHDI Managers, January, 2006
  - EHDI managers asked to determine NICU screening practices for their state

- **Results**
  - Responses from 43 states
2006 Study: What technology is used for the initial hearing screening?

- OAE: 9%
- AABR: 30%
- OAE or AABR: 61%

Jacobs, Roush, White, 2006
2006 Study: If re-screening is necessary, what technology/protocol is most often used?

<table>
<thead>
<tr>
<th>NICU Screening Method and Order</th>
<th>Number of States (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>OAE followed by OAE</td>
<td>5</td>
</tr>
<tr>
<td>OAE followed by AABR</td>
<td>9</td>
</tr>
<tr>
<td>AABR followed by AABR</td>
<td>26</td>
</tr>
<tr>
<td>AABR followed by OAE</td>
<td>0</td>
</tr>
<tr>
<td>Protocols vary</td>
<td>53</td>
</tr>
<tr>
<td>Re-screens not conducted</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>7</td>
</tr>
</tbody>
</table>
2006 Study: Most significant obstacles or frustrations associated with infant hearing screening in the NICU

- Difficulty with tracking and follow-up
- Discharge before screening completed
- Narrow window of time from when infant is stable and transfer occurs
- Priority of medical concerns
- Lack of qualified screening personnel (especially on weekends)
- Excessive ambient noise levels

(Jacobs, Roush and White, 2006)
Current Study

Hearing Screening in the NCIU: Current Status and Future Needs
Current Study

“Hearing Screening in the NICU: Current Status and Future needs”
- Technology used for screening (OAE/ABR/Both)
- Protocols (for initial screening and re-screening)
- Referral criteria
- Challenges encountered with NICU screening
- Changes planned or anticipated
- Recommendations for improvement
Methodology

- **Survey Instrument**
  - Electronically distributed (Qualtrics)

- **Distribution**
  - Email notification to EHDI Managers Jan 2010 (White)
    - Jan-Feb 2010 (Data collection)
  - EHDI managers asked to identify a knowledgeable respondent at each NICU
  - EHDI managers asked to forward link to Qualtrics survey
  - Two reminders sent
  - Replies were anonymous once submitted (but sorted by state for summary report to EHDI manager)
Survey Questions

☐ Please describe the technology you use for initial hearing screenings in your NICU

☐ If an infant does not pass the initial screening in your NICU, what follow-up is provided?

☐ If an infant who passed the initial hearing screening is re-admitted for a condition associated with SNHL what procedure is followed?
Survey Questions (continued)

- What do you consider the greatest challenges associated with infant hearing screenings in your NICU?
- Over the next year, what changes, if any, do you anticipate in your hospital with regard to NICU hearing screening or follow-up?
- What recommendations do you have for improving NICU hearing screening and/or follow-up?
Results

- Returns
  - 442 NICUs in 43 states
Describe the technology you use for initial hearing screening in your NICU:

- Both OAEs and AABRs: 23%
- AABRs only: 64%
- OAEs only: 13%
If an infant does not pass the initial screening in your NICU, what follow-up is provided?

<table>
<thead>
<tr>
<th>Answer</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>We provide a second screening by NICU personnel prior to discharge.</td>
<td>50%</td>
</tr>
<tr>
<td>We follow another protocol not listed above. Please describe the protocol you follow.</td>
<td>18%</td>
</tr>
<tr>
<td>We refer infants/families to an audiologist for follow-up.</td>
<td>16%</td>
</tr>
<tr>
<td>We provide a second screening by an audiologist prior to discharge.</td>
<td>11%</td>
</tr>
<tr>
<td>We refer infants/families to another professional (not an audiologist) for follow-up. In the space below, please specify the specialist(s).</td>
<td>5%</td>
</tr>
<tr>
<td>We alert parents/families of screening results, but don't provide a second screening or a referral for follow-up.</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>
Other protocols employed after failed initial screening

- Rescreen in 2-4 weeks as an outpatient at same hospital
- Rescreen in NICU and schedule diagnostic ABR prior to discharge
- Perform tympanometry and rescreen if tymps were flat; refer if tymps were normal
- Rescreen repeatedly until discharged
If a second screening is necessary, what is the technology/protocol employed?

<table>
<thead>
<tr>
<th>Response</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>We use ABR for the initial screening followed by re-screening with ABR.</td>
<td>73%</td>
</tr>
<tr>
<td>We use OAEs for the initial screening followed by re-screening with OAEs for infants who do not pass.</td>
<td>12%</td>
</tr>
<tr>
<td>We use OAEs for the initial screening followed by re-screening with ABR.</td>
<td>9%</td>
</tr>
<tr>
<td>We use another technology/protocol not listed. Please describe the technology and protocol you use.</td>
<td>5%</td>
</tr>
<tr>
<td>We use ABR for the initial screening followed by re-screening with OAEs.</td>
<td>1%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>
If a second screening is performed are both ears re-screened?

- Rescreen: 37%
- Rescreen both ears: 61%
- Follow other procedure: 2%
If an infant who passed the initial hearing screening is re-admitted for a condition associated with SNHL, what is the protocol?

- 20% Rescreen
- 28% Don't rescreen
- Use other procedure
Other Re-admission Protocols

- Rescreen per physician or NICU staff request

- Infants are not re-admitted to the NICU and are subject to screening protocols of the unit they enter
What are the greatest challenges associated with infant hearing screenings in your NICU?

- Transfers/External: 57%
- Discharge: 25%
- Access: 16%
- Documentation: 14%
- Transfers/Internal: 14%
Other Challenges

- NICU professionals are responsible for ordering screenings; screenings ordered inappropriately or not at all
- Lack of audiologists to do diagnostic follow-up
- Ambient noise in NICU
- Equipment problems/availability
- No guidelines for screening following administration of ototoxic medications
Recommendations from Respondents

- More/better training for NICU nurses, attending physicians, and pediatricians
  "...have them attend a conference where they hear families speak on what happened to their child because they missed a screen, or were given inaccurate information."

  "Each baby needs to be a real person to them with a future that will be positive because they were identified early and given intervention, not just a number and another test to perform for that day."
Recommendations (continued)

- Improve communication between transferring hospitals
- Better take-home materials to educate parents on importance of returning for follow-up
- Better access to specialized audiology services
- More notice before discharge so screenings, diagnostics, and paperwork can be completed
Anticipated Changes

- Purchasing new AABR equipment
- Adding screening staff
- Moving to electronic charting/reporting system
- Moving AABR in all NICU screenings
- More training for NICU staff on high risk factors
Summary

- There is considerable variability in methods and protocols.
- Over one-third (36%) of the NICUs surveyed are using OAEs alone or in combination with ABR.
- Approximately half the programs surveyed perform a rescreening by NICU personnel prior to discharge; there is considerable variability in the other half.
- When a second screening is performed by NICU personnel, nearly three-fourths of the NICUs surveyed use ABR.
Summary (continued)

- If a second screening is performed, many NICUs rescreen only the failed ear (39%)
- When infants are readmitted to the NICU for conditions that increase the risk of SNHL, over one-fourth of the NICUs surveyed (28%) do not rescreen
- Challenges to successful NICU screening include:
  - discharge/transfer prior to screening,
  - Referral, tracking, and surveillance after discharge/transfer
Missed Screenings

- **“Transferred” Infants**
  - 24.6% of transferred infants missed
  - 2.5% of non-transferred infants missed
  
  Dauman et al 2009

- **NICU status is strongest predictor of a missed screen**
  - 3.2% of NICU infants missed
  - 0.15% of well babies missed

  Vohr et al 2002

- **NICU infants six times more likely to be lost to follow-up**

  Vohr et al. 2002

Counseling in the NICU

- “To the extent possible, audiologists should be the professionals who communicate with parents when a baby has not passed a hearing screening.” (Guidelines for Audiologists Providing Informational and Adjustment Counseling to Families of Infants and Young Children With Hearing Loss Birth to 5 Years of Age, ASHA, 2008)

- “An audiologist should be involved in each component of the hearing-screening program, particularly at the level of statewide implementation and, whenever possible, at the individual hospital level.” (JCIH 2007)
Next Steps –

- NCHAM and UNC collaborators are preparing a report to each state EHDI manager summarizing:
  - Number of NICUs responding for their state
  - Hearing technologies and protocols reported
  - Challenges and obstacles noted for their state
  - A list of recommendations for improvement based on the responses obtained from all states
  - An “FAQ” summary of the JCIH recommendations and rationale for NICU hearing screening
Final Note

- Many challenges remain
  - Loss to follow-up
  - ‘Mild’ HL missed by current screening technology
  - Late onset / progressive conditions

- Much has been accomplished!
  - Nationwide implementation of UNHS
  - EHDI programs in all 50 states
  - Earlier identification and intervention
  - Positive outcomes for children and families
Training Resource

- Newborn Hearing Screening
  - Newborn Hearing Screening Training Curriculum
    - http://www.infanthearing.org/nhstc_dvd/streaming.html
    - Consistent training across screeners
    - Competency based
  - New version for NHS Program managers in development
New Resource in Development

- National Pediatric Audiology Facilities Directory
  - Working Group
    - Purpose:
      - To develop an internet based tool to assist families and professionals in locating Audiology Centers (facilities and personnel) that provide clinical services to infants and young children birth to 6 years of age, and their families
  - Learn more at the EHDI National Conference in Atlanta February 21-22, 2011
Thank you