RISK MONITORING FOR DELAYED-ONSET HEARING LOSS IN YOUNG CHILDREN

Jessica Stich-Hennen, Au.D., PASC
Doctor of Audiology
Specialty Certification in Pediatric Audiology
Idaho Sound Beginnings- Audiology Consultant
I have no relevant financial relationships with the manufacturers of any commercial products and/or provider of commercial services discussed in this CME activity

I do not intend to discuss an unapproved/investigative use of a commercial product/device in my presentation
Learning Objectives

- Identify risk indicators which require monitoring for delayed-onset hearing loss
- List risk indicators which require more frequent audiological monitoring
- Explain options for risk monitoring protocols
Joint Committee on Infant Hearing (JCIH)

JCIH was established in 1969

Comprised of:
- American Academy of Pediatrics
- American Academy of Ophthalmology and Otolaryngology
- American Speech & Hearing Association
JCIH position statements
JCIH 1973 Position Statement

- High risk criteria
  - Family history of childhood hearing loss
  - Intrauterine fetal infection (Rubella)
  - Defects of ear, nose or throat (atresia, cleft lip/palate)
  - Low birth weight (<1500 grams)
  - High bilirubin levels
JCIH 1982 Position Statement

- High risk criteria
  » Bacterial meningitis, severe asphyxia (i.e. low APGAR) were added

- Screening recommendations
  » Ideally performed by 3 months (no later than 6 months)
  » Preferably under the supervision of an audiologist
  » Observation of behavioral or electrophysiologic response to sound
High risk criteria additions:

» Ototoxic medications
» Prolonged mechanical ventilation
» Physical findings of syndromes
» Parent/caregiver concerns
» Head trauma
» Neurodegenerative disorders
» Infectious diseases associated with hearing loss

Screening recommendation changes:

» Auditory Brainstem Response measurement, not behavioral testing
Studies showed that only 50% of all hearing loss were being identified using the High Risk Register

- Pappas, 1983
- Elssman, Matkin, Sabo 1987
- Mauk, white, mortensen, Behrens 1991
Risk monitoring:
– Audiological testing every 6 months until age 3 years.
Joint Committee on Infant Hearing (JCIH)

YEAR 2007 POSITION STATEMENT: Principles and Guidelines for Early Hearing Detection and Intervention Programs
Expanded definition of targeted hearing loss to include:

- Neural hearing loss (Auditory Neuropathy/Dysynchrony) in infants admitted to the NICU

Separate protocols for NICU and well baby nurseries:

- NICU babies (>5 days) are to have ABR screening so that neural hearing loss will not be missed
Re-admissions

- Infant readmitted in the first month of life and present with conditions, which are associated with potential hearing loss, need a repeat hearing screen prior to discharge.

Monitoring of high risk indicators

- “Infants with risk factors for hearing loss should have at least one diagnostic evaluation by 24-30 months of age.”
Caregiver concerns (re: hearing, speech, language, or developmental delay)

Family history of permanent childhood hearing loss

Neonatal Intensive Care (NICU) of more than 5 days or any of the following regardless of length of stay: ECMO, assisted ventilation, exposure to ototoxic medications (gentimycin and tobramycin) or loop diuretics (furosemide, Lasix), and hyperbilirubinemia that requires exchange transfusion.

In-utero infections

Craniofacial anomalies

Known physical findings associated with a syndrome

Syndromes associated with hearing loss, progressive hearing loss or late-onset hearing loss neurodegenerative disorders

Culture-positive postnatal infections associated with hearing loss

Head trauma, especially basal skull/temporal bone, requiring hospitalization

Chemotherapy
Risk indicators for delayed-onset hearing loss
Incidence of risk factors for hearing loss

- Epstein and Reilly (1989) reported 10-12% of all babies had at least one risk factor.
<table>
<thead>
<tr>
<th>Most frequently occurring risk factors</th>
<th>Least frequently occurring risk factors (&lt;10%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ototoxic Medications (&gt;70%)</td>
<td>Hyperbilirubinemia</td>
</tr>
<tr>
<td>Severe Asphyxia (&gt;50%)</td>
<td>Craniofacial anomalies</td>
</tr>
<tr>
<td>Mechanical Ventilation less than 5 days (&gt;25%)</td>
<td>Family history</td>
</tr>
<tr>
<td>Low birth weight (&gt;20%)</td>
<td>Congenital infections</td>
</tr>
<tr>
<td>Parental/Physician concerns (&gt;15%)</td>
<td>Bacterial meningitis</td>
</tr>
<tr>
<td>ECMO (&gt;10%)</td>
<td>Substance abuse (maternal)</td>
</tr>
<tr>
<td></td>
<td>Neurodegenerative disorders</td>
</tr>
</tbody>
</table>

(Cone-Wesson, et al., 2000; Van Riper & Kileny, 1999; Van Riper & Kileny, 2002; Hall, 2007)
Frequency of hearing loss among high risk indicators

<table>
<thead>
<tr>
<th>Risk Indicator</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Craniofacial anomalies</td>
<td>(&gt;50%)</td>
</tr>
<tr>
<td>ECMO treatments</td>
<td>(&gt;20%)</td>
</tr>
<tr>
<td>Severe Asphyxia/ Mechanical ventilation</td>
<td>(&gt;15%)</td>
</tr>
<tr>
<td>Congenital infections</td>
<td>(&gt;15%)</td>
</tr>
<tr>
<td>Family History</td>
<td>(&gt;15%)</td>
</tr>
<tr>
<td>Bacterial meningitis</td>
<td>(&gt;10%)</td>
</tr>
<tr>
<td>Other risk indicators</td>
<td>(&lt;10%)</td>
</tr>
</tbody>
</table>

(Cone-Wesson, et al., 2000; Van Riper & Kileny, 2002; Hall, 2007; Fligor, 2008)
Ototoxic Medications

- Over 200 known ototoxic medications (prescriptions and OTC)
- Used to treat serious infections, cancer, heart disease
- Damage may be temporary or permanent
  - Aspirin (temporary)
  - Cisplatin (permanent)
Aminoglycosides

- Introduced in 1940s
- Used to treat serious infections due to multi-drug resistant Gram negative bacteria
- May remain in hair cells for months after application (Aran et al, 1999)
- “…weekly or biweekly monitoring is recommended ideally.” “…follow-up testing should also be scheduled a few months after drug discontinuation.” (AAA Ototoxicity Monitoring, 2009)
Gentamicin

- Introduced 1963
- Most common aminoglycoside used in NICU
- Low cost
- Effectiveness against most Gram-negative bacteria
ASHA 2010- Evidence Based Systematic Review: Drug-Induced Hearing Loss- Gentamicin

- Systematic literature review (20 studies)
- Reported hearing loss from gentamicin induced cochleotoxicity ranging from 0-58%
- Studies varied in dosing, patient populations, diagnostic testing, diagnostic criteria for hearing loss
Trends noted in the studies:

- Frequency of administration did not influence the likelihood of hearing loss
- Dosing amount did not influence the likelihood of hearing loss
A1555G genetic mutation

- Prezant et al (1993) reported on the genetic mutation A1555G, associated with aminoglycoside deafness

- Estivill et al (1998) reported profound hearing loss without aminoglycoside treatments
A1555G genetic mutation

- United Kingdom study (2002) found 1 in 206 newborns expressing the mutation

- Texas study (1999) only 1 in 1,161 newborn with mutation
Ototoxicity in preterm infants (Zimmerman E, Lahav A, 2012)

- **Effects of genetics**
  - Iowa Children’s Hospital (Ealy et al 2011)
  - N=703 (1.8% with mtDNA variant)
  - No hearing loss

- **Loud noise exposure**
  - Animal studies have found potentiating effect between noise and aminoglycosides
Approximately 25% of NICU infants are considered “LOW” risk and discharged by 5 days old.
- The remaining approximately 75% of NICU infants, who are hospitalized for greater than 5 days, are considered the “TARGET” population to rule out neural hearing loss.

**NICU stay of greater than 5 days and exposure to loop diuretics were not associated with increased risk of hearing loss (Kraft et al, 2014)**
Mechanical Ventilation/Hypoxia

Cone-Wesson et al. (2000) estimates 1/56 children with permanent hearing loss at age 1

Robertson et al. (2002) found greater than 50% of severe neonatal respiratory survivors had sensorineural hearing loss at 4 years old

Beswick et al (2013) study found a correlation between postnatal hearing loss and prolonged ventilation (≥5 days)
Expracorporeal Membrane Oxygenation (ECMO)

- Expracorporeal Membrane Oxygenation (ECMO)- is an aggressive treatment that is used for the life support in infants with respiratory or cardiopulmonary failure
ECMO (Fligor, 2008)

- N = 111 neonates
- Congenital Diaphragmatic Hernia raised risk of SNHL 2.6 times
- Aminoglycoside antibiotics cumulative of 14 days or more in the course of ECMO raised the risk of SNHL by 5.56 times
- ECMO 160 hours raised risk of SNHL 7.18 times
Physical findings/Syndromes associated with hearing loss

- Waardenburg syndrome
- Branchio-Oto-Renal (BOR) syndrome
- Stickler syndrome
- CHARGE syndrome
- Neurofibromatosis Type II
- Downs syndrome
- Treacher Collins syndrome
- Usher syndrome
- Pendred syndrome
- Alport syndrome
- Jervell Lange-Nielsen
Infections

**Congenital Infections**
- Cytomegalovirus (CMV)
- Rubella
- Herpes
- Syphilis
- Toxoplasmosis

**Postnatal infections**
- Bacterial or viral meningitis
- Varicella
- Herpes viruses
Craniofacial anomalies

- Head trauma
- Recurrent OME
- Cleft palate
- Abnormal pinna
- Abnormal ear canal
- Ear tags and pits
- Malformed eyes
- Choanal atresia
- Craniosynostosis
- Hemifacial microsomia
% of hearing loss in cleft palate patients

- Yules (1970)
- Paradise (1975)
- CHOP (1976)
- Helias (1988)
- Viswanathan (2008)
Idaho Cleft Palate and Craniofacial Deformities team (Oct 2007- Feb 2010)

- Normal hearing: 49%
- Conductive: 45%
- Mixed: 2%
- Sensorineural: 4%
Family History

- Positive family history of congenital hearing loss or hearing loss acquired during childhood

- Family history of hearing loss is the most common risk indicator found in healthy newborns (Hall 2007)

- Australia study (Beswick, et al. 2013) showed that the risk factor of family history did predict the occurrence of postnatal hearing loss
Head trauma

- Involving basal skull/temporal fracture that requires hospitalization

- May result in:
  - Facial nerve paralysis (partial, complete)
  - Hearing loss (conductive, sensorineural, mixed)
  - Vertigo
  - Tympanic membrane perforations
Neurodegenerative disorders/Sensory motor neuropathies

- Hunter syndrome
- Charcot Marie Tooth disease
- Friedreich ataxia
Recent publications looking at risk indicators for delayed-onset hearing loss
Beswick et al (2012)

- Literature Review (40 articles)
- CMV, ECMO, congenital diaphragmatic hernia, persistent pulmonary hypertension associated with postnatal hearing loss
Beswick et al (2013)

- N = 2107 children
- 2.7% with postnatal hearing loss
- Findings:
  - Family history and craniofacial anomalies (monitored throughout childhood)
  - Syndromes and prolonged ventilation (favorable results for monitoring)
  - Low Birth Weight (no monitoring)
Prospective study
Evaluate risk indicators for childhood hearing loss
Estimate cost burden of monitoring imposed by some risk indicators
Findings: NICU stay and exposure to loop diuretics are not associated with increased risk for delayed onset hearing loss

- Literature review
- Findings
  - Family History of HL, consanguinity in (grand)parents, malformation syndromes, fetal alcohol syndrome (HIGH)
  - Hyperbilirubinemia (MODERATE)
  - Low birth weight, low APGAR, NICU stay, ototoxic medications (LOW/VERY LOW)
Risk monitoring programs
Goals of risk monitoring programs

- Identify infants and children at risk for delayed onset or progressive hearing loss
- Timely diagnostic assessments from a pediatric audiologist
- Maintain a monitoring and tracking system in the state EHDI data management system
EHDI Risk Monitoring Programs

- Birthing hospitals & Birthing centers
- State EHDI program
- Pediatric Audiology center
- Medical home
Hospitals/Birthing Center roles:

- Identify infants who have 1 or more risk indicators
- Provide family with referral to pediatric audiology clinic
- Provide family with information about risk indicators
- Provide medical home information regarding risk indicator referral
- Report infants with risk indicators to state EHDI program
“Your baby has been identified as having a risk indicator for (_____) for delayed-onset hearing loss. The recommendation for babies with risk indicators is an audiological evaluation around 9 months of age. You will receive a reminder letter when your baby is 8 months old along with a list of pediatric audiologists who can test infants and toddlers.”
Medical home roles:

- Being familiar with risk factors for delayed onset hearing loss
- Explaining screening results and answer questions for the family
- Encourage risk monitoring follow-up
- Providing family with referral to pediatric audiology clinic
Pediatric audiology center roles:

- Providing appropriate comprehensive diagnostic testing for children with risk factors

- Knowledge of risk factors that have high prevalence of delayed onset hearing loss and require early and more frequent assessments

- Providing documentation regarding evaluation outcomes to state EHDI program
State EHDI program roles:

- Providing training and support for hospitals, birthing center, physicians, and pediatric audiologists on risk factor

- Providing a method for hospitals, birthing centers and pediatric audiologists to report information regarding infants with risk indicators to the state EHDI program

- Tracking and surveillance of infants with risk factors
Idaho EHDI program
Data collected by referral forms
Prevalence of Infants with a Risk Indicator in ISB 2007-2013 Data

<table>
<thead>
<tr>
<th>Year</th>
<th>% Infants WITH risk factors</th>
<th>% Infants WITHOUT risk factors</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>3.1</td>
<td>96.9</td>
</tr>
<tr>
<td>2008</td>
<td>4.1</td>
<td>95.9</td>
</tr>
<tr>
<td>2009</td>
<td>7.3</td>
<td>92.7</td>
</tr>
<tr>
<td>2010</td>
<td>9.3</td>
<td>90.7</td>
</tr>
<tr>
<td>2011</td>
<td>9.8</td>
<td>90.2</td>
</tr>
<tr>
<td>2012</td>
<td>10.2</td>
<td>89.8</td>
</tr>
<tr>
<td>2013</td>
<td>11.4</td>
<td>88.6</td>
</tr>
</tbody>
</table>
Number of Risk Indicators Reported in ISB
2007-2013 Data

- Neonatal indicators: 79.63%
- Family history: 8.64%
- Craniofacial anomalies: 5.19%
- Mechanical ventilation: 3.02%
- Syndromes: 0.86%
- Physical findings: 0.91%
- Postnatal infection: 1.40%
- Chemotherapy: 0.10%
- Head trauma: 0.28%
- Neurodegenerative disorder: 0.01%
Idaho’s classification system for risk monitoring
- Pediatric audiologist and NICU physicians began discussions
  - May 2011
- Developed guidelines
  - May-October 2011
- Two hospitals implemented
  - October 2011
Class A: Risk indicators

* In-utero infections (congenital CMV)
* Culture Positive postnatal infection (Bacterial and viral meningitis)
* Syndromes associated with progressive or delayed onset hearing loss (Neurofibromatosis, Osteopetrosis, Usher Syndrome, Townes-Brock)
* Syndromes associated with hearing loss (Down syndrome and Sticklers)
* Cleft Lip/Palate
* ECMO assisted ventilation
* Head Trauma involving basal skull/temporal fracture that requires hospitalization
* Chemotherapy treatments
* Neurodegenerative disorders or sensory motor neuropathies

If baby passes the newborn hearing screening & has one or more CLASS A risk indicator = Recommendation for diagnostic ABR evaluation with pediatric audiologists by 3 months of age.

Class B: Risk indicators

* Family history of childhood hearing loss
* In-Utero Infection (Herpes, Rubella, Syphilis, Toxoplasmosis)
* NICU stay of greater than 5 days
* Any amount of ototoxic exposure (aminoglycosides)
* Any amount of mechanical ventilation
* Craniofacial anomalies involving pinna, ear canal, ear pits and temporal bone anomalies

If baby passes the newborn hearing screening & has one or more CLASS B risk indicators = Recommendation for diagnostic pediatric hearing evaluation by 1 year of age.
Data collected
January 2012 - December 2013

- HiTrack data management system
- Reviewed data November 2015
- N= 10,634 babies
- = 1.6% 175 babies with CLASS A risk indicator
- = 11.04% 1175 babies with any risk indicator (CLASS A and/or CLASS B)
% babies with reported risk indicators (2012-2013)

- Total Babies: 89%
- Risk Babies: 11%
Risk indicator occurrence

N=1175 babies

- CLASS B: OTOTOXIC MEDICATIONS: 734
- CLASS B: REPORTED FAMILY HISTORY OF HL: 175
- CLASS A: 175
Class A risk indicators

N=175 babies

50% LOST TO FOLLOW-UP
50% TESTED
Class A risk indicators

N=87 babies tested

- NORMAL HEARING: 75%
- SNHL/MIXED: 6%
- CONDUCTIVE: 19%
Children with Class A risk indicators & permanent hearing loss

- 5/87 sensorineural/mixed hearing loss
  - 2 children with cleft palate
  - 1 child with Townes Brock syndrome
  - 1 child with Acrofacial Dysostosis
  - 1 child with congenital CMV
Class B/Ototoxic Medications

N=743 babies

46% LOST TO FOLLOW-UP
54% TESTED
Class B/Ototoxic Medications

N = 345 babies tested

- 84% NORMAL HEARING
- 15% SNHL/MIXED
- 1% CONDUCTIVE
Children with history of Ototoxic medications & permanent hearing loss

- 5/345 children with sensorineural/mixed hearing loss
  - 1 child with ototoxic medications and extended NICU stay
  - 1 child with ototoxic medications, mechanical ventilation, extended NICU stay
  - 3 children ototoxic medication plus CLASS A risk indicator
Class B/Family History

N=175 babies

- 63% TESTED
- 37% LOST TO FOLLOW-UP
Class B/Family History

N = 65 babies tested

- 84% NORMAL HEARING
- 11% SNHL/MIXED
- 5% CONDUCTIVE
Children with positive family history & permanent hearing loss

- 3/65 sensorineural/mixed hearing loss
  - 2 children with only risk indicator Family History (siblings)
  - 1 child with multiple risk indicators (syndrome, family history, ototoxic medications, mechanical ventilation, extended NICU stay)
Barriers to monitoring risk indicators for delayed-onset hearing loss
Barriers

- Accurate reporting by hospital staff
- Accurate reporting by families (i.e. family history)
- Accurate and timely reporting by audiologists
- Shortage of pediatric audiologists
- High lost-to follow-up rates
- Lack of support by medical homes
- No standard protocol for audiological monitoring of risk indicators
  - What age to start/stop monitoring
  - What tests to use for evaluation
Why do we monitor children with risk indicators for delayed-onset hearing loss...
Case #1

- Passed AABR hearing screening
- Born at 35 weeks 6/7 days
- NICU stay less than 5 days
- Referred to audiology for risk indicator monitoring (Ototoxic medications)
- No family history of childhood hearing loss
- No history of otitis media
Audiology Evaluation
9 months old

<table>
<thead>
<tr>
<th>LEFT</th>
<th>KEY</th>
<th>RIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>X(0)</td>
<td>AIR CONDUCTION (MASKED)</td>
<td>O(0)</td>
</tr>
<tr>
<td>&gt; (0)</td>
<td>BONE CONDUCTION (MASKED)</td>
<td>&lt; (0)</td>
</tr>
<tr>
<td>SF</td>
<td>SOUND FIELD</td>
<td>SF</td>
</tr>
<tr>
<td>A</td>
<td>AIDED</td>
<td>A</td>
</tr>
<tr>
<td>CI</td>
<td>COCHLEAR IMPLANT</td>
<td>CI</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>PREDICTED SRT (PTA)</th>
<th>PHONE RIGHT</th>
<th>PHONE LEFT</th>
<th>BINAURAL</th>
<th>UNAIDED</th>
<th>AIDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>60</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>80</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>90</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>100</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>OBTAINED SRT (QUIET)</th>
<th>PHONE RIGHT</th>
<th>PHONE LEFT</th>
<th>BINAURAL</th>
<th>UNAIDED</th>
<th>AIDED</th>
</tr>
</thead>
<tbody>
<tr>
<td>30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

MAXIMUM COMFORT LEVEL

TOLERANCE THRESHOLD

SRT

SRT HTL QUIET

SRT HTL QUIET

SRT HTL QUIET
Otoacoustic Emissions

Right: 22-Jan-13: -: 750-8000 Hz Diagnostic Test - High Noise: 13A22D01.OAE

<table>
<thead>
<tr>
<th>L1(dB)</th>
<th>L2(dB)</th>
<th>F1(Hz)</th>
<th>F2(Hz)</th>
<th>GM(Hz)</th>
<th>DP(dB)</th>
<th>NF(dB)</th>
<th>DP-NF(dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>64.9</td>
<td>55.5</td>
<td>6516</td>
<td>7969</td>
<td>7206</td>
<td>11.5</td>
<td>-20.6</td>
<td>32.1</td>
</tr>
<tr>
<td>64.7</td>
<td>55.9</td>
<td>4922</td>
<td>6000</td>
<td>5434</td>
<td>6.4</td>
<td>-25.8</td>
<td>32.2</td>
</tr>
<tr>
<td>65.1</td>
<td>55.9</td>
<td>3281</td>
<td>3984</td>
<td>3616</td>
<td>0.7</td>
<td>-8.4</td>
<td>10.1</td>
</tr>
<tr>
<td>64.7</td>
<td>55.9</td>
<td>2484</td>
<td>3000</td>
<td>2730</td>
<td>0.5</td>
<td>-14.8</td>
<td>15.3</td>
</tr>
<tr>
<td>64.7</td>
<td>55.2</td>
<td>1641</td>
<td>2016</td>
<td>1818</td>
<td>3.2</td>
<td>1.6</td>
<td>1.6</td>
</tr>
<tr>
<td>65.3</td>
<td>55.2</td>
<td>1219</td>
<td>1500</td>
<td>1352</td>
<td>7.1</td>
<td>-2.7</td>
<td>9.8</td>
</tr>
</tbody>
</table>

Left: 22-Jan-13: -: 750-8000 Hz Diagnostic Test - High Noise: 13A22D00.OAE

<table>
<thead>
<tr>
<th>L1(dB)</th>
<th>L2(dB)</th>
<th>F1(Hz)</th>
<th>F2(Hz)</th>
<th>GM(Hz)</th>
<th>DP(dB)</th>
<th>NF(dB)</th>
<th>DP-NF(dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>68.3</td>
<td>55.6</td>
<td>6516</td>
<td>5969</td>
<td>7206</td>
<td>-16.4</td>
<td>-28.1</td>
<td>11.7</td>
</tr>
<tr>
<td>68.0</td>
<td>57.8</td>
<td>4922</td>
<td>6000</td>
<td>5434</td>
<td>-20.9</td>
<td>-24.6</td>
<td>3.7</td>
</tr>
<tr>
<td>65.7</td>
<td>55.6</td>
<td>3281</td>
<td>3984</td>
<td>3616</td>
<td>-15.5</td>
<td>-18.8</td>
<td>3.3</td>
</tr>
<tr>
<td>68.1</td>
<td>55.7</td>
<td>2484</td>
<td>3000</td>
<td>2730</td>
<td>-5.7</td>
<td>-11.4</td>
<td>5.7</td>
</tr>
<tr>
<td>64.5</td>
<td>55.3</td>
<td>1641</td>
<td>2016</td>
<td>1818</td>
<td>-8.9</td>
<td>0.4</td>
<td>-9.3</td>
</tr>
<tr>
<td>65.9</td>
<td>55.3</td>
<td>1219</td>
<td>1500</td>
<td>1352</td>
<td>3.0</td>
<td>4.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>
ABR evaluation
10 months old
3 years old
Future research
Questions and Answers