Learning Objectives
• Background and justification for early childhood screening
• An overview of OAE and audiometry screening
• Risk Factors for Late Onset and Progressive Hearing Loss
• Middle Ear and Tympanometry
• Best Practice Guidelines and Protocols
• Strategies for Successful Screening
• Troubleshooting
• Parent Education and Communication
• Resources
• New Hearing Screening Technology

Background and Justification
Hearing Loss Per 10,000 Compared to Other Congenital Conditions

Newborn Hearing Screening and Beyond

- The EHDI (Early Hearing Detection and Intervention) national 1-3-6 goals specify that all babies are screened prior to 1 month of age, diagnosed with hearing loss prior to 3 months of age and enrolled in early intervention programs prior to 6 months of age.

- Studies have shown that infants who are diagnosed with hearing loss and begin receiving early intervention services before 6 months of age have significantly better outcomes in language, speech, and social-emotional compared to children who begin receiving therapies after 6 months of age.

Newborn Hearing Screening and Beyond

- > 96% of babies born in the United States are screened for hearing loss before one month of age.

- Approx 60% of babies who do not pass the newborn hearing screening are lost to follow-up and don’t get the follow-up testing needed.

- Some children have hearing losses that occur after the newborn period (late onset or progressive hearing loss).

- Subjective methods of screening children before age 3, eg. noise makers and paper screen questionnaires are not efficient in detecting mild, moderate or unilateral hearing loss.
**Important Facts about Hearing in Children**

- Hearing loss is an invisible condition and can develop at any age
- 50% of infants born with hearing loss don’t have risk factors for hearing loss
- Between birth and school age, hearing loss doubles
- 35% of children have repeated ear infections which can impact a child's hearing
- Mild or unilateral hearing loss may not be obvious but is educationally significant and can effect a child’s ability to develop normal speech and language

**Impact of Hearing Loss**

- Two little girls with no known cognitive or developmental conditions
  - The first one was identified late before newborn hearing screening and the awareness of early identification
  - The second one was identified at birth

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Spring is my favorite season. The sun shines bright. The flowers begin to grow like spring.
How OAE Screening Works

Early Childhood Hearing Outreach: “ECHO”

- The ECHO Initiative is a collaboration between
  - Maternal and Child Health Bureau
  - The Federal Administration for Children and Families-Head Start Bureau
  - National Center for Hearing Assessment and Management

- For more information and resources go to:
  www.kidshearing.org
Kidshearing.org

ECHO: How OAE Screening Works

Outer Ear Middle Ear Inner Ear (Cochlea)
Anatomy as it Relates to OAE Screening

Middle ear and Tympanometry

• A measure of middle ear function
• Is not a test of hearing
• Will cause child to refer on OAEs and often refer on puretone screening
Tympanometry and Otitis Media

- Otitis media is an infection of the fluid in the middle ear
- The most common cause of temporary hearing loss
- Common cause of sick days, emergency room visits and antibiotics
- Will cause child to refer on OAEs and often refer on pure tones

Sample Tympanograms

![Sample Tympanograms Image](Image courtesy of Brad Ingrao, MSEd, CCC-A, FAAA / EDEN - The Electronic Deaf Education Network / www.bradingrao.com)

Screening a child with PE Tubes

Screening can be conducted on ears with PE Tubes

- It is a small tube placed in the eardrum that provides ventilation and drains fluid trapped in the middle ear space
- The screening result should be a “pass” if the PE Tubes and cochlea are functioning properly
Screening Responsibly:  
Know the Limitations of OAEs

- Do not tell you why the child does not pass  
- Do not tell you how much of a hearing loss may be present  
- Is effected by outer and middle ear problems  
- May not pick up all hearing losses that have unusual configurations  
- Will not pick up on hearing losses that happen along the auditory nerve to the brain  

- IF A CHILD PASSES THE SCREENING, BUT CONCERNS STILL EXIST, REFER TO A PEDIATRIC AUDIOLOGIST

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Risk Factors for Late Onset and Progressive Hearing Loss

JCIH 2007 Risk Factors: jcih.org

- Caregiver concerns regarding speech or developmental delay  
- Family history of permanent childhood hearing loss  
- NICU care of more than 5 days or any other following regardless length of stay: ECMO, assisted ventilation, ototoxic med, hyperbilirubinemia requiring blood transfusion  
- Low Birth Weight < 1500 grams  
- In utero infection: CMV, herpes, rubella  
- Physical findings that are associated with a syndrome known to include SNHL or permanent CHL  
- Craniofacial anomalies  
- Syndromes associated with hearing loss  
- Neurodegenerative disorders  
- Culture positive postnatal infections associated with SNHL: meningitis  
- Head Trauma  
- Chemotherapy
Late Onset and Progressive HL

- Most common risk factors for late onset or progressive loss are:
  - Cytomegalovirus (CMV)
  - Cranio-facial Anomalies
  - Meningitis
  - Head Injury
  - Family History of congenital hearing loss

Unilateral and Mild Hearing Loss

- Studies show that unless early identification and management occurs, children with mild and moderate hearing loss on average achieve one to four grade levels lower and
- Studies have shown that approximately 37% of children with unilateral hearing loss are at risk for failing a grade

Tharpe, 2007

Guidelines and Protocol
Overview of Age Appropriate Screening Guidelines

Birth to Three

- Ideal for children, birth to 3 because it does not require a behavioral response
- OAEs are not a true test of hearing
- Babies in the NICU for > 5 days are at a higher risk for neural losses, therefore OAEs must be used responsibly

Overview of Age Appropriate Screening Guidelines

Approximately Age Three and Older

- Pure tone/audiometry screening: considered the gold standard because it is a comprehensive screen of the auditory system
- Use OAEs only for children for whom you are unable to condition or obtain a behavioral response

ECHO: OAE Protocol in Detail
ECHO: OAE Protocol in Detail

ECHO: OAE Documentation Form

Strategies for Successful Screening
ECHO: Strategies For Successful Screening

Strategies for Successful OAE Screening: Preparing to screen

- Ready the equipment
  - Visual inspection
  - Sound check
  - Plugged in or fully charged
- Ready the Room
  - Quiet environment
  - Toys to distract children
  - A familiar, comforting adult
  - Convenient chairs
- Infection Control
  - Container to keep used probes
  - Gloves or hand sanitizer to use between children
  - Antibacterial wipes to clean equipment in between screenings

What to Bring to Successfully Screen!

When screening young children, be well prepared. Along with making sure your equipment is charged and working properly, there are a number of items that will help the screening run smoothly.

Consider investing in a plastic caddy type of container or basket with a handle and assembling a screening kit with the following items:

- Plenty of probe/ear tips (include a few adult sizes so you can check equipment by testing yourself).
- Extra probe replacement nozzle/probe tubes/probe tips
- Baggie(s) for dirty probe tips
- Alcohol packs
- Antibacterial hand gel
- Pen
- Screening/Reporting forms
- Assorted quiet innovative toys that can be disinfected such as:
  - Books
  - Bubbles
  - Role of tape
  - Plastic balls
  - Windmills
  - Light up spinning wands
  - Stickers
  - Mini Etch a Sketch
  - Cartoon Bandages
  - Puppets
Strategies for Successful OAE Screening: Probe Fit Integrity

1. Visual inspection of ear
   - Note the size of the canal opening
   - When NOT to screen
     - Significant wax blockage or loose wax draining from ear
     - Fluid or drainage from the ear
     - Blood
     - Open sore
     - Foreign object in the ear canal

2. Pick an ear tip that looks slightly larger than the ear canal

3. Position yourself on the side and just behind the ear you are screening

4. Clip the cord to the child’s clothing closest to the ear you are screening

5. If you are using a foam tip, fully compress before placing in ear

6. With one hand pull back on the pinna to fully open the canal

7. With the other hand, gently insert the probe deep in the canal and twist slightly

8. When the child settles, let go of the probe

9. Perform the "Tug Test"

10. The probe should be secure and stay in place on its own

11. Before screening the opposite ear, always check the probe to ensure there is no wax or debris blockage
Strategies for Successful OAE Screening
Probe Fit Integrity

Hand’s-On Demonstration
Troubleshooting

- Noisy room
- Noisy child
- Probe fit
- Probe blocked with wax
- Other error messages on the screen

Strategies for Successful OAE Screening

<table>
<thead>
<tr>
<th>Challenge</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child is non-compliant, afraid and unwilling to allow screening</td>
<td>1. Have a very familiar adult accompany the child for the screening, e.g. a parent, caretaker or teacher.</td>
</tr>
<tr>
<td></td>
<td>2. Have the child sit in the adult's lap facing away from the child so they are not distracted by the examiner.</td>
</tr>
<tr>
<td></td>
<td>3. Let the child know you want to play and use a listening game and ask for their help in holding the &quot;game&quot; and pressing the buttons.</td>
</tr>
<tr>
<td></td>
<td>4. Keep some innovative &quot;quiet&quot; toys and distractions in hand...bubbles, stickers, band-aids, old cell phone, crayons and coloring books...</td>
</tr>
<tr>
<td></td>
<td>5. If still unsuccessful, try screening during the child's nap!</td>
</tr>
</tbody>
</table>
Strategies for Successful Screening

<table>
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<tr>
<th>Challenge</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Noisy / high artifact error messages</td>
<td>1. Find a quieter area to screen. Ideally, screening should be conducted in a quiet room. Take children out of a noisy room and into a quiet room to screen</td>
</tr>
<tr>
<td></td>
<td>2. Check probe fit to ensure probe is securely placed in the ear</td>
</tr>
<tr>
<td></td>
<td>3. If child has a cold or upper respiratory condition,</td>
</tr>
<tr>
<td></td>
<td>4. Check for probe blockage. Wax, debris can create “noise” or interference</td>
</tr>
</tbody>
</table>

Rescreening

- Know when to re-attempt screening
  - When a child is moving
  - When there is excessive internal or external noise
  - If you aren’t sure about your probe fit
  - If the probe is blocked

Audiometry Screening Process
Screening Results

All state EHDI programs have reporting mandates. Contact your state Early Hearing Detection and Intervention (EHDI) program or visit infanthearing.org to obtain your state specific profile.

Educating Parents on Ear Wax Removal

Know Your State Reporting Requirements

• All state EHDI programs have reporting mandates
• Results must be reported to the
• Contact your state Early Hearing Detection and Intervention (EHDI) program or visit infanthearing.org
Resources

EHDI-PALS
Links to Pediatric Audiology Services

A national web-based directory of facilities that offer pediatric audiology services to young children who are younger than five years of age

ehdipals.org

Community Funding Resources

- Every community has funding and grant initiatives for children with special health care needs and/or developmental disabilities
- Do a google search for resources in your community...ie “funding opportunities for children with developmental delays in your city”
- The Lion’s and Rotary clubs

Grant Template on ECHO Website
Screening and Follow-up Resources

- [http://www.ehdi-pals.org](http://www.ehdi-pals.org) (Pediatric Audiologist's)
- [http://www.kidshearing.org](http://www.kidshearing.org) (ECHO Website)
- [http://www.infanthearing.org](http://www.infanthearing.org) (NCHAM Website)

Handheld portable devices, such as the Madsen ALPHA and PATH SENTIERO, are ideal for birth to 5 screening.
Madsen Alpha
Entertainment Value

- User friendly
- Large Touch Screen
- Child mode to engage child
- Built-in probe quality check
- PE tubes and perforations
- Updated lightweight probe design
- Low cost disposables

Madsen Alpha
New Technology to Maximize Screening outcomes

Alpha = Basic version

- One pre-defined DPOAE protocol testing 2-5 kHz using 65-55 dB SPL
- Simple touch screen and navigation
- Prints to label printer
- Stores 50 tests
Alpha+ = Enhanced features

- Ability to add demographic/patient information
- 8 predefined DPOAE protocols including a TEOAE protocol
- Stores 250 tests
- Results can be printed from a PC with a Print to PDF tool or label printer

Probe Check Convenience

Built-in Probe Test Cavity

Eartip Selection for ALPHA and Sentiero
**PATH Sentiero Handheld Screener**

Combination device with OAEs and audiometry in one handheld, portable lightweight device making it easy to go from child to child.
PATH Sentiero: Combined Technologies

PATH Sentiero

The VIP Probe:

- Provides light for a more accurate positioning
- Unique feature is especially helpful in dark rooms
- Allows for continuous monitoring to ensure a proper fit and seal

Resources: audiologysystems.com/alpha
Questions?

- rwinston@audiologysystems.com