

Hearing Screening in Early Childhood: What, Why, How



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Information covered in this presentation

- Why is screening for hearing loss in early childhood important?
- What are methods of hearing loss identification for ages 6 months to 5 years?
- Pros and cons of different methods

Requirements – Hearing Loss Identification



Requirements to perform hearing screening

Part C of the Individuals with Disabilities Education Act

- Part C (2004) provides for early intervention services for infants and toddlers under the age of 3. As part of the early intervention services, each state is required to have a **child find system to identify, locate and evaluate all children with disabilities.**
- The Part C regulations at 34 CFR §303.322(c) require that the evaluation and assessment of an infant or toddler be based on informed clinical opinion, and include the following:
 - (ii) An evaluation of the child's level of functioning in each of the following developmental areas:
 - (B) Physical development, including vision and hearing.

Part C requirements continued

- In addition, for a child who has been evaluated for the first time and determined eligible under Part C, an individualized family service plan (IFSP) must include “a statement of the child’s present level of physical development (including vision, **hearing**, and health status), cognitive development, communication development, social or emotional development, and adaptive development. ... **This statement must be based on professionally acceptable objective criteria.**”
34 CFR §303.344(a).

OSEP clarification, Nov. 6, 2003

The Office of Special Education Programs (OSEP) provided clarification on the necessity of providing audiological evaluations to infants or toddlers with suspected communication delays.

“...under Part C, an infant or toddler suspected of a communication delay, whose hearing has not been tested **and for whom an audiology evaluation is determined needed**, must receive an audiology evaluation as part of the evaluation required to be conducted under 34 CFR §303.322(c)(ii)(B). This evaluation is needed in order to reflect the child’s present level of functioning on the IFSP.”

Part C summary

- If the agency acts consistently with: *“the very fact that they have a speech delay means that further audiological testing is warranted to rule out any late-onset hearing loss”* then audiological evaluations should be provided for these children.
- Even if the agency does not enact this belief, it is still required to use *objective criteria* to assess functional hearing to fulfill the present level of performance statement on the IFSP.

Further Part C Considerations

- It is typical for approximately half of children served by state Part C programs to be eligible primarily due to concerns about communication delay.
- From a risk standpoint, if the agency truly wanted to identify children with previously unidentified hearing loss it would make sense to obtain a hearing evaluation on every child found to have a communication delay in the absence of other disability conditions.
- Since doing so is NOT explicitly required by Part C, many agencies instead opt to identify hearing loss by some type of **systematic screening** of each child undergoing eligibility evaluation or IFSP assessment. This screening must utilize objective criteria per 34 CFR §303.344(a).

Requirements to perform hearing screening

Head Start

- In the Head Start standards for training, qualifications and conduct of home visits, **offering annual hearing screening** for children from birth to entry into kindergarten, *when needed* is required. (Public Law No: 110-134).
- Head Start Performance Standards require that an **auditory screening** be conducted within the first 45 days of enrollment (1304.20 Child health and developmental services).

Head Start Continued

- Grantee and delegate agencies must obtain direct guidance from a **child development professional** on how to use the findings to address identified needs.
- (iii) Obtain or **arrange further diagnostic testing**, examination, and treatment by an appropriate licensed or certified professional for each child with an observable, known or suspected health or developmental problem; and
- (iv) Develop and implement **a follow-up plan** for any condition identified in 45 CFR 1304.20(a)(1)(ii) and (iii) so that any needed treatment has begun.

Head Start & EPSDT

- **Head Start requires that EPSDT screening be conducted.** EPSDT (in accordance with section 1905(r) of the Act), must include screening services and a comprehensive health and developmental history -- (including assessment of both physical and mental health development);
- **Hearing** is listed under required EPSDT screening services. “At a minimum, include diagnosis and treatment for defects in hearing, including hearing aids.”
- The EPSDT periodicity schedule for Periodic Screening, Vision, and Hearing services in **Minnesota specify subjective hearing screening measures** through age 3 and objective screening at age 4, 5, 6, 8, 10, 12, 14, 16, 18 years.
- **EPSDT is held to a lower level of stringency in hearing loss identification methods for 0-3 than Part C.**

Requirements to perform hearing screening

Part B of IDEA 2004

- Provides rules and regulations for special education for children between the ages of 3 and 21 and states that "each public agency must conduct a full and individual initial evaluation" to identify a disability and subsequent eligibility for special education services
- 300.304(b)(3): Use technically sound instruments that may assess the relative contribution of cognitive and behavioral factors, in addition to physical developmental factors.
- 300.304(b)(4): The **child is assessed** in all areas related to the suspected disability, **including, if appropriate**, health, vision, **hearing**, social and emotional status, general intelligence, academic performance, communicative status and motor abilities.

Affects of Hearing Loss on Development

Risk Factors

- Approximately 1/6 of the pediatric hearing loss population have hearing loss as one of a number of symptoms comprising a syndrome.
- Thus, early hearing detection and intervention (EHDI) screening for hearing loss in newborns has decreased the delay in identifying children with syndromes that are not physically obvious.
- Over 400 syndromes have been identified that include hearing loss.

Affects of Hearing Loss on Development

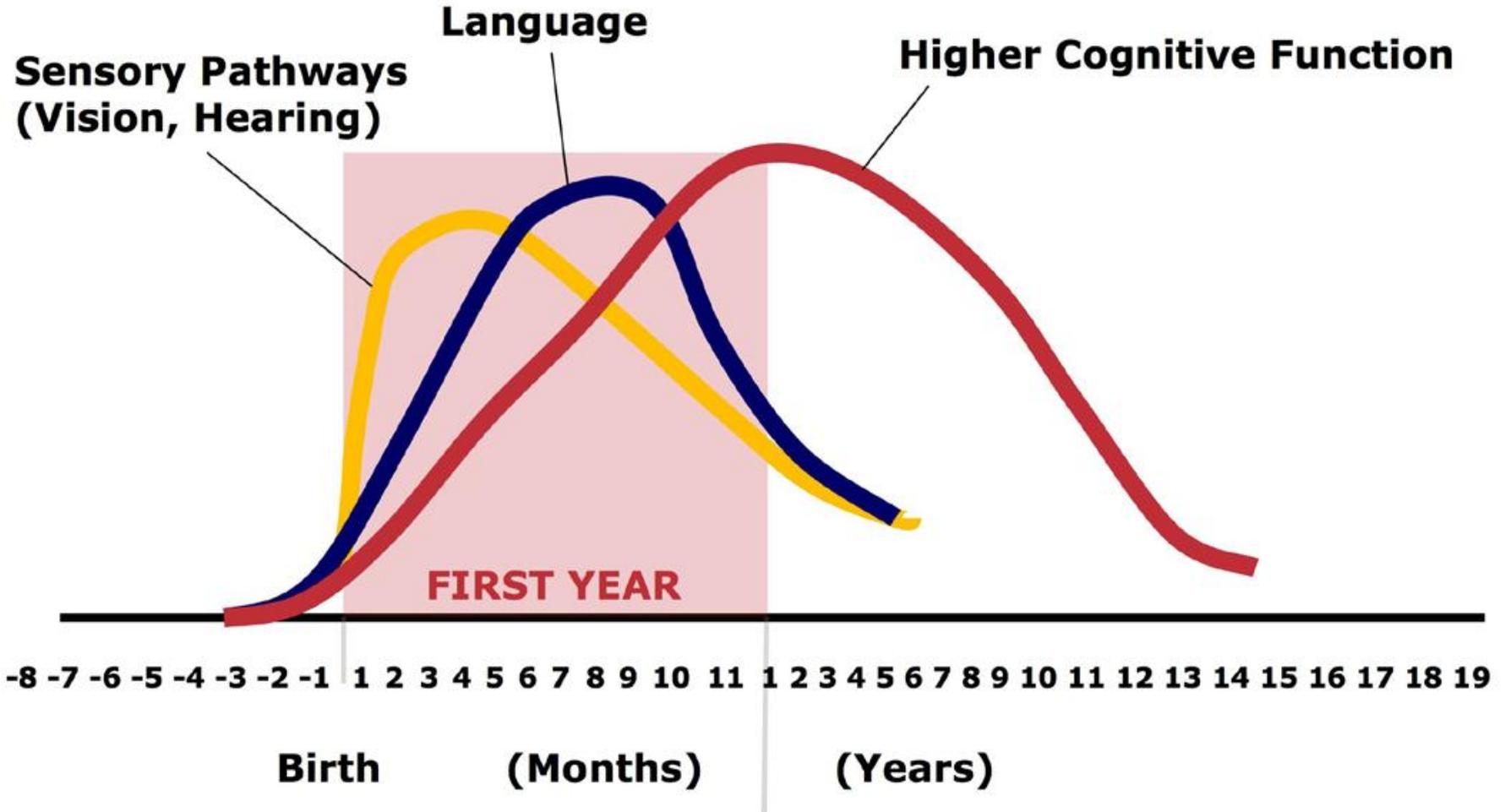


Risk Factors and Hearing

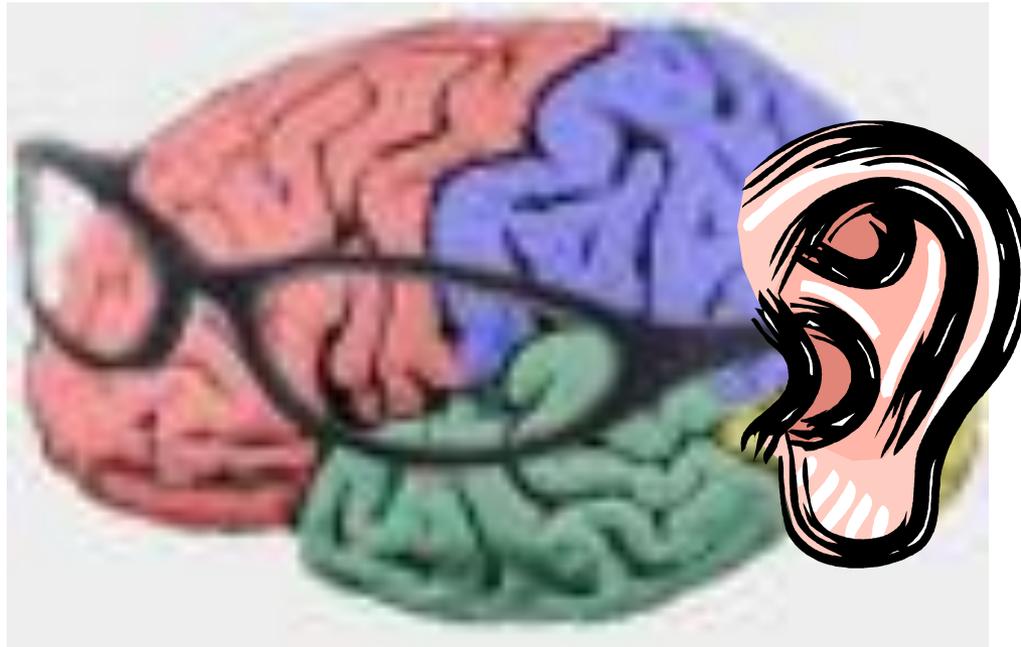
- More children born prematurely and/or with obvious disabilities are surviving. Prematurity is a risk factor for hearing loss.
- Hearing loss is the most common birth disorder.
- In about half of children with hearing loss the cause is due to genetic abnormality.
- Approximately 30-40% of children with hearing loss will have additional disability conditions.

Human Brain Development

Neural Connections for Different Functions Develop Sequentially



We hear and see with our brains.



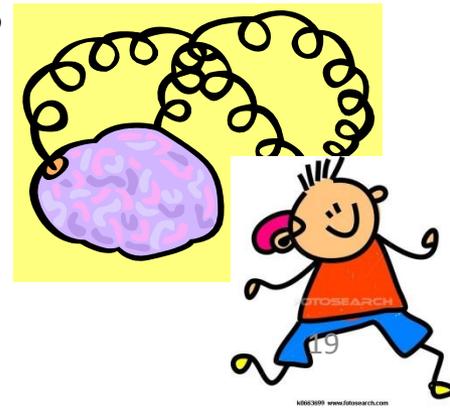
The Early Developing Brain

- How a brain develops hinges on a complex **interplay** between the **genes** you are born with and the **experiences** you have
- Early **experiences** have a **decisive impact** on the architecture of the brain, and on the nature and extent of adult capacities
- **Early interactions** don't just create a context; they **directly affect** the way the brain is “wired”



Brain Development and Urgency to Amplify

- Construction of brain pathways is dependent upon sensory input
- Due to the reliance on hearing as part of foundation building of brain pathways it is critical to fit hearing aids to infants with hearing loss within 1 month of diagnosis, preferably no later than 3 months of age.
- Hearing aids are assistive technology devices and therefore are to be provided by Part C as payer of last resort to meet the unique developmental needs of children with hearing loss.



OSEP Clarification in 2003

In an OSEP policy letter it was clarified that:

- Appropriate Part C services must be available to all eligible children and their families
- Are designed to meet the developmental needs of the individual child
- Assistive technology devices are among those included as early intervention services (including hearing aids)
- At no cost to families (unless a sliding fee system is in place)

Knowledge of brain development in combination with evidence based practices supporting amplification as early as possible reinforces that amplification be provided through Part C to eligible children without undue delay.

<http://www2.ed.gov/policy/speced/guid/idea/letters/2003-1/goodman032503earlyinter1q2003.pdf>

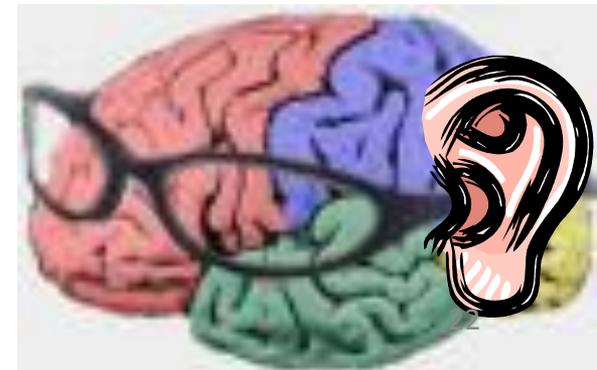
Hearing and Development

- Vision and hearing are your distance senses
- 95% of all learning is through your distance senses
- 90% of learning is incidental
- Language is learned incidentally
- Incidental exposure to language or experiences only occurs if the child is within 'earshot'



A **barrier** in information gathering!

- We hear with our brains – these pathways develop most in the first few months of life
- Children tune into speech about a year before they begin to say actual words
- Hearing loss is a barrier to children being exposed to speech that typically will delay their readiness to begin talking
- AND their neural pathways will NOT develop optimally unless they are consistently stimulated before 6 months of age



Language is
CAUGHT not TAUGHT



The Listening Bubble

Not in range!



In range & listening!



Out of 'ear shot' means language is not caught!

Hearing Does Not Develop

- Children can hear starting in the womb at about 4 months gestation
- When born, children hear as well as adults (or better) but need to learn what sounds mean
- When born, children with hearing loss are already behind in sound awareness/identification
- A child with normal hearing will develop auditory skills needed to detect, identify, and comprehend what sounds in their environment mean – all during the first few months of life
- Children with hearing loss must be exposed to a specific hierarchy of experiences so that they learn these skills; even for children with mild loss

Experience for Yourself!!

Hearing loss affects how **loudly** sound is perceived

- **Slight** loss (20 dB)  -similar to loss due to ear infection
- **Mild** loss (30 dB)  -about ½ with this much hearing loss do not wear hearing aids

Experience for Yourself!!

Hearing loss can affect perception of different **itches**

- Missing many high pitch sounds
(s, f) 
- Hearing only the low pitch sounds
(oo, aw) 

Won't most children with hearing loss be identified by newborn screening?

- Even with universal newborn hearing screening not all children with educationally significant hearing loss will be identified:
 - Newborn screening is at 35-40 dB ; significant hearing loss starts at 16-20 dB. **For every 1 child with mild hearing loss identified, 2 will not be found until speech/language delays are evident.**
 - Children with hearing loss right at the cutoff will often pass upon retest after newborn screening
 - Some families decline newborn hearing screening or do not obtain follow up hearing evaluations if their newborn failed screening (about 3% of fails)
 - Progressive and late onset hearing loss occur after the newborn period

UNFAIR SPELLING TEST

List of 10 words



Consider trying to learn language for the first time with these hearing losses!



Answers to the Unfair Spelling Test

Is 'hearing' with this type of loss enough to **really** learn complete language incidentally?

- 1. fill
- 2. catch
- 3. thumb
- 4. heap
- 5. wise
- 6. wedge
- 7. fish
- 8. shows
- 9. bed
- 10. juice



How many children should be identified?

Estimates vary

- NIDCD suggests **6-7 per 1000 children have permanent hearing loss in addition to the 3 per 1000 likely to be diagnosed shortly after birth₁**
- The National Health & Nutrition Evaluation Studies (NHANES) for the periods of 1976-80 and 1988-94 screened children from 6-19 years of age indicated that the estimated 3/1000 prevalence of permanent hearing loss in infants can be expected to increase to 9-10/1000 children in the school-age population₂



What about for Early Childhood?

- Data gathered on screening performed on Early Head Start children ages 0-3 and follow-up suggests that approximately 2 of every 1000 children screened in early childhood settings are being identified with a permanent hearing loss³.
- So **it is conservative to assume** that 2-3 additional children with permanent hearing loss will be identified in early childhood and at least another 3 or 4 per 1000 children in elementary school.

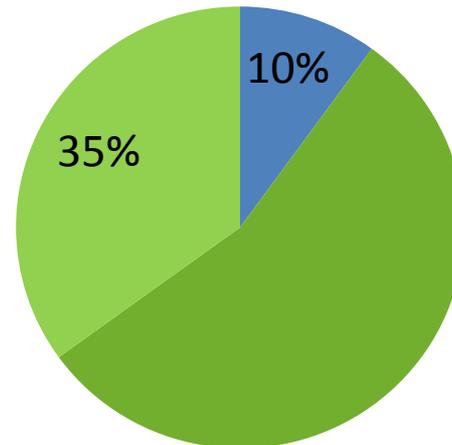
- Thus, the anticipated number of children identified with significant hearing loss who pass newborn screening should be 2-3/1000 of the early childhood population screened
- This would therefore be a **doubling of the number of children found with significant hearing loss shortly after birth.**
- Many of these will be children with 'mild' hearing loss whose parents will see that they respond to sound and may not be concerned about hearing.

Types of hearing loss

- Permanent hearing loss is relatively rare. Far greater in number are the children who experience middle ear effusions associated with hearing loss.
- Early Head Start hearing screening for children ages 0-3 identified 18 children per 1,000 to have transient conductive hearing loss secondary to fluid or infection behind the eardrum³.
- Due to follow up issues, the 18/1000 finding likely underestimates the actual children with hearing issues due to middle ear effusion.

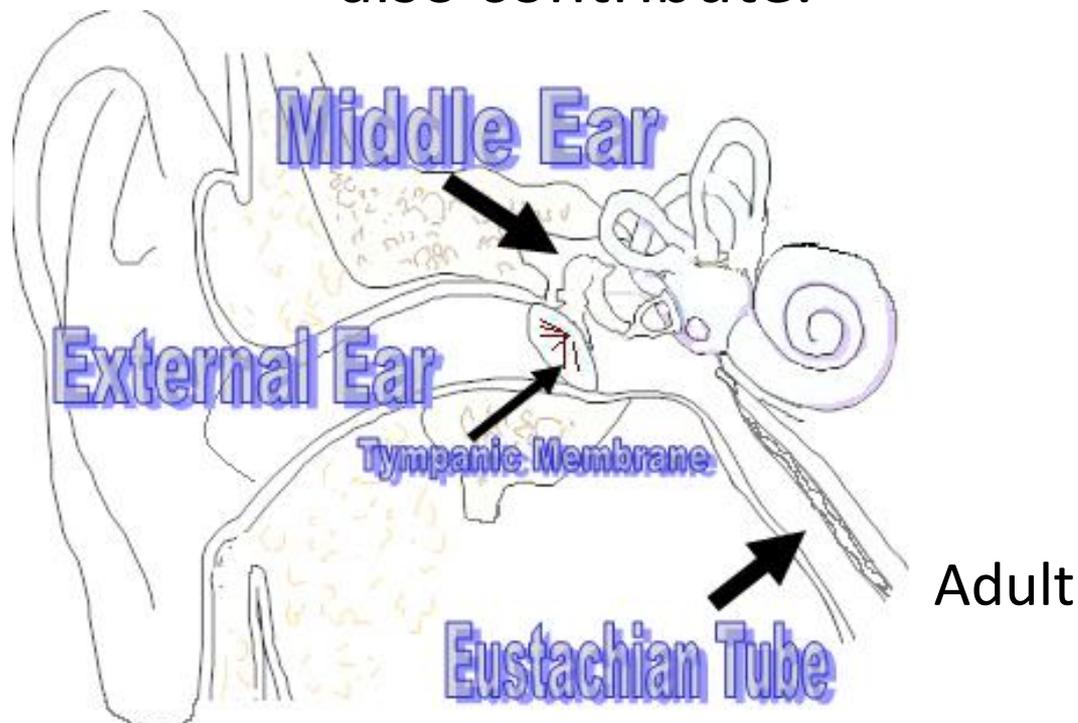
A common problem

- About 90% of children under the age of 3 have experienced at least one episode of ear infection or fluid.
- An estimated 35% of pre-school children experiencing intermittent hearing loss secondary to repeated episodes of ear infections with some untreated for extended period of time₄

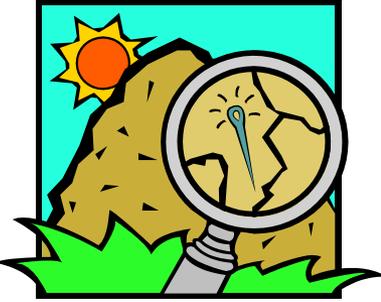


Fluid or infection behind the eardrum, in the middle ear space, can cause significant temporary hearing loss.

Young children are more prone to ear problems because the Eustachian tube is much more horizontal and bacterial from the throat can more easily invade the middle ear space. Lower immunity and allergies also contribute.



Who *SHOULD* we identify?

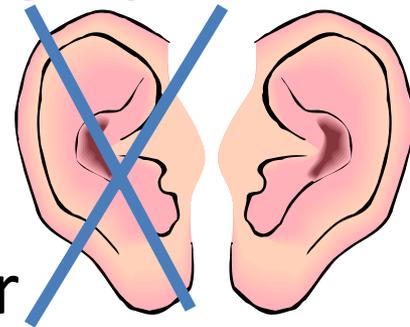


Our primary target is young children with permanent hearing loss in one or both ears

- A long history of fluctuating hearing loss secondary to chronic, recurrent middle ear effusion has been correlated with early delays in speech/language development and affects on the ability to listen in noise.
- A single screening will not differentiate children with chronic ear problems from those with the occasional ear problem due to a cold.
- The most effective screening protocols will strive to differentiate between potential permanent and temporary hearing loss.

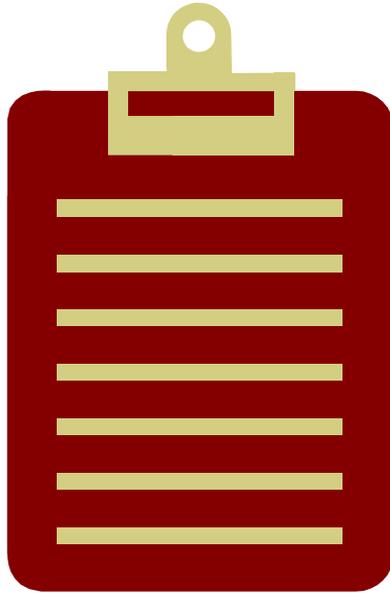
A word about unilateral hearing loss

- About 20-25% of newborns identified with permanent hearing loss after hearing screening have unilateral hearing loss.
- It is a common misperception that hearing loss in one ear will not cause any developmental concerns
- 1/3 develop expressive language delays
- 1/5 develop behavior/social concerns
- 1/4 develop hearing loss in their better ear
- These children are at 10 times the risk for school failure or special education than normal hearing peers
- Any transient hearing loss due to ear infection will increase the risk of delay



Methods of screening
for hearing loss in
young children
6 months to 5 years

Methods of screening for hearing loss in young children 6 months to 5 years



- ✓ Informal observation and parent interview
- ✓ Checklists
- ✓ Traditional pure tone hearing screening
- ✓ Otoacoustic emissions
- ✓ Tympanometry

Informal observation and parent interview



- Asking if family members have any hearing concerns has long been considered sufficient to identify hearing problems in most early intervention programs, even when there are primarily communication development concerns.
- Some early intervention programs have included informal observation of the young child when a bell or other noisemaker is used as a measure of functional hearing ability.

Checklists



- At least one checklist is available that lists ‘red flag’ questions for hearing loss and auditory milestones by age to allow identification of possible delays that could indicate a hearing loss.
- As part of the health history it is common for early intervention programs to ask questions about the result of newborn hearing screening.
- Questions may also be asked about a child’s history of ear infections or permanent hearing loss in the family.

Traditional pure tone hearing screening

- This hearing screening method requires a response from the child; typically dropping a block into a bucket when they hear a beep through earphones.
- Pure tone hearing screening methods are usually successful with typically developing 3 year olds. Success is possible with some children as young as 24-30 months.



Otoacoustic emissions (OAE)

A small tip into the ear as the child listens to a soft clicking. A healthy cochlea will send back a very soft echo that is measured by a microphone. The test provides information about how the child is hearing, but does not tell how much hearing or the type of hearing loss.



Tympanometry



- Tympanometry checks how well the eardrum moves and how well the eardrum and middle ear system send sound to the inner part of the ear.
- Tympanometry does not tell if a child is hearing or not. It indicates if there is fluid in the middle ear which can cause temporary hearing loss.
- It can also tell the size of the child's ear canal. If the child has tubes, the test shows that the tubes are working right.

Tympanometry



OAE/tymp
Combination
unit



Informal observation and parent interview PROS & CONS



- PRO – minimal training, no equipment cost
- PRO - family centered; assumes parents are aware if a hearing problem is present
- CON - Hearing reduces the size of a child's listening bubble. For all but the children with severe to profound degrees of deafness, there will be conditions under which they are observed to respond to sound.
- CON - The younger or less developmentally mature the child, the easier it is to mistakenly assume that hearing is normal.
- CON – Does not meet the requirement for professionally objective assessment criteria.

Pros and Cons

Hearing Screening Techniques

Checklist PROS & CONS



- PRO – inexpensive, requiring only copying costs
- PRO – minimal training needed
- PRO – provides a systematic means for the IFSP team to consider functional hearing ability that can be applied across early intervention programs
- CON - Using parent questionnaires found that this method of identification misses at least 80% of mild hearing loss or does not differentiate between those with and without hearing loss.
- CON – Does not meet the requirement for professionally objective assessment criteria.

Traditional pure tone hearing screening PROS & CONS



- PRO – many schools and Health Departments already have access to this equipment due to school hearing screening
- PRO – considered the optimal choice for identifying hearing loss in preschool and school age because it can identify even mild loss
- CON – Many three year olds are challenging to screen and populations younger than three are too difficult to test effectively in mass screening
- CON - Even more challenging to successfully screen developmentally delayed populations

OAE PROS



- PRO – meets the requirement for professionally objective assessment criteria.
- PRO – quick and painless, often successfully completed by trained personnel using distraction techniques (child looking at video)
- PRO - Equipment applies pass/fail criteria preventing screening personnel from making this judgment

OAE CONS



- CON – requires purchase of OAE equipment, tips, cleaner.
- CON – requires the child to be still and quiet
- CON – requires significant training of personnel otherwise cannot-test rate can be as much as 50%
- CON – OAE screening equipment is typically set to identify hearing losses greater than 35-40 dB, so many (2/3?) mild hearing losses are missed
- CON – the presence of middle ear fluid or pressure will also cause a screening failure

Tympanometry PROS & CONS



- PRO – use of tympanometry in conjunction with OAE screening will differentiate children who are likely failing from middle ear effusion from those who are likely to have permanent hearing loss
- PRO – quick, painless and is not as sensitive to movement or background noise as OAE
- CON – NOT a hearing test
- CON – requires purchase of equipment, tips, cleaner
- CON - requires training on how to use equipment
- CON – should be done in conjunction with otoscopy to identify possible draining ears or those with holes in the eardrum

Implementation Costs & Issues

Identifying Hearing Loss 0-5

Checklist/Parent

Interview/Observation method

- Cost \$
 - Minimal cost for materials and training
 - Possible litigation for missed hearing loss
- Issues   
 - Does not meet requirement for objective assessment criteria
 - Miss/hit rate approximately 80/20 (permanent loss)
 - Individual cost to children in terms of limitations on potential progress due to hearing loss, despite provision of quality early intervention services

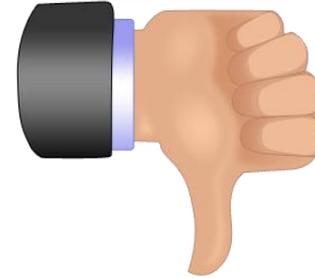
OAE screening method

- Cost 
 - Approximately \$4500 per OAE screener
 - Ongoing costs for tips and tip cleaning time
 - Suggest ½ day or more training of screening personnel. Training should include oversight by an experienced and highly trained person during initial use of OAE
 - Time needed for repeated follow up screening to see if hearing problem resolves over time as a means of reducing over referral rate due to OAE inability to differentiate transient from permanent hearing loss
- Issues 
 - Still miss many/most with mild hearing loss
 - Miss/hit rate 20/80 depending on loss to follow up
 - Rigorous protocol needed for screening/rescreening to manage loss to follow up rate and identify referrals⁵⁶

Tympanometry & OAE Screening

- Cost 
 - Approximately \$4500 for OAE, \$3500 for tympanometer or \$7000 for a combined tympanometer/OAE unit
 - Ongoing costs for tips (<\$50/yr) and tip cleaning time
 - Same extensive training needed as OAE screening
- Issues 
 - Miss/hit rate of 6/94
 - Agency must decide on referral practices and follow up for children with apparent middle ear effusion (fail OAE/tympanometry)

Infant/Toddler Screening Summary: Time, Money, & Effectiveness



- Although the **checklist/observation method** of hearing loss identification is most simple, it is not effective nor does it fulfill the requirement for objective assessment criteria.



Infant/Toddler Screening Summary: Time, Money, & Effectiveness



- **OAE screening** fulfills the objective assessment criteria at the cost of the equipment, training, and serial rescreening time until a referral can appropriately be made.
- Serial rescreening often competes with high caseload demands and intervention needs resulting in lack of completion in a timely manner.
- The time taken for rescreening is ultimately time lost to appropriate intervention if a permanent hearing loss is truly present.



Infant/Toddler Screening Summary: Time, Money, & Effectiveness

- **OAE/tympanometry** screening is at high initial cost for equipment and training, but results are more accurate with less staff time to rescreen children with common ear problems.



Preschool Hearing Screening

- Conditioned play audiometry is still the 'gold standard' for ages 3 and 4
- If child **cannot** be conditioned then OAE could be used.
- Tympanometry will help to differentiate between probable middle ear effusion and possible permanent hearing loss
- Monitoring of preschoolers with recurrent chronic middle ear effusion can be an important related service for those in Special Education preschool settings with language delays.
- Children who are Down Syndrome and those with cleft palate issues are also at high risk for continual hearing problems and merit hearing monitoring.



Summary



- It is hoped that this presentation
 - Raised your awareness of the legal requirements for hearing loss identification
 - Raised your awareness of issues related to hearing loss in young children
 - Raised your awareness of the complexities of screening for hearing loss in young children
 - And provided you with the information needed for your agency or program to determine next steps for implementing or improving a hearing screening initiative.

Resources

- OSEP 11/6/2003 audiology evaluations [letter of clarification](#)
- Head Start [health and developmental services](#)
- Minnesota EPSDT periodicity schedule
- The Harvard Center on the Developing Child [Brief](#) on early brain development.
- OSEP 3/25/03 [assistive tech letter of clarification](#)
- [Ear Infections and Language Development](#) e-brochure by US Department of Education and ASHA
- [Parent Interview Protocol for Child Hearing & Vision Skills](#)



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