

## DIAGNOSTIC TESTING GUIDELINES – for Audiology

In 1999, the Illinois legislature passed the Hearing Screening for Newborns Act. By December 31, 2002, hospitals delivering babies were required to provide hearing screening to all babies born in their facility.

The goals of the Illinois program are:

1. All infants born in Illinois will have their hearing screened no later than one (1) month of age.
2. All newborns referred from the Illinois Newborn Hearing Screening Program will have diagnostic testing completed no later than three (3) months of age.
3. All infants diagnosed with significant hearing loss will receive appropriate treatment, including hearing aids if appropriate, and be offered Early Intervention Program and Division of Specialized Care for Children services no later than six (6) months of age.

All audiologists are encouraged to become providers for:

Illinois Department of Healthcare and Family Services (HFS) formerly Public Aid  
<http://www.dpailinois.com/>

University of Illinois Division of Specialized Care for Children (DSCC)  
<http://www.uic.edu/hsc/dscc/>

Illinois Early Intervention Program (EI)  
<http://www.state.il.us/agency/dhs/earlyint/earlyint.html>

It is essential that audiologists to whom babies are referred for diagnostic evaluations have experience using age appropriate diagnostic techniques for infants. The Joint Commission on Infant Hearing (JCIH) has produced guidelines for reference. Based on this information, the Newborn Hearing Screening Advisory Committee in Illinois has recommended diagnostic audiology guidelines, which are listed below. All audiologists are encouraged to adopt the following guidelines in their practice:

**Significant Hearing Loss: means a dysfunction of the auditory system of any type or degree that is sufficient to interfere with the acquisition of speech and language skills.**

The methodology used to evaluate infant hearing should detect, at a minimum, unilateral or bilateral hearing loss greater than 30 dBHL or 30dBnHL (2000-4000Hz region). However, the effects of minimal hearing loss should not be discounted.

All infants who are referred from a newborn hearing screening program because they failed two (2) inpatient hearing screenings in one or both ears should be seen for an outpatient rescreening no later than one month of age. If the infant doesn't pass the outpatient rescreening, then a full diagnostic audiology assessment including Auditory Brainstem Response (ABR) testing should be scheduled and completed prior to 3 months of age.

**A. Auditory Brainstem Response or Evoked Otoacoustic Emissions Rescreening**

1. Rescreen with an Automated Auditory Brainstem Response Test (AABR) at levels no greater than 35 dB nHL.
2. Rescreen with Evoked Otoacoustic Emissions at levels, which will detect no greater than 35 dB hearing loss.

**B. Diagnostic Audiology Assessment**

Infants who do not pass the rescreen in one or both ears should receive a diagnostic audiology assessment to include but not limited to ABR testing. **Best practices dictate the use of a test battery in the evaluation of infants and young children in order to provide a thorough assessment and act as a cross-check system for an accurate diagnosis.** Infants should be tested without sedation to the extent possible. If sedation is required, the audiologist, the patient's physician and the patient's family should discuss the appropriate protocol and monitoring dictated by best practices.

The diagnostic assessment should include:

1. Comprehensive case history
2. Otoscopic evaluation.
3. Auditory Brainstem Response/Auditory Evoked Potential (ABR/AEP) evaluation:
  - a. Obtain ABR threshold in each ear using a click and/or high frequency (e.g. 4000 Hz) tone-burst stimuli. Thresholds should be determined in steps no greater than 10 dB, although larger step sizes may be appropriate early in the evaluation to initially bracket the threshold region.
  - b. Best practices suggest obtaining as much frequency specific information as possible. At minimum, in addition to click or high frequency stimuli, ABR thresholds in response to tone-burst stimuli centered at 1000 Hz or lower should be assessed.
  - c. The use of bone-conducted stimuli may be appropriate to aid in the differential diagnosis between a conductive or sensorineural hearing loss.
  - d. Analysis of ABR morphology and absolute and interpeak latencies in response to high intensity stimuli should be performed. Latencies should be compared to established clinic and published pediatric norms.

- e. At a higher intensity level the polarity of the air conduction click stimuli should be reversed on alternate runs to look for the cochlear microphonic. If the waveform reverses, further assessment for auditory neuropathy or other neurologic dysfunction of the auditory pathway should be completed. Insert earphones are recommended to avoid stimulus artifact overlapping with the cochlear microphonic.
3. Evoked otoacoustic emission evaluation in each ear (TEAOE and/or DPOAE) to further evaluate cochlear function. OAEs should be evaluated even when click ABR thresholds are normal since it is possible to obtain more frequency specific information.
4. Multi-component/high frequency (1000K Hz) immittance testing is the only appropriate immittance test for infants less than 6 months of age.
5. Behavioral audiometric testing should be incorporated in children older than 6 months of age and considered in children who have a suspected hearing loss for infants less than 6 months of age.
6. All parents should receive written information about hearing, speech, and language developmental milestones and information regarding risk indicators for progressive or late onset hearing loss. If at any time questions arise about the infant's hearing, speech, and/or language development, an infant should be referred for an age appropriate audiologic assessment.
7. Complete the "Neonatal Hearing Screening Follow-up Services Report" and mail, fax or email it to the Illinois Department of Public Health - Newborn Screening Program (attached).
8. For families who desire financial assistance, complete DSCC form 3.45 (Diagnostic Evaluation Authorization for Newborn Hearing Screening Program) to obtain reimbursement from DSCC for diagnostic evaluation. DSCC will pay for diagnostic testing if the child does not have Public Aid, KidCare or if private insurance does not cover the services. This form will also serve as a referral to DSCC. If hearing loss has been confirmed, DSCC staff will contact the family to invite them to apply for assistance / care coordination.

When a hearing loss is present and the family does not require financial assistance for the diagnostic evaluation a referral to DSCC should still be made for care coordination and potential financial services for hearing aids.

9. If hearing loss is diagnosed, refer the family to the appropriate Child and Family Connections office for early intervention services within 2 days of diagnosis. For a listing of Child and Family Connections offices search the internet using key words: Illinois Child and Family Connections (EI website: [www.dhs.state.il.us/ei/](http://www.dhs.state.il.us/ei/) then click on "Provider" then click on CFC Directory. Or the EI Provider Connections website: [www.wiu.edu/providerconnections](http://www.wiu.edu/providerconnections) and click on "Related Links." CFC comes up as an option to select.)

### **C. Confirmed Hearing Loss Follow-Up Guidelines**

The following should be completed prior to three (3) months of age:

1. If a bilateral/unilateral hearing loss of greater than 30 dB HL or greater than 30 dBnHL in either ear is detected, refer the infant to an otolaryngologist for an examination and medical clearance (See Recommended Guidelines for Medical Protocol for Infants With Confirmed Hearing Loss). Begin the process of fitting amplification, if appropriate.

Hearing loss is defined as an average of the frequencies 500 Hz, 1000 Hz, 2000 Hz and 4000 Hz or if the hearing level of any two (2) of these frequencies is greater than 30 dB HL or greater than 30 dBnHL.

2. If evidence of middle ear disease is present, refer the infant to an otolaryngologist for evaluation and treatment. Repeat the diagnostic evaluation following medical treatment.
3. If the ABR threshold is significantly elevated or the morphology is abnormal (e.g., prolonged latencies) and OAE results are normal, refer the infant to an otolaryngologist for evaluation of possible retrocochlear dysfunction (auditory neuropathy or auditory dys-synchrony.) Refer to local Child and Family Connections and initiate appropriate intervention.
4. If a unilateral hearing loss is detected with normal sensitivity in the “good” ear, provide the family with information regarding the effects of unilateral hearing loss on auditory, speech, and language skills, as well as the importance of hearing conservation for the “good” ear. Continued audiologic monitoring of the child’s hearing and speech and language development is recommended every six (6) months until the child is three (3) years of age. Also, consider amplification options and refer the infant to an otolaryngologist for evaluation and medical clearance, if appropriate.

### **D. Pediatric Amplification Guidelines**

The following should be completed no later than six months of age for infants with confirmed hearing loss.

1. Qualifications for Pediatric Hearing Aid Services
  - a. A Medical Clearance must be obtained from an otologist, a pediatric otolaryngologist, or a general otolaryngologist prior to hearing aid fitting.
  - b. An audiologist must complete the diagnostic audiology assessment recommended in the Audiologic Diagnostic Assessment Guidelines section of this document.
  - c. An audiologist is the professional most qualified to select and fit all forms of amplification for infants and children, including personal hearing aids, FM systems, cochlear implants and assistive listening devices.

- d. An audiologist must have the appropriate Illinois licensure in Audiology issued by the Department of Professional Regulation.
- e. It is preferred that an audiologist working with infants and children has experience in the management and fitting of amplification in infants and children with hearing loss. The audiologist must have the equipment necessary to complete the tests required for hearing aid selection and evaluation procedures.

## 2. Criteria for Determining Candidacy for Amplification

Infants should be fit to the “best estimate” audiogram based on the completion of the physiological assessment techniques outlined in the “Audiologic Diagnostic Assessment Guidelines” section of this document. Amplification decisions should be based on information obtained from on-going audiologic re-evaluation, performance of the infant in the home and/or educational environment, existence of other special needs, speech, language and auditory developmental milestones, and the family’s information. Criteria for determining candidacy should be based on best practice measures:

- a. Electrophysiologic measures of hearing sensitivity (i.e., click and frequency-specific auditory evoked potentials, Auditory Steady State Response - ASSR, OAE frequency-specific results),
- b. Ear specific behavioral thresholds obtained by standard audiometric techniques appropriate to the child’s developmental level (i.e., visual reinforcement audiometry, conditioned play audiometry, or standard audiometry).

A child is considered a candidate for amplification when a permanent, unilateral or bilateral hearing loss of greater than 30 dB HL (at any two frequencies 500-4000 Hz) for behavioral testing or when a hearing loss is greater than 30 dBnHL for click ABR threshold (2000-4000 Hz region).

## 3. Pre-selection: Physical Characteristics of Amplification

Note: With bilateral hearing loss, all amplification should be binaural unless contraindicated.

- a. Amplification options:
  - i. Behind-the-ear (BTE) aids are the most appropriate for infants and children. In-the-ear (ITE) hearing aids are not recommended for use with infants and young children due to the growth of the outer ear, problems with increased feedback, and safety issues.
  - ii. A bone conduction hearing aid or bone anchored hearing device may be appropriate if the hearing loss is conductive and BTE hearing aids cannot be worn due to medical or physical contraindications.

- iii. Body aids should only be used when BTE hearing aids cannot be fit due to medical or physical contraindications.
  - iv. A cochlear implant may be appropriate if the child has a bilateral sensorineural hearing loss, which meets current FDA guidelines, has received an appropriate trial period with binaural hearing aids, and exhibits minimal benefit from the hearing aids. In addition the child must have be enrolled and show intent for continued enrollment in an appropriate early intervention program.
  - v. An FM system coupled to the infant's personal hearing aids should be considered.
  - vi. Hearing aids with digital processing, multiple channels, multiple memories and/or directional or dual port microphones should be considered for their flexibility, improvement in signal-to-noise ratio, and other features.
- b. Amplification requirements for FM system and assistive device compatibility:
    - i. Direct audio-input capabilities (DAI).
    - ii. A telecoil
    - iii. A microphone-telecoil switching option (M - T switch)
  - c. Retention devices can be used to aid in full-time use.
    - i. "Huggies"
    - ii. "Crittter" or retention clips, with appropriate safety warnings
    - iii. Two sided tapes / wig tape
  - d. Earmold lubricants such as "Otoease" or "Otofirm" to help temporarily reduce feedback.
4. Hearing Aid Selection and Verification
- a. The pediatric hearing aid should be selected and fitted according to procedures that are especially designed for pediatrics accounting for the individual / age appropriate ear acoustics, as well as degree, configuration and type of hearing impairment (e.g., DSL methodology). The fitting procedure should include a prescriptive technique, which estimates target responses appropriate for the child and characteristics of the amplification system (linear vs. non-linear, analog vs. digital). Best practices suggest the verification method include real-ear-to coupler-difference (RECD) measures, real-ear saturation response (RESR) and target maximum output values. The child's ear/ ear acoustics, ear mold, and amplification system should be included in the measurements whenever possible.
- Ear mold requirements:
- 1) Should be a soft material
  - 2) Should be replaced when feedback occurs at recommended settings or when retention becomes a problem

Amplification safety requirements:

- 1) Tamper resistant battery doors
- 2) Volume control covers or ability to disable volume control

It is recommended that families obtain a maintenance kit that includes:

- 1) Dry aid kit
- 2) Battery tester
- 3) Listening tube/stethoscope
- 4) Extra batteries

5. Validation of aided auditory function should be on-going and include:
  - a. Probe microphone measurements to assess output of hearing aid at the tympanic membrane.
  - b. Audiologic assessment directly measuring the child's performance including aided sound field responses to speech and frequency specific stimuli.
  - c. Functional auditory skill assessment obtained by an audiologist, hearing itinerant and/or early interventionist.
  - d. Speech, communication, and language skill assessment obtained by the early interventionist and/or a speech language pathologist.
  - e. Parent input as well as input from other professionals involved with the child.
6. Counseling and Follow-Up:
  - a. Information about all appropriate amplification options should be given to the parents prior to final purchase of amplification.
  - b. Parents and other family members or individuals that will assist in the insertion of and maintenance of the amplification system should receive orientation and ongoing support.
  - c. Families should be provided with contact information regarding resources such as Early Intervention, DSCC, and parent support groups.
7. Suggested frequency of audiologic re-evaluation/follow-up:
  - a. At least every three (3) months during the first two (2) years of amplification use.
  - b. Every three (3) to six (6) months after the first two (2) years of amplification use.

8. Audiologic re-evaluation and/or follow-up includes:
  - a. Behavioral audiometric evaluations including air and bone conduction (obtain separate ear information as soon as possible);
  - b. Immittance measurements to monitor middle ear function;
  - c. Adjustment of the amplification system based on updated audiometric information and child growth;
  - d. Electroacoustic evaluations of the hearing aids;
  - e. Listening checks of the hearing aids;
  - f. Evaluation of ear mold fit;
  - g. Probe microphone measurements; measurement of the RECD should be completed and adjustments should be made as the child grows and receives new earmolds
  - h. Functional gain measurements to document the development of auditory skills.
9. The infant/young child should be enrolled in an Early Intervention Program which includes:
  - a. Home visits
  - b. A professional with extensive and in-depth knowledge of, and experience with, children with varying degrees of hearing loss, their families and all the attendant issues

**DISCLAIMER: Early Intervention, Public Aid or DSCC may not pay for all services or amplification options.**

**Please refer to the following for more detailed guidance:**

Joint Committee on Infant Hearing 2000 Position Statement. Available from: <http://www.jcih.org/posstatemts.htm>

American Academy of Audiology. (2003, October) Pediatric Amplification Protocol. Available from: <http://www.audiology.org>

American Speech-Language-Hearing Association. (2004) Guidelines for the Audiologic Assessment of Children From Birth to 5 Years of Age. Available from: <http://www.asha.org/public/hearing/testing/assess.htm>