Kansas
Department of Health and Environment
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KANSAS GUIDELINES FOR INFANT AUDIOLOGIC ASSESSMENT

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SoundBeginnings

KANSAS GUIDELINES FOR INFANT AUDIOLOGIC ASSESSMENT

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CHAPTER

SoundBeginnings

KANSAS GUIDELINES FOR INFANT AUDIOLOGIC ASSESSMENT

These guidelines were developed **to facilitate the confirmation of hearing loss by three (3) months of age.** Health and Human Services' Healthy People 2010 includes the following goal for infants: *to confirm hearing loss by three months of age with appropriate intervention no later than six months of age.* With existing technology and expertise, this goal can be met routinely. The purpose of these guidelines is to identify the essential components of an audiologic assessment. The guidelines are not a description of how to carry out an audiologic assessment.

Infants are candidates for audiologic assessment when they have not passed an initial hearing screening in the birthing facility using physiologic measures and an outpatient screening using physiologic measures within 2-4 weeks of discharge from the birthing facility. Procedures and protocols for the initial and outpatient hearing screenings can be found in the SoundBeginnings Kansas Newborn Hearing Screening Guidelines[1].

I. INTRODUCTION

The primary purpose of an audiologic assessment is the confirmation of hearing loss. When a hearing loss is confirmed, a description of the severity, type, and configuration may assist in the subsequent medical diagnosis and the determination of etiology.

Assumptions Underlying Audiologic Assessment of Infants:

- Hearing loss can be confirmed within the first months of life.
- A battery of tests is needed to confirm and describe hearing loss.
- Results of audiologic assessment are necessary to plan appropriate intervention strategies.
- Audiologic assessment of infants is an ongoing process. Behavioral threshold information may be obtained as early as six (6) months of age using visual reinforcement audiometry (VRA) procedures with insert earphones.

II. MINIMUM REQUIREMENTS FOR PROVIDERS OF INFANT AUDIOLOGIC ASSESSMENT

Equipment

The judgment regarding the ability to provide infant audiologic assessment is equipment-driven; currently there is no certification for "pediatric audiology" in Kansas. Families prefer to go to one site rather than multiple sites for their infant's audiologic assessment. Facilities should have access to the equipment identified below:

- Auditory brainstem response (ABR) test equipment capable of various stimulus levels, stimulus types (clicks and tone bursts at audiometric frequencies), and transducers (air conduction insert earphones and bone conduction oscillator);
- Evoked otoacoustic emissions (OAE) test equipment, either transient-evoked OAE (TEOAE) and/or distortion product OAE (DPOAE) capable of a variety of test parameters, especially adjustment of stimulus levels; and
- Middle ear acoustic immittance analyzer for tympanometry and acoustic reflex threshold measurement, preferably with multi-frequency probe tones.

Additional equipment needed for on-going assessment via behavioral audiometry:

- Sound-treated audiometric test booth;
- Audiometer; insert earphones;
- Sound-field testing capability; and
- Visual reinforcement equipment.

Practitioner Qualification

Accurate infant audiologic assessment necessitates appropriate practitioner training and experience using the equipment (listed above) and the protocols (Chapter III). In the absence of a specialized certification, practitioners are expected to follow their professional code of ethics regarding their capability of providing such services. **If the practitioner does not have the expertise and equipment to follow these guidelines, the infant and family should be referred to a professional equipped for and qualified in infant audiologic assessment.**

Audiologists who provide the audiologic assessment must hold a current license in Audiology (*e.g.*, in Kansas, through the Health Occupations Credentialing Program, Kansas Department of Health and Environment).

III. PROTOCOL FOR INFANT AUDIOLOGIC ASSESSMENT

The test battery for audiologic assessment of infants includes the following procedures:

Child-Family History
The Joint Committee on Infant Hearing *Year 2000 Position Statement* outlined specific risk indicators for hearing loss in infants. Child-family history is to include the documentation concerning these risk indicators. (Appendix A)

Otoscopic Inspection
An otoscopic examination of the infant's outer ears should be performed to ensure that the ear canals are clear enough to proceed with further testing.

Evoked Otoacoustic Emissions (OAEs) Assessment
Transient-evoked OAE (TEOAE) or distortion product OAE (DPOAE) are the two types of OAEs.

Purpose: OAEs reflect normal cochlear function at the level of the outer hair cells.

Interpretation: The interpretation that follows assumes that appropriate stimuli were used, testing was conducted in a quiet place, and the infant was quiet or sleeping.

What normal means: Normal sensitivity may be inferred for all frequencies at which OAEs are present.

What the absence of OAEs means: The absence of OAEs may indicate a sensory hearing loss greater than 20-30 dB HL and/or middle ear dysfunction.

What partly normal means: The presence of OAEs at some frequencies but not at others **may** help to estimate audiometric configuration.

Auditory Brainstem Response (ABR) Assessment
ABR Threshold: An ABR threshold is obtained to determine severity, configuration and type of hearing of loss.

- ABR threshold for click stimuli will identify the overall amount of hearing loss. A 10 dB step-size may be sufficient.
- Threshold for tone bursts provides more specific information about severity of loss at various frequencies. Threshold responses to tone bursts of 500 Hz and one high frequency (2, 3, and/or 4 kHz) minimally will help to estimate the configuration of loss.

- Bone conducted click ABR measures are essential for defining the type of hearing loss in infants. If air conduction click threshold is elevated, bone conduction click ABR threshold should be obtained. Air-bone gaps of 20 dB or more should be considered significant.

Integrity of auditory pathway: To assess the integrity of the auditory neural pathway:

- High level (70-80 dB nHL) click ABR to:
  - Evaluate absolute latencies for waves I, III, V
  - Evaluate interpeak latencies for waves I to III, III to V and I to V
  - Evaluate waveform morphology
- Compare the above with age appropriate norms (Hall, 1992; Hood, 1998)
- If no neural response is identified, compare recordings obtained to rarefaction and condensation clicks presented at 80 to 90 dB nHL using a fast click rate (>30/second). If a response (*e.g.*, cochlear microphonic) is observed, an auditory neuropathy may be present.

Middle Ear Measures

Middle ear acoustic immittance measures may help to further define type of hearing loss. Tympanometry assesses middle ear function. Acoustic reflex thresholds may help predict severity of loss. With infants under approximately four (4) months of age, the immittance battery should be interpreted cautiously. Multi-component/multi-frequency testing is suggested. For infants older than four months, the immittance battery becomes more reliable and valid.

Behavioral Response

The infant's behavioral response to sound, or the lack of it, should be obtained via parent report or direct observation.

IV. INTERPRETATION OF RESULTS

- If OAEs are present throughout the frequency range from 1000 to 4000 Hz, peripheral hearing loss sufficient to interfere with speech and language development can be ruled out. If there are no risk indicators for neurologic auditory problems, assessment need not include ABR testing.
- If click ABR threshold and OAEs are normal, testing may be terminated. Given a normal click ABR threshold, normal sensitivity may be inferred for all frequencies at which OAEs are present.
- Hearing loss is confirmed when ABR thresholds are elevated or absent.

- Infants who have passed ABR but who do not pass OAEs should receive a medical referral to their primary care physician to rule out external and/or middle ear pathology. A repeat audiologic assessment should be recommended.

In all instances, parents should be given information about typical language, speech and listening development, and progressive and delayed-onset hearing loss.

If the diagnostic battery results are normal, infants who are at risk for delayed-onset hearing loss (Joint Committee on Infant Hearing Risk Indicators, Appendix A) should receive audiologic monitoring and follow-up using age-appropriate audiologic screening or test procedures at six-month intervals until age three years.

V. FOLLOW-UP RECOMMENDATIONS

Based on the Healthy People 2010 goal, the following should be completed by three months of age for infants **with confirmed hearing loss**:

- Review results of the audiologic assessment, implications of the audiologic findings, and recommendations for intervention with the parents including:

  Article Information regarding the need for medical evaluation and diagnosis;

  Article Amplification options;

  Article Information regarding the importance of early intervention;

  Article The availability and importance of parent-to-parent support;

  Article Information and referral for funding assistance if necessary; and

  Article A Kansas Resource Guide for Families with Infants and Toddlers who are Deaf/Hard of Hearing.[2]

- In consultation with the infant's primary care physician, refer the infant/family to an ENT (Ear, Nose, and Throat) physician for medical assessment.

- As appropriate, discuss additional specialty evaluations (*e.g.*, genetics, ophthalmology, child development) with the parents and the infant's primary care physician.

- Initiate the amplification process if appropriate and assure that medical clearance for amplification has been obtained.

- Refer the family to the community's Infant-Toddler Services Coordinator for specific information regarding early intervention options and local resources. If not part of the Infant-Toddler Services referral, contact the educational audiologist in the child's school district.

- Complete the Audiologic Assessment Report with copies as noted. (See "Audiologic Assessment Report" Form, Appendix B)

The following should be completed immediately after assessment for infants **with hearing within normal limits:**

- Review results of the audiologic assessment, implications of the audiologic findings, and recommendations with the parents including:

  - Information about risk indicators for progressive and delayed-onset hearing loss, and

  - Information about typical speech, language and listening developmental milestones.

- Complete the "Audiologic Assessment Report" with copies as noted. (See "Audiologic Assessment Report" Form, Appendix B)

VI. REPORTING DATA

For Confirmed Hearing Loss:

Data sets have been determined by the Centers of Disease Control and Prevention (CDC) in collaboration with the Directors of Speech and Hearing Programs in State Health and Welfare Agencies. Additions for clarification and state purposes have been made for SoundBeginnings. The following definitions apply:

- Hearing loss: Confirmed by a battery of tests to be greater than 20 dB HL.

- Congenital hearing loss: present at birth.

- Permanent congenital hearing loss: Permanent hearing loss includes both sensorineural and non-transient conductive hearing loss (*e.g.*, due to craniofacial anomalies, ossicular fixation, etc.).

- Transient hearing loss: not permanent (*e.g.*, due to middle ear effusion).

- Acquired hearing loss: hearing loss known to have occurred after birth (*e.g.*, from meningitis).

- Laterality of hearing loss: either unilateral or bilateral. Degree of unilateral

hearing loss is to be reported according to the poorer ear. Degree of bilateral hearing loss is to be reported according to the better ear.

- Degree of hearing loss: determined by the average hearing level for frequency information available in the 500-2000 Hz region. Results of 4000 Hz should be reported if greater than 20dB HL.

With parental consent, the following data, using the definitions described above, should be reported via fax, mail, or secure internet within one month of testing to KDHE using the "Audiologic Assessment Report" Form (Appendix B):

Article Child's name and identification data;

Article Date of confirmation of hearing loss;

Article Child's chronological age when hearing loss confirmed;

Article Laterality of hearing loss (bilateral; unilateral);

Article Type of hearing loss (sensorineural; mixed; conductive);

Article Degree of hearing loss (in dB HL) (average of 500, 1000 and 2000 Hz):

Article	Mild hearing loss	21 to 40
Article	Moderate hearing loss	41 to 70
Article	Severe hearing loss	71 to 90
Article	Profound hearing loss	91+

Article Test results at 4000 Hz if greater than 20 dB HL (*i.e.*, 21+ dB HL).

Additional testing may be required to complete the above data sets for any child. Report the follow-up data to KDHE when acquired. (Use the "Audiologic Assessment Report" Form, Appendix B.)

For Hearing Within Normal Limits:

The following data should be reported via fax, mail, or secure internet immediately after assessment to KDHE using the "Audiologic Assessment Report" Form (Appendix B):

Article Child's name and identification data; and

Article Date of confirmation that hearing is within normal limits.

VII. TRANSITION TO EARLY INTERVENTION

The outcomes of a successful early hearing detection and intervention (EHDI) program are that a) all infants with hearing loss are identified as soon as possible, preferably within three months of age; and b) infants with confirmed hearing loss begin receiving early intervention services, as appropriate for the child and family, as soon as possible and preferably by six months of age.

The audiologist should provide a list of facilities that can provide early intervention services for the infant and family. The audiologist's follow-up audiologic care for an infant with a confirmed hearing loss should include confirming that other early intervention services are meeting the needs of the child and family. The audiologist is encouraged to participate in planning these services, such as being an active team member in the development and ongoing review of the child's Individualized Family Service Plan (IFSP).

A Kansas Resource Guide for Families with Infants and Toddlers who are Deaf/Hard of Hearing has been developed for families whose infant has a confirmed hearing loss.
Additional information can be obtained by contacting:

The Make a Difference Information Network (1-800-332-6262 V/TTY)
SoundBeginnings at KDHE (1-800-332-6262 V/TTY)
Infant-Toddler Services at KDHE (1-800-332-6262 V/TTY)
The Kansas Commission for the Deaf and Hard of Hearing (1-800-432-0698 V/TTY)
The community's local Infant-Toddler Early Intervention Network
The local Health Department

SELECTED REFERENCES

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Hood, L.J. (1998). *Clinical Applications of the Auditory Brainstem Response*. San Diego: Singular Publishing Group, Inc.

Joint Committee on Infant Hearing (2000). Year 2000 Position Statement: Principles and Guidelines for Early Hearing Detection and Intervention Programs. *American Journal of Audiology, 9,* 9-29.

Roizen, N.J & Diefendorf, A.O. (Eds) (1999). Hearing Loss in Children. *Pediatric Clinics of North America. 46*(1).

SELECTED WEB SITES

American Speech-Language-Hearing Association

www.audiology.org
American Academy of Audiology

www.colorado.edu/slhs/mdnc
Marion Downs National Center for Infant Hearing

www.infanthearing.org
National Center for Hearing Assessment and Management

www.audiospeech.ubc.ca/haplab/haplab.htm
Human Auditory Physiology Laboratory

www.nih/gov/nidcd
National Institute on Deafness and Other Communication Disorders

www.kdhe.state.ks.us/bcyf/cds/newborn_hearing.html
KDHE SoundBeginnings Newborn Hearing Screening Program

APPENDIX A
RISK INDICATORS FOR HEARING LOSS

From the Joint Committee on Infant Hearing *Year 2000 Position Statement*

Risk Indicators: Birth through age 28 days where universal newborn hearing screening is not mandated

This information should be used by all primary health care providers (*e.g.*, physicians, local health department personnel) to assess risk status for hearing loss during the well-baby visit.

- an illness or condition requiring admission of 48 hours or greater to a NICU
- stigmata or other findings associated with a syndrome known to include a sensorineural and/or conductive hearing loss
- family history of permanent childhood sensorineural hearing loss
- craniofacial anomalies, including those with morphological abnormalities of the pinna and ear canal
- in-utero infection such as cytomegalovirus (CMV), herpes, toxoplasmosis, or rubella

Risk Indicators: For use with infants (29 days through 2 years) when the newborn hearing screening test was passed

Passing the newborn hearing screening does not mean that the child will not develop or acquire a hearing loss. The presence of any of these risk indicators for progressive or delayed-onset sensorineural hearing loss and/or conductive hearing loss denotes the need to provide audiologic monitoring every 6 months until age 3 years.

- parental or caregiver concern regarding hearing, speech, language, and or developmental delay
- family history of permanent childhood hearing loss
- stigmata or other findings associated with a syndrome known to include a sensorineural or conductive hearing loss or eustachian tube dysfunction
- postnatal infections associated with sensorineural hearing loss including bacterial meningitis
- in-utero infections such as cytomegalovirus, herpes, rubella, syphilis, and toxoplasmosis
- neonatal indicators - specifically hyperbilirubinemia at a serum level requiring exchange transfusion, persistent pulmonary hypertension of the newborn associated with mechanical ventilation, and conditions requiring the use of extracorporeal membrane oxygenation (ECMO)
- syndromes associated with progressive hearing loss such as neurofibromatosis, osteopetrosis, and Usher's syndrome
- neurodegenerative disorders, such as Hunter syndrome, or sensory motor neuropathies, such as Friedreich's ataxia and Charcot-Marie-Tooth syndrome
- head trauma
- recurrent or persistent otitis media with effusion for at least 3 months

APPENDIX B

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AUDIOLOGIC ASSESSMENT REPORT FORM

Infant's name _____
First Middle Last Generation

Infant's date of birth _____/_____/_____ State of Birth _____ County of Birth _____
Month Day Year

Mother's Maiden name _____
First Middle Last Generation

Parent/Guardian name _____
First Middle Last Generation

Home (or mailing) address _____

_____
City State Zip

Phone Number: Home (_____)_____ Work (_____)_____

Infant's Primary Care Physician _____

Name of infant's birth facility (hospital): _____

Date of confirmation of **hearing within normal limits**: _____
Month Day Year

OR

Date **type of hearing loss** was confirmed: _____
Month Day Year

Infant's chronological age in months: _____

Type of hearing loss: _____sensorineural _____mixed _____conductive

Hearing loss: _____permanent _____transient
_____congenital _____acquired

Laterality of hearing loss: _____unilateral hearing loss _____bilateral hearing loss

Date hearing loss was confirmed: _____
Month Day Year

Degree of hearing loss (average of 500, 1000 and 2000 Hz): 4000 Hz

Right ear: _____ mild (21-40 dB) _____ moderate (41-70 dB) _____ severe (71-90 dB) _____ profound (91+ dB) | _____

Left ear: _____ mild (21-40 dB) _____ moderate (41-70 dB) _____ severe (71-90 dB) _____ profound (91+ dB) | _____

Audiologist completing the audiologic assessment: _____
First Middle Initial Last Credential

Facility Name _____

Fax or mail a copy to:

1. Family
2. Newborn's primary care physician
3. SoundBeginnings KDHE (fax: 785-291-3493)