



— EARLY HEARING DETECTION AND INTERVENTION —

Guidelines for the Organization and Administration of Universal Newborn Hearing Screening Programs in the Well-Baby Nursery

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INTRODUCTION

This document provides recommended guidelines for newborn hearing screening programs for infants in the well-baby nursery. For hearing screening guidelines in the special care nursery and the neonatal intensive care unit (NICU), please see the [Guidelines for the Organization and Administration of Universal Newborn Hearing Screening Programs in the Special Care Nursery and NICU](#)¹. To help ensure that every Minnesota newborn is screened for hearing loss, state law ([Minnesota Statute 144.966](#)²) requires that a hearing screen be performed on all newborns prior to hospital discharge.

Because of the importance of early identification of hearing loss, all screening, follow-up, and tracking procedures must, at a minimum, be consistent with national Early Hearing Detection and Intervention (EHDI) guidelines and current Minnesota Department of Health (MDH) Newborn Screening Program recommendations. Additional resources are available from the Newborn Screening Program to assist hospitals and hearing screeners with specific issues of program development and management such as training, supervision, equipment options, and quality assurance issues.

BACKGROUND

The goal of an EHDI Program is to promote communication from birth for all children through the early identification of hearing loss and the initiation of appropriate intervention services. Newborn hearing screening and follow-up plays a critical role in the EHDI process by identifying newborns who are at risk for hearing loss and connecting them with diagnostic, support, and intervention services. Without EHDI, infants with hearing loss may experience delays in a variety of developmental areas, including vocabulary, articulation, intelligibility, social adjustments, and behavior.

National standards specify that screening should be complete as soon as possible but at no later than one month of age; hearing loss should be clinically diagnosed as soon as possible but at no later than three months of age; and intervention should be initiated as soon as possible but at no later than six months of age. With prompt referral and follow-up, Minnesota children have the opportunity to receive life-changing care and services even earlier than national guidelines prescribe.

Early identification and intervention can substantially reduce or even eliminate entirely the developmental

delays that too often stem from a late diagnosis of hearing loss. Studies have shown that if hearing loss is identified before three months of age and intervention is initiated at no later than six months of age, children perform as much as 20 to 40 percent higher on school-related measures than children with hearing loss that was not identified early. For many children with hearing loss, early identification and intervention enables them to perform on language assessments at the same level as their hearing peers.

CHILD- AND FAMILY-CENTERED COMMUNICATION

Minnesota statute requires hospitals to present information to parents prior to performing the hearing screen that covers the following topics:

- Potential risks and effects of hearing loss
- Benefits of early detection and intervention
- Nature of the screening procedure
- Applicable costs of screening procedure
- Parental options in regards to screening, storage, and use of hearing test results



Best practice includes providing the following information to parents along with the results of their infant's screen:

- Prevalence of and risk factors for permanent childhood hearing loss (see [Appendix A³](#))
- Possibility of late or progressive onset of hearing loss, including otitis media
- Developmental milestones for speech, language, and hearing (see [Appendix B⁴](#))

PERSONNEL PERFORMING HEARING SCREENING

Screening may be performed by trained personnel, including the following:

- Audiologists, audiological technicians/assistants
- Nurses
- Nursing assistants
- Other trained medical personnel

Although licensed audiologists do not need to conduct the actual hearing screening, audiologists are uniquely qualified to develop and implement all aspects of an EHDI program. Hospital screening programs benefit from direct access to audiological consultation to address screening criteria, quality assurance, follow-up assessment, and intervention services.

Training Qualified Screeners

Ensuring all screeners are competent is critical for every screening program. Training is an ongoing process and should be based on current best practice procedures as reported in professional literature and recommended by the Newborn Screening Program. Training typically includes three phases: initial training and demonstration of competency and skills, ongoing quality assurance, and refresher training.

The initial training may need to be provided using multiple resources and over a number of days. Initial training and demonstration of competency and skills shall include the following, at a minimum:



✓ Demonstration of competency and skills to perform hearing screening should be completed annually and documented appropriately:

- Measure the trainee’s competency based on performance in the nursery environment using the [Performance Based Criterion Checklist](#)⁵ (see Appendix C) or a similar performance evaluation tool

Ongoing quality assurance of screeners shall include the following, at a minimum:

- ✓ Performing periodic observations of each screener in the nursery environment by a skilled professional such as an audiologist and/or program manager
- ✓ Reviewing of hearing screening data (e.g., number of screens and number of refers) by an audiologist and/or program manager for each screener to determine their effectiveness

Refresher training should be completed annually, with individual trainings available as needed. Refresher trainings should measure the trainee’s competency based on performance in the nursery environment using the [Performance Based Criterion Checklist](#)⁵ (see Appendix C) or a similar performance evaluation tool.

Resources for training may include a combination of experienced screening program managers; local, licensed clinical and educational audiologists; MDH audiologists; hearing screening equipment manufacturers; national online training modules such as the [Newborn Hearing Screening Training Curriculum](#)⁶ offered by the National Center for Hearing Assessment and Management (NCHAM); or other online resources as recommended by the Newborn Screening Program. It is not a requirement that all nursery personnel be trained to perform newborn hearing screening. Each facility may select appropriate staff to carry out the hearing screening and related duties.

HEARING SCREENING EQUIPMENT

Screening programs must use objective physiological screening methods such as automated auditory brainstem response (AABR) or otoacoustic emissions (OAE). OAEs can be either distortion product (DPOAE) or transient evoked (TEOAE). AABR and OAE do not require a behavioral response from the infant and have proven to be effective screening measures. All hearing screening equipment must meet technical specifications, calibration standards, and hospital safety standards. A quality screening program benefits from incorporating

✓ Completion of required hospital orientation, including:

- Infection control policies and procedures
- Hospital infant security procedures
- Cultural sensitivity

✓ Completion of instructional training for newborn hearing screening:

- Benefits of early detection of hearing loss
- Hearing Screening equipment use and care instruction
- Knowledge of hospital or birth facility hearing screening policy and procedures
- Documentation of screening results
- Communicating screening results to the infant’s parent/guardian and appropriate medical staff personnel

new and improved evidence-based technologies and procedures as they become available.

Stimulus Parameters

TOAEs should be measured in response to a click at approximately 80 dB SPL (78-82 dB SPL). DPOAEs should be measured in response to a series of paired tones (f1 and f2), with a ratio of 1.22 at a moderate level, where $L1/L2 = 65/55$ dB SPL.

Newborn screening ABRs typically are evoked using click stimuli at 30 to 35 dB nHL at a moderate stimulus rate. ***Non-automated ABR screening is NOT recommended for newborn hearing screening programs in hospital nurseries due to issues of potential operator error and significant time/cost issues.***

Default stimulus parameters of both OAE and ABR equipment should be reviewed by skilled professionals such as a consulting audiologist or MDH audiologist to ensure they are appropriately set or to adjust them to be in accordance with clinically accepted national practices.

Pass/Refer Criteria

Pass/refer criteria need to be selected and monitored carefully to maximize sensitivity and specificity. In most cases, pass/refer criteria is already preset into the hearing screening equipment by the manufacturer. When hearing screens are administered, a pass or refer result should automatically appear. There should be no interpretation of results by the hearing screener at the time of the screen. Pass/refer criteria should be reviewed regularly by a consulting audiologist or MDH audiologist and should be in accordance with clinically accepted national practices.

OAE

Typical passing criteria for TOAEs include overall reproducibility greater than 50 percent, at least 50 low noise samples collected, stimulus stability of 75 percent or greater, and responses present at least 6 dB above noise floor for at least three of the five test frequencies, with 4000 Hz a mandatory passing frequency.



Typical passing criteria for DPOAEs requires absolute response amplitude of at least -6 dB and responses at least 6 dB above the noise floor at three or more of the test frequency bands, with the 4000Hz region a mandatory passing frequency.

AABR

Typical passing criteria requires repeatable wave V evoked responses to clicks at ≤ 35 dB nHL for each ear, within specific latency parameters.

HEARING SCREENING PROTOCOL

The following screening protocols have been developed by local experts and are based on nationally accepted guidelines put forth by the Joint Committee on Infant Hearing (JCIH). They have been tailored to fit Minnesota's system of care to help ensure that every infant receives quality screening and follow-up throughout the state. See Appendix D for details about the [Hearing Screening Result and Follow-up Process](#)⁷ and Appendix E for a sample [Newborn Hearing Screening Flowchart for the Well-Baby Nursery](#)⁸ that outlines this process.

Inpatient Hearing Screening

The initial hearing screen is the first screen performed on a newborn; preferably at least 12 hours after birth. The screen may be performed sooner if needed; however, a higher referral rate may occur due to residual birthing debris in the ear canal. Infants who refer/fail the initial hearing screen should be rescreened prior to discharge.

If an infant does not pass the rescreen in one or both ears, an appointment for outpatient rescreening or audiological evaluation should be scheduled for the family prior to discharge.

Inpatient hearing screening should consist of **no more than two attempts** using the same screening technique on each ear—assuming the infant is calm and quiet and there are neither equipment problems nor environmental interference during either test. The likelihood of obtaining a pass by chance alone is increased when screening is performed repeatedly, which means a child with a hearing loss may go undetected and suffer developmental consequences.

Both ears must pass a single screening to be considered as an overall passing result. Combining passing results in opposite ears on successive screens does not make a passing result.



Follow-up/Documentation of Inpatient Hearing Screening

Minnesota statute requires the following:

- Screening results must be documented in the infant's medical record.
- Screening results must be communicated to the infant's parent(s) both verbally and in writing.
- Screening results must be communicated in writing to the infant's primary care provider within 10 days of the final screen and be available at the first clinic visit, whichever comes first.
- Screening results must be reported to Newborn Screening Program staff within 10 days of the final screen.

Minnesota best practice recommends the following:

- For infants with refer results, an outpatient follow-up appointment for hearing rescreening or pediatric audiological evaluation should be scheduled before the infant is discharged from the hospital. The infant's primary care provider and Newborn Screening Program staff should be promptly notified of the date/location of the follow-up rescreen or diagnostic appointment to help facilitate timely services.
- Families of infants who receive refer results on newborn hearing screening should be provided with information about the importance of follow-up.

Outpatient Rescreening

Outpatient rescreening is an option for programs who wish to reduce referrals to specialty providers. If the infant does not pass the *final* inpatient hearing screening in one or both ears, he or she may have a rescreen completed at no later than one month of age. Both ears must pass a single screening to be considered an overall passing result. Combining passing results in opposite ears on successive screens *does not* make a passing result.

National guidelines recommend allowing one to two weeks from the time of the initial screen to allow any transient ear conditions to resolve before rescreening. Best practice recommends that the following be included as part of the rescreen:

- Take a complete history, including neonatal history, family history of childhood hearing loss, and the parents' observations of their infant's response to sounds at home.
- Use either AABR or OAE, regardless of which technology was used for the inpatient hearing screening. Note, however, that there is a slight risk of missing neural hearing loss if an infant is rescreened using OAE after receiving a refer result using AABR.
- Rescreen both ears even if only one ear failed the inpatient hearing screening.
- The rescreen should consist of a maximum of two attempts on each ear, assuming that the infant is calm and quiet and there are neither equipment problems nor environmental interference during either attempt.

Follow-up/Documentation of Outpatient Rescreening

Minnesota statute requires the following:

- Outpatient rescreening results must be documented in the infant's medical record.
- Outpatient rescreening results must be communicated to the infant's parent(s) both verbally and in writing.
- Outpatient rescreening results must be communicated to the infant's primary care provider in writing within 10 days.
- Outpatient rescreening results must be reported to Newborn Screening Program staff within 10 days.

Minnesota best practice recommends the following:

- For infants who refer on outpatient rescreening, a diagnostic audiology appointment should be scheduled for the family before they leave. The primary care provider and Newborn Screening Program staff should be promptly notified of the date/time of the diagnostic audiology appointment to help facilitate timely services.
- Families of infants who refer on the outpatient rescreening should be provided information about the importance of follow-up. Review of data from newborns screened in Minnesota has demonstrated that the rate of confirmed hearing loss, after infants refer on initial outpatient rescreen, has been between 30 and 50 percent.

Transferred Infants

If an infant is going to be transferred to a different hospital/unit, conduct the newborn hearing screening before transfer, if possible, and communicate the results with the receiving facility or unit. If newborn hearing screening cannot occur before the transfer, alert the Newborn Screening Program of the infant's transfer using the [Hearing Screening Form for Transferred Infants](#)⁹ (see Appendix F) and provide this form to the receiving facility. The hospital that discharges the infant home is responsible for screening the infant's hearing and reporting the results to the family, primary care provider, and the Newborn Screening Program.

Out-of-Hospital Births

[Minnesota Statute 144.966](#)¹ requires all health professionals attending a birth outside of a hospital to provide information (orally and in writing) to parents about the importance of hearing screening and where they can have their infant screened.

For infants born outside of a birthing hospital (e.g., at home or a non-hospital birth center), there are several options available to ensure that newborn hearing screening is performed. There are many midwives throughout the state of Minnesota with access to screening equipment who have been trained by Newborn Screening Program audiologists to perform newborn hearing screening. The Minnesota Council of Professional Midwives (MCCPM), for example, has distributed hearing screening equipment to trained members practicing across the state to screen newborns for hearing loss. MCCPM members also offer newborn hearing screening to families who are not clients in their practice. Midwives who do not have access to hearing screening equipment are encouraged to educate parents

about newborn hearing screening and set up a hearing screening appointment with another provider before the infant is one month of age. See the [Guidelines for the Organization and Administration of Universal Newborn Hearing Screening Programs for Out-of-Hospital Births](#)¹⁰ for additional information.

Readmitted Infants

Infants readmitted to the hospital during the first month of life with conditions associated with potential hearing loss (e.g., hyperbilirubinemia, meningitis, sepsis) need to have a hearing screen repeated prior to discharge. Because of the high incidence of neural hearing loss associated with significantly elevated bilirubin, these infants should be referred for audiological assessment to include ABR measures.

TIMELY CASE MANAGEMENT

The purpose of a hearing screen is to identify infants who need further testing. It is important to remember that a hearing screen is not a diagnostic tool.

EHDI is part of a continuum of care that progresses from parental education, to screening, to assessment, to amplification (if elected), to educational intervention. Many professionals—working in different entities and at different phases of the EHDI process—need to work together and clearly communicate follow-up steps in order to provide quality care and ensure early diagnosis of hearing loss. Hospital screening staff plays a critical role in this process. For infants who do not pass newborn hearing screening and subsequent outpatient rescreening, assessment referrals must be made to audiologists with expertise in pediatric physiological and behavioral assessment and management. See the [Minnesota EHDI website](#)¹¹ to locate providers that offer pediatric diagnostic assessments and habilitation services in Minnesota.

The nationally recommended timeline for hearing screening and follow-up is commonly referred to as the 1-3-6 plan. The timeline includes the following benchmarks:

- Screening is complete at no later than one month of age
- Diagnostic audiological assessment is complete at no later than three months of age
- Amplification (if elected) and/or intervention services are initiated at no later than six months of age

With prompt referral and follow-up, Minnesota children can receive appropriate care and services even earlier than the nationally recommended timeline.

Without an adequate follow-up plan, even the best EHDI program is ineffective. Please refer to the current [Guidelines for Infant Audiologic Assessment](#)¹² and [Guidelines for Pediatric Amplification](#)¹³ for additional information on recommended best practices.

Follow-up for Middle Ear Effusion

Although persistent middle ear effusion requires medical referral, which may delay the evaluation timeline several weeks, diagnostic audiological evaluation must not be repeatedly postponed solely due to middle ear dysfunction and should still be complete before three months of age. The information from a diagnostic audiological evaluation is valuable both in determining the extent of the effect of the middle ear condition on the infant's hearing and in identifying whether an underlying sensorineural hearing loss exists, thereby impacting the course of both medical and educational intervention.



Follow-up for Infants with Positive Risk Factors (JCIH 2007 clarification document)

The timing and number of hearing re-evaluations for children with risk factors should be individualized depending on the relative likelihood of a subsequent delayed-onset hearing loss. Infants who pass the neonatal screening—but have a risk factor—should have at least one diagnostic audiology assessment by 24 to 30 months of age. Early and more frequent assessment may be necessary for children with the following risk factors (see [Appendix A³](#) for a detailed list):

- Cytomegalovirus (CMV) infection
- Syndromes associated with progressive hearing loss
- Neurodegenerative disorders
- Head trauma
- Culture-positive postnatal infections associated with sensorineural hearing loss
- Receipt of extracorporeal membrane oxygenation (ECMO) or chemotherapy
- Caregiver concern or a family history of hearing loss



QUALITY ASSURANCE/QUALITY IMPROVEMENT

MDH and hospitals work together to ensure and improve the quality of screening programs across the state so that every Minnesota infant receives comprehensive screening and follow-up. To help hospitals evaluate and improve their performance, MDH sends semi-annual quality assurance reports to every screening program. Each hospital can contribute to quality assurance by monitoring and improving the quality of its own screening program.

Hospitals should establish a quality assurance protocol and be able to report, on an annual basis, critical performance data including, but not limited to, the following:

- Total number of live births
- Number of newborns screened
- Number of newborns who passed the hearing screening
- Number of newborns who did not pass the hearing screening (results by right ear, left ear and both ears)
- Number of newborns whose parent/guardian refused newborn hearing screening
- Number of newborns whose parent/guardian did not refuse screening but who were “missed” (not screened)
- Number of follow-up appointments scheduled for newborns who did not pass the hearing screen or were missed
- Total number of newborns transferred in/out of the facility
- Number of newborns screened who were transferred in/out of the facility
- Number of deceased newborns

At a minimum, methods should be in place for monitoring referral rates – in order to ensure effective screening – and for monitoring parent satisfaction with the hearing screening process. A hospital nursery with an effective hearing screening program should have a referral rate of 4 percent or less.

The overall goal of quality assurance is information management and accountability to the following stakeholders:

- Infants and their families
- Advocates
- Clinical and educational audiologists
- EHDI managers
- Hospitals
- Medical and educational specialists
- Otolaryngologists
- Primary care providers
- Screeners
- State of Minnesota

REFERENCES

American Speech-Language-Hearing Association (2004). *Guidelines for the Audiologic assessment of children from birth to 5 years of age*. Rockville, MD: ASHA.

CDC EHDI National Goals and Objectives, Final Version by the EHDI Data Committee, July 13, 2006.

Gorga, M.P., Neely, T.S., Ohlrich, B., Hoover, B., Redner, J. & Peters, J. (1999). From laboratory to clinic: A large scale study of distortion product otoacoustic emissions in ears with normal hearing and ears with hearing. *Ear and Hearing*, 18, 440-455.

Hall, J.W., Smith, S.D., & Popelka, G.R. (2004). Newborn hearing screening with combined otoacoustic emissions and auditory brainstem responses. *Journal of the American Academy of Audiology*, 15, 414-425.

HRSA, Final Report. Evaluation of Universal Newborn Hearing Screening and Intervention Program. Based on 2005 – 2006 Data.

Joint Committee on Infant Hearing Position Statement (2007), *Year 2007 position statement: Principles and guidelines for early hearing detection and intervention*. *Pediatrics*, 120, 898-921.

Joint Committee on Infant Hearing Position Statement (2007) Update. *Clarification for Year 2007 JCIH Position Statement*. Retrieved May 2008, from www.jcih.org/Clarification%20Year%202007%20statement.pdf.

Minnesota Statute 144.966. Early Hearing Detection and Intervention Program. 2007. Retrieved from www.revisor.mn.gov/statutes/?id=144.966.

National Consortium for Newborn Hearing Screening. (Nov 16-18, 1995). *TEOAE-based universal newborn hearing screening*. Georgetown University School of Medicine, Washington DC.

Norton, S., Gorga, M., Widen, J., Folsom, R., Sininger, Y., Cone-Wesson, B., Vohr, B., & Fletcher, K. (2000). Identification of neonatal hearing impairment: A multicenter investigation. *Ear and Hearing*, 21 (5), 348-356.

Ontario Health and Long-Term Care Ministry—Infant Hearing Program (2002). *Universal infant hearing screening assessment and communication development: Local implementation support document*.

Washington State Department of Health Protocol for



Newborn Hearing Screening. Retrieved June 24, 2007, from www.doh.wa.gov/Portals/1/Documents/Pubs/344-023_EHDDINBSrnProto.pdf.

SELECTED LINKS

¹ Guidelines for the Organization and Administration of Universal Newborn Hearing Screening Programs in the Special Care Nursery and NICU
http://www.health.state.mn.us/newbornscreening/docs/nicu_hear-guidelines.pdf

² Minnesota Statute 144.966
<https://www.revisor.mn.gov/statutes/?id=144.966>

³ Appendix A: Risk Factors Associated with Permanent Congenital, Delayed-onset, or Progressive Hearing Loss in Childhood
<http://www.improveehdi.org/wi/library/files/Risk%20Indicators%20from%20JCIH%202007%20Position%20Statement.pdf>

⁴ Appendix B: Hearing and Speech Milestones
<http://www.improveehdi.org/wi/library/files/Hearing%20and%20Speech%20Milestones%20from%20AAP%20and%20AAA.pdf>

⁵ Appendix C: Performance Based Criterion Checklist
<http://www.improveehdi.org/wi/library/files/Competency%20Checklist.pdf>

⁶ NCHAM Newborn Hearing Screening Training Curriculum
<http://www.infanthearing.org/nhstc/index.html>

⁷ Appendix D: Hearing Screening Result and Follow-up Process
<http://www.improveehdi.org/wi/library/files/Hearing%20Screening%20Result%20and%20Follow-up%20Process.pdf>

⁸ Appendix E: Newborn Hearing Screening Flowchart for the Well-Baby Nursery
<http://www.improveehdi.org/wi/library/files/WBNurseryFlowchartwithMyths.pdf>

⁹ Appendix F: Hearing Screening Form for Transferred Infants
<http://www.health.state.mn.us/newbornscreening/docs/nicutransf.pdf>

¹⁰ Guidelines for the Organization and Administration of Universal Newborn Hearing Screening Programs for Out-of-Hospital Births
[COMING SOON](#)

¹¹ EHDl Website Provider Search
<http://www.improveehdi.org/mn/providers.cfm>

¹² Guidelines for Infant Audiologic Assessment
<http://www.improveehdi.org/wi/library/files/MDH%20Audiologic%20Assessment%20Guidelines%281%29.pdf>

¹³ Guidelines for Pediatric Amplification
<http://www.improveehdi.org/wi/library/files/MDH%20Pediatric%20Amplification%20Guidelines.pdf>



This document has been revised from the MDH Audiology Task Force, Protocols for Organization and Administration of UNHS Programs Document (2005).