

Chapter 2

Newborn Hearing Screening

Randi Winston, AuD, CCC-A; & Karen M. Ditty, AuD

Purpose and Standard of Care for Newborn Hearing Screening

In their most recent position statements, the Joint Committee on Infant Hearing (JCIH 2000, 2007) recommends that all infants be screened no later than 1 month of age. The basis for this recommendation is to maximize social, emotional, and linguistic outcomes for children who are deaf or hard of hearing. This recommendation is widely recognized and has been institutionalized as a standard of care by hospitals nationwide. There has also been an increase in the number of out-of-hospital birth screens (Centers for Disease Control and Prevention [CDC], 2012b). Although this increase represents a very small percentage of total U.S. births (1.4%; CDC, 2012b), state Early Hearing Detection and Intervention (EHDI) programs are focused on efforts and strategies to increase the number screened. These efforts are supported by the CDC EHDI national goals (CDC, 2012a). A survey conducted by the American Academy of Pediatrics (AAP) highlighted six states' statistics and steps they are taking to increase the number of out-of-hospital birth screenings (AAP, 2011).

The [Health Resources and Services Administration/Maternal and Child Health Bureau](#) (HRSA/MCHB) and the [CDC](#) are the federal agencies most instrumental in assisting states to fulfill the JCIH recommendations. Since 2000, through the provision of large funding opportunities, assistance has been provided to state health departments for ongoing program development. HRSA grants have focused primarily on building EHDI infrastructure within state health departments to ensure babies are screened for hearing loss by 1 month of age, diagnosed by 3 months of age, and enrolled in early intervention programs no later than 6 months of age. As a part of that infrastructure architecture, HRSA/MCHB is also having states emphasize “small tests of change” to reduce loss to follow-up/loss to documentation after the child fails to pass their newborn hearing screen (“reducing loss to follow-up after failure to pass newborn hearing screening”). CDC grants have focused on assisting states to develop and implement EHDI tracking and surveillance systems specifically to improve follow-up outcomes and monitor program quality. Many states have utilized this funding to

The Joint Committee on Infant Hearing recommends that all infants be screened no later than 1 month of age.

assist hospitals with the development of standardized newborn hearing screening tracking and reporting programs and to provide ongoing support for training and technical assistance (CDC, 2012b).

A number of public health agencies have issued consensus and position statements in support of universal screening of all infants. The [National Institutes of Health](#) issued one of the first in 1993, followed by the JCIH in 1994. Other agencies that have released statements of support include the [American Academy of Pediatrics](#) (1999), [Healthy People](#) (2000, 2010), and the [U.S. Preventative Task Force](#) (2001, 2008). By 2007, the collaboration of these efforts led to 97% of all infants being screened prior to hospital discharge (CDC, 2013).

As of 2012, 44 states have passed legislation related to newborn hearing screening. Of those 44 states, 28 require that all babies be screened prior to hospital discharge. Others set standards for a percentage that must be screened (National Center for Hearing Assessment and Management [NCHAM], 2012). States not passing legislation have had to utilize other approaches for gaining hospital support and advocacy for universal newborn hearing screening (UNHS; i.e., public health awareness and education). States with legislation—depending on what is included in the mandate—have varying degrees of coverage for the cost of conducting newborn hearing screening. For example, some states mandate that insurance companies pay for screenings (NCHAM, 2012). States with voluntary programs may not provide any financial assistance, with all costs absorbed by the hospital. Regardless of each state’s reimbursement profile or financial challenges and barriers, newborn hearing screening has been successfully implemented as a standard of care in the vast majority of hospitals throughout the United States.

Targeted Hearing Loss

The [JCIH 2007 position statement](#)

provides best practice principles and guidelines for state EHDI programs and specifically for hospitals with regard to newborn hearing screening. In its most recent revision (2007), it expanded the target hearing loss as permanent bilateral, unilateral sensory, or permanent conductive hearing loss to include neural hearing loss (e.g., Auditory Neuropathy Spectrum Disorder [ANS]). It also established separate screening and rescreening protocols for well baby and neonatal intensive care units (NICU), specifying that babies in the NICU for 5 days or more should be screened with Automated Auditory Brainstem Response (A-ABR) technology.

Achievable Benchmarks

The JCIH 2007 position statement discusses the concept of “regular measurements of performance.” They recommend routine monitoring of these measures for “comparison and continuous quality improvement” within the program. Here are the JCIH 2007 quality indicators and benchmarks for screening:

- Percentage of newborn infants who complete screening by 1 month of age; the recommended benchmark is more than 95% (age correction for preterm infants is acceptable).
- Percentage of newborn infants who fail initial screening and fail any subsequent rescreening before comprehensive audiological evaluation; the recommended benchmark is less than 4%.

Birthing facilities have incorporated these benchmarks into quality assurance measures. Monitoring of these measures ensures that policies, procedures, and protocols are implemented so that all babies are screened prior to discharge, and that the numbers of false positives are low. This will be discussed in more detail later in this chapter.

The importance of developing relationships and partnerships with birthing facilities, professionals, and stakeholders involved in EHDI cannot be overemphasized.

Roles of Professionals and Stakeholders: Importance of Buy-In, Partnerships, and Ongoing Education

The importance of developing relationships and partnerships with birthing facilities, professionals, and stakeholders involved in EHDI cannot be overemphasized.

Program education must be ongoing and occur at a number of different levels for there to be buy-in, advocacy, and for progress and sustainability to occur. On a national level, NCHAM at Utah State University provides resources, education, and technical assistance to all state EHDI programs. With the advent of UNHS in the late 1990s and early 2000s, NCHAM has played a significant role in assisting states and hospitals with the implementation of newborn hearing screening programs (NCHAM, n.d.-c).

Continuing education of hospital and birthing facility administrators, stakeholders, and other related professionals is vital if program momentum is to be sustained. State EHDI programs have different mechanisms in place to assure continuing education occurs in screening programs. Major challenges that hospitals face involve staffing changes and turnover. The integrity of a screening program can be greatly impacted if administrators do not realize the importance of EHDI, as well as the role of newborn hearing screening. It is not uncommon for staff and employees to be unaware of the benefits of early hearing screening or that an EHDI program exists in their state. Once educated on the importance of EHDI, the 1-3-6 EHDI national goals, the importance of their role as the first step in the process, and the impact their role has on the quality of a child's life, buy-in is easier to achieve. The Newborn Hearing Screening Training Curriculum offers a helpful solution to educating stakeholders on the importance of newborn hearing screening. This is also a comprehensive, competency-based training program for hearing screeners that has been updated from DVD to a web-based version. This resource is available on the NCHAM

the HOSPITAL UNHS team members

these stakeholders may include

- Parents and Families of the Newborn
- Hospital Medical Director
- OB Director/Director of Women's & Infant's Services
- Maternal Child Director
- Chief Nursing Officer (CNO)
- Information Technology
- Risk Management
- Clinical Educator
- Hospital Audiologist
- Habilitation Personnel
 - Speech Pathologists
 - Occupational Therapists
 - Physical Therapists
 - Early Interventionists
- Healthcare Providers
 - Pediatrician (Medical Home Provider)
 - Neonatologist
 - Geneticist
 - Ophthalmologist
 - Otolaryngologist
 - Hospitalist
 - Neonatal and OB Nurse Practitioner
- Family Service Coordinators
 - Counselor
 - Social Worker

There are two types of technology used for newborn hearing screening: otoacoustic emissions (OAEs) and auditory brainstem response (ABR). Both have been adapted by manufacturers for automated use in screening programs.

website in a variety of modalities, including an eLearning Moodle version that, upon completion with a passing score, provides an NCHAM certificate of completion (www.infanthearing.org).

Although every birthing facility is somewhat unique with regards to its daily operations and functions, there are administrators, healthcare providers, management, and staff who may *not* be involved in the day-to-day operations of the UNHS program. These personnel can become essential members of the team necessary for the success of EHDI programs. Their advocacy and support is needed for implementation and continuation of a quality UNHS program.

Some hospitals offer audiology services. Audiologists have varying degrees of involvement with newborn hearing screening programs. The JCIH 2007 position statement recommends audiological oversight, as audiologists have the training and expertise necessary to provide consultation and support to programs. It is not recommended, however, that audiologists perform daily screening activities. The audiologist's highly specialized training and expertise is better utilized for diagnosis, treatment, and intervention of hearing loss. According to the [American Academy of Audiology Task Force on Early Identification of Hearing Loss](#) (AAA, 2008), the supervising audiologist should be experienced in both the development and maintenance of a UNHS program, including an understanding of technology options.

Hearing Screening Technology

There are two types of technology used for newborn hearing screening: otoacoustic emissions (OAEs) and auditory brainstem response (ABR). Prior to the advent of newborn hearing screening, both technologies were primarily used for clinical diagnostic audiology applications. Both have been adapted by manufacturers for automated use in screening programs.

Automated screening equipment is ideal for non-audiologist screeners, because it provides a pass or refer (fail) outcome and does not require interpretation. Both technologies provide an objective measure that does not require a behavioral response from the infant, making them ideal for newborn hearing screening applications. OAE and ABR screening technology can be purchased individually (OAE only or ABR only) or in the form of a combined screener—OAE/ABR. ABR screening equipment is often referred to as “automated ABR”—or A-ABR. The major difference between the two technologies lies in the application (how screening is conducted), the portion of the auditory system being screened, and the costs incurred for equipment and disposables.

With OAE screening, a small probe is placed in the ear canal, and soft tones or clicks are introduced. The sound travels along the pathway from the outer ear through the middle ear to the cochlea (inner ear). If the cochlea is functioning normally, it will produce an otoacoustic emission—or echo—which then travels back out through the middle and outer ear canal. This emission is measured by the probe and analyzed by a computer. If the emission is sufficiently robust, “pass” is displayed on the screen. If there is any middle ear fluid/dysfunction or blockage along that pathway, the equipment will be unable to measure the emission, and the result will be a fail or “refer.” Because the OAE response is generated by the outer hair cells in the cochlea before it reaches the eighth nerve, it is often referred to as a “pre-neural” response.

For A-ABR screening, a click sound is introduced into the ear canal by either a probe or an ear coupler that fits over the ear. As with OAE screening, the sound travels through the outer, middle, and inner ear. However, in ABR, the sound continues along the eighth nerve to the brain. An electrical response from that nerve is picked up by electrodes that have been strategically placed on the infant's head. This response is recorded and analyzed by the computer as a “pass” or “refer.”

Hearing Screening Equipment Evaluation Considerations

OAE and A-ABR technology are recommended for newborn hearing screening and are considered efficient and highly reliable (high sensitivity and specificity). Prior to deciding which technology to use, screening programs should conduct a thorough investigation regarding the pros and cons of each technology for their unique setting and make a selection that best suits the program. Some of the considerations are:

- Does the birth facility have an NICU? If so, A-ABR screening equipment will be needed.
- What is the number of births per year? Birth facilities that have a high birth rate and limited budget may want to closely investigate the per-baby cost of disposables and supplies.

- What is the average length of stay? The average length of stay may have an impact on a hospital's ability to allow time for vernix to dissipate and perform a screen or rescreen prior to discharge from the facility.

Comparing features between different screening equipment can help you in the decision-making process. You may also consider requesting that the manufacturer loan you the equipment for a trial period prior to committing to a purchase. It may also be helpful to contact other birthing facilities to learn about their experiences using the equipment being evaluated. Consulting with professionals who are experienced in screening newborns is an important component of the selection process. To obtain further information or assistance with equipment selection, contact a local pediatric audiologist or the NCHAM Regional Technical Support Network (NCHAM, n.d.-c). More information on specific equipment options and considerations can be found on the NCHAM website (NCHAM, n.d.-b).

UNHS should follow an established set of policies and procedures that define the **Who, What, When, Where, and How** for the hospital or birthing facility.

Who will be the manager of the UNHS program?

The manager is often an audiologist. However, a hospital administrator, nurse, or physician affiliated with or contracted by the hospital may also be the manager. The program manager should be an individual experienced in newborn hearing screening management who has an understanding of the equipment necessary for implementation of the program and the responsibilities required for management of the program. ***The program manager will:***

- Be responsible for equipment, staff, and protocol decisions.
- Assure that each new staff member has received appropriate training according to established procedures and standards of care.
- Oversee screeners and monitor schedules to ensure 365 days of coverage.
- Provide focused re-education when needed and take corrective action as necessary to improve or maintain program performance.
- Monitor the timely generation and dissemination of reports in compliance with hospital and/or state guidelines.
- Assure that screening supplies are available, as needed.
- Perform a baby-by-baby reconciliation every month to assure all admissions are included in the EHDI database.
- Coordinate services and follow-up for infants who need further evaluation.
- Educate medical and clinical staff on the benefits of EHDI.
- Report to state agencies as required by state law and governing rules.

Who will be the screener(s) of the UNHS program?

This individual may be one of the support personnel at the hospital or birthing facility, a nurse, audiologist, retired professional, college student, or high school graduate. With the exception of the audiologist, it is likely that none of these individuals will have had any training for newborn hearing screening. With the proper training, guidance, and adequate supervision, they should be able to adequately perform newborn hearing screening. **The newborn hearing screener will:**

- 1 Meet minimum age, education, and criminal background check requirements of the hospital or birthing facility.
- 2 Complete all compliance requests from the hospital and/or contractor for whom they will be screening (i.e., orientation requirements, drug screening, infant CPR training).
- 3 Be free of communicable diseases and current with immunizations.
- 4 Work independently and demonstrate competency-based skills necessary to perform the specific tasks assigned:
 - Follow a precise sequence of instructions for the screening protocol.
 - Have the manual dexterity necessary to apply small objects to infant ears and head.
 - Operate screening equipment properly.
- 5 Communicate and interact with hospital and medical staff (be a team player).
- 6 Meet the physical demands of the screening process (e.g., able to stand, walk, and handle equipment for prolonged periods of time; able to see and read small print (such as names and numbers on infant ID badges).

With the proper training, guidance, and adequate supervision, screeners should be able to adequately perform newborn hearing screening.

What will the program manager need to do to establish a UNHS program at their center?

- 1 **Identify financial considerations for the UNHS program.**
Questions to be asked:
 - What screening equipment will be purchased? Should OAE or A-ABR screening, or a combination of both, be purchased? What are the screening equipment and any parts replacement costs?
 - What is the cost of disposables per infant screened?
 - Electrodes
 - Probetips and/or earmuffs
 - Disinfectant wipes
 - Stickers/labels
 - Brochures/handouts
 - What is the warranty for the unit(s) purchased? Is there an additional charge for an extended warranty? Will software and firmware updates be provided free of charge or will additional charges be incurred?
 - Is there a charge for manufacturer or distributor technical support?
 - Is the hearing screening equipment capable of being calibrated annually for quality assurance documentation? If so, what is the process and cost?

Quotes from JCIH 2007:

“The birth hospital, in collaboration with the state EHDI coordinator, should ensure that parents and primary healthcare professionals receive and understand the hearing-screening results, that parents are provided with appropriate follow-up and resource information, and that each infant is linked to a medical home.”

“The EHDI system should be family centered with infant and family rights and privacy guaranteed through informed choice, shared decision-making, and parental consent in accordance with state and federal guidelines.”

“For all infants with and without risk indicators for hearing loss, developmental milestones; hearing skills; and parent concerns about hearing, speech, and language skills should be monitored during routine medical care consistent with the AAP periodicity schedule.”

“When statistical probability is used to make pass/fail decisions, as is the case for OAE and A-ABR screening devices, the likelihood of obtaining a pass outcome by chance alone is increased when screening is performed repeatedly.”

- What is the average number of births at the hospital or birthing facility?
- What CPT billing codes will be used for charges?
- What will the charge be for each procedure?
- What will be the reimbursement for the hearing screening procedures?
 - If the hospital performs the test, will the charges be bundled in the newborn birthing charge?
- Does the facility have an NICU, which would require A-ABR screening and the purchase of appropriate equipment? (JCIH 2007)
 - If a contractor is performing the test, can they charge for the procedure?
 - Does Medicaid pay for the procedure?
 - What is the payer mix at the hospital?
- What will be the cost of ancillary supplies (i.e., paper, printers, and ink for the printers; information systems support; etc.)?
- How will the screeners be paid? What benefits will be provided?
- How many hours of work will be required from support or contract personnel to operate the UNHS program?

2 Identify educational considerations for the UNHS program.

Questions to be asked:

- What forms or letters will be provided to parents regarding screening outcomes?
- What information will be provided to the parents explaining the hearing screening process?
 - Are all of the materials provided to parents culturally sensitive and at a fourth-grade reading level for ease of understanding?
 - Have any handouts or brochures been translated into alternative languages (i.e., Spanish, Vietnamese, etc.)? Selection of alternative languages must be consistent with the population and demographics in the city or region where the hearing screening will be performed.
- Do informational materials supplied to parents discuss normal speech and language developmental milestones for infants and children? Whether or not an infant passes a newborn hearing screening, there are instances when an infant may have late onset or progressive hearing loss. By monitoring the infant’s developmental milestones, parents and physicians may be alerted to the need for further audiological testing.
 - What if an infant passes the initial hearing screening but has a risk indicator that may require additional screening at a later date? Are parents informed of available sites for outpatient audiological monitoring of the infant? What materials are provided to families regarding recommendations for next steps?
 - What if an infant does not pass the initial hearing screening? Is there appropriate parent education regarding next steps and referral sites for pediatric audiological diagnostic testing?

3 Establish policies and procedures to be followed by the hearing screening staff.

Policies and procedures should include:

- Mission and vision of the department.
- Job descriptions for all program personnel.
- Infant security measures and the role of the UNHS screener.
- Emergency codes.
- Infection control.
- Overview of the state EHDI system.
- Flowchart of policies and procedures regarding special populations.
- Standard of care for hearing screening.
- Step-by-step procedures for hearing screening.
- Protocol for babies that fail the hearing screening (i.e., how often to rescreen an infant).
- Database transfer steps, if required.
- Documentation of test results in the medical record.
- Communication of screening results to staff, parents, and the infant’s primary care provider.

When will the newborn hearing screen take place for each infant born at the hospital or birthing facility?

1

Well Babies

Infants born without any complications can be screened for hearing loss as early as 6 hours of age. For optimal results, it is recommended hearing screening be performed as close to discharge as possible. This time period allows for any vernix (or wet birthing debris) that may be in the infant's ear canals to dry out and allows more efficient and accurate screening. Many centers will wait for the infant to be at least 24 hours old before hearing screening is attempted.

2

NICU Babies

If an infant is in the NICU, hearing screening is performed prior to the infant's discharge from the hospital or when the infant is in stable condition and in an open crib. NICU infants may be screened earlier or more than once, depending on their medical condition.

3

Home Births or Infants Born in a Birthing Facility

For those infants born in a birthing facility or at home, it is recommended that hearing screening be performed within the first 2 weeks of the infant's life, unless the state EHDI program has more stringent guidelines.

Infants born without any complications can be screened for hearing loss as early as 6 hours of age.

Where will hearing screening take place?

Very few hospitals provide a sound-treated room for hearing screening. Some centers have mother couplet care; others prefer hearing screening be performed in the patient's room. Whatever the circumstances and requirements of the center, the question "where" should hearing screening take place must be determined. **Questions to consider:**

1

Where will hearing screening for "well babies" take place?

2

Where will infants in Level II or III nurseries be tested?

3

Will hearing screening be performed in the mother's room?

4

Will noise levels in the nursery prohibit hearing screenings from being performed there?

5

Will the screening take place in a designated room selected for optimal quiet and efficient testing?

6

Will Level II or III nurseries have a screening area relatively free of electrical interference?

7

Where will follow-up screening or audiological testing be available?

How will the screeners be trained and demonstrate skills?

Questions to consider:

1

How will the technician demonstrate competence to perform the hearing screening, as well as manage the necessary data? Competencies to be evaluated are:

- Hospital or birthing facility policies and procedures.
- Hearing screening equipment use and care.
- Knowledge of hearing screening protocols.
- Documentation of screening results.
- Communicating screening results to the infant's parents and appropriate medical staff personnel.

2

How should the newborn hearing screening manager evaluate the screener's skills during the training process? A checklist may include the screener's:

- Completion of required hospital orientation.
- Completion of instructional training. An example of this training is: Newborn Hearing Screening Curriculum developed by NCHAM. This can be found at <http://www.infanthearing.org>
- Completion of infant CPR training.
- Understanding of hospital emergency codes.
- Knowledge of infection control policies and procedures.
- Awareness of hospital infant security procedures.
- Ability to complete hearing screening independently.
- Knowledge and application of procedures for communication with parents and stakeholders regarding screening results and the need for necessary follow-up.
- Demonstration of cultural sensitivity for parents.

"Interpretive criteria for pass/fail outcomes should reflect clear scientific rationale and should be evidence-based. Screening technologies that incorporate automated-response detection are necessary to eliminate the need for individual test interpretation, to reduce the effects of screener bias or operator error on test outcome, and to ensure test consistency across infants, test conditions, and screening personnel."
(JCIH 2007)

How will program personnel ensure that every baby has been screened?

- Obtain a census each day of all new admissions to the nursery and NICU.
- Identify infants transferred to another facility and document their new location to the state EHDI program.
- Identify and properly document deceased infants according to state EHDI policies.
- Identify "special needs" infants (i.e., infants under child protection or those in the adoption process).
- Provide documentation in each infant's medical chart of date and time the screening was administered, outcomes, as well as any follow-up that may be required. (A copy of the screening test results should be included in the documentation. Individual ear screening results should be printed and filed in the medical chart. This type of documentation is critical for medical/legal reasons.)
- Identify infants whose parents refuse to allow a hearing screening to be performed and place a signed refusal in the medical chart.

How will program personnel handle infants who do not pass their newborn hearing screening or are missed?

Quotes from JCIH 2007:

“For all infants, regular surveillance of developmental milestones, auditory skills, parental concerns, and middle-ear status should be performed in the medical home, consistent with the American Academy of Pediatrics’ periodicity schedule. All infants should have an objective standardized screening of global development with a validated assessment tool at 9, 18, and 24 to 30 months of age or at any time if the healthcare professional or family has concerns.”

“There are no national standards for the calibration of OAE or ABR instrumentation. Compounding this problem, there is a lack of uniform performance standards. Manufacturers of hearing-screening devices do not always provide sufficient supporting evidence to validate the specific pass/fail criteria and/or automated algorithms used in their instruments.”

- Document a need for follow-up hearing screening in the medical records. The infant’s parents and medical home provider must be notified of the need for follow-up screening. If a state database is used, these infants must be appropriately documented with identifying information that is current and complete. If possible, a second point of contact should be obtained and documented. Policies and procedures required by the state EHDI program must be followed.
- Schedule an appointment date for the infant to receive a follow-up screening or diagnostic test before the parents leave the hospital. The infant’s parents and medical home should be notified of the follow-up appointment.

How will the program manage infants who are identified with a risk indicator and may require additional audiological follow-up?

The purpose of collecting risk-indicator information is to help identify infants who pass the newborn hearing screening but are at-risk for developing delayed-onset and/or progressive hearing loss. Risk indicators are also used to identify infants who may have passed the newborn hearing screening but may have mild forms of permanent hearing loss (JCIH 2007).

The program manager needs to refer to their state EHDI guidelines for reporting requirements regarding risk factors for newborns. A list of state EHDI websites can be found at <http://www.infantheating.org/states/index.html>

Early and more frequent assessment may be indicated for children identified with a family history of hearing loss, CMV infection, syndromes associated with progressive hearing loss, neurodegenerative disorders, trauma, or culture positive postnatal infections associated with sensorineural hearing loss and for infants who have received ECMO or chemotherapy. Children should be evaluated by an audiologist whenever there is a caregiver concern regarding hearing loss (JCIH 2007).

It is recommended that:

- Risk indicators be documented and forwarded to the infant’s medical home.
- Parents and medical home providers are given a list of pediatric audiologists who are capable of providing ongoing audiological surveillance of the infant’s hearing status.
- Parents may also be directed to EHDI PALS. This site can be located on the web at <http://www.cdc.gov/Features/hearinglossdirectory>. This free web-based list of pediatric hearing audiology facilities, known as the [Pediatric Audiology Links to Services \(PALS\)](#), is a search tool designed to help families find where to go for hearing tests and other hearing-related services. There is no other listing of U.S. audiology facilities for young children as complete, accessible, or easy to use. This information was developed by a national group of health professionals and parents (CDC, n.d.).

How will the program ensure that hearing screening equipment is calibrated and within manufacturers' specifications?

- Ensure that calibration of the hearing screening equipment is completed and documented at regular intervals as recommended by the equipment manufacturer.
- Document daily listening checks to assure equipment is operating properly.
- Provide regular care and maintenance of the probe or cables that are used with the hearing screening equipment.

How will program personnel ensure that the UNHS program is meeting established benchmarks for quality assurance and program quality?

Quality indicators for hearing screening programs as recommended by the JCIH 2007 position statement are outlined below. In addition, many state EHDI programs have developed specific screening guidelines, quality indicators, and benchmarks. A list of state EHDI websites can be found at <http://www.infanthearing.org/states/index.html>

- Percentage of all newborn infants who are screened by 1 month of age at the hospital or birthing facility: >95% (age correction for preterm infants is acceptable).
- Percentage of all newborn infants who do not pass the initial hearing screening and fail any subsequent rescreening before referral for outpatient comprehensive audiological evaluation: < than 4%.
- Percentage of infants referred for follow-up outpatient testing and receiving the testing: $\geq 70\%$.
- Documentation of regular calibration of equipment as recommended by the manufacturer.
- Documentation of annual competency assessments for the newborn hearing screening staff.

Screening Protocols

The JCIH 2007 position statement recommends the use of either OAE or A-ABR screening technology as acceptable methods for screening newborns. They make a very important distinction regarding the recommended standard of practice for babies in NICUs for greater than 5 days and babies with risk indicators for late onset or progressive hearing loss. As mentioned earlier in this chapter, targeted hearing loss in the NICU not only includes babies with sensorineural hearing loss, but also those babies at risk for ANSD, which is a condition affecting the eighth nerve. Infants who require NICU care for more than 5 days may have

had a more complicated birth associated with factors that put them at a significantly greater risk for ANSD. The JCIH recommends that these babies be screened with ABR, so these disorders will not be missed. All other babies (well babies and babies in the NICU for less than 5 days with no risk indicators for late onset or progressive hearing loss) can be screened with OAE.

Program Organization

UNHS should follow an established set of policies and procedures that define the *Who, What, When, Where, and How* for the hospital or birthing facility.

The JCIH 2007 position statement recommends the use of either OAE or A-ABR screening technology as acceptable methods for screening newborns.

The *Who, What, Where, When, and How* of UNHS also offers many challenges for facilities providing the screening and for state EHDI programs. In spite of these challenges, infants **are** being identified and afforded the well-documented benefits of early intervention.

These policies should be based on current standards of care combined with evidenced-based procedures for UNHS.

The *Who, What, Where, When, and How* of UNHS also offers many challenges for facilities providing the screening and for state EHDI programs.

- **Loss to follow-up and loss to documentation.** Although loss to follow-up has improved from almost 50% in 2006 to 35.3% in 2011, state EHDI programs continue to work diligently to reduce this percentage (CDC, 2013). In an effort to reduce loss to follow-up, the National Initiative for Children’s Healthcare Quality organized a “learning collaborative experience” with eight states. Teams were trained in the “Model for Improvement,” a quality-improvement approach that includes setting clear aims, tracking results, identifying proven or promising change strategies, and using the plan-do-study-act tests for these changes. Teams identified some promising change strategies which included:
 - Ensuring correct identification of the primary care provider before discharge from the birthing hospital.
 - Acquiring a second contact phone number for each family before discharge.
 - Scripting the message given to families when an infant does not pass the initial screening test.
 - Scheduling a follow-up appointment (rescreening or diagnostic) before the family leaves the hospital and stressing its importance to the family.
 - Calling the family to verify the follow-up appointment and provide assistance, such as transportation vouchers, if necessary.

A publication in the Journal of the American Academy of Pediatrics concluded that this quality improvement initiative led to promising improvements in statewide systems of care for infants who require follow-up after newborn hearing screening (Russ, Hanna, DesGeorges, & Forsman, 2010). Similar initiatives can be incorporated in hospitals and birthing facilities to reduce their loss to follow-up.

Additional challenges within the EHDI system include:

- **The shortage of professionals with skills and expertise in pediatrics and hearing loss,** including audiologists, deaf educators, speech-language pathologists, early intervention professionals, and physicians. Professional organizations, such as the American Academy of Audiology, American Academy of Otolaryngology-Head and Neck Surgery, American Academy of Pediatrics, American Speech-Language-Hearing Association, Council on Education of the Deaf, Directors of Speech and Hearing Programs in States, and NCHAM, continue to work on education and training within their respective professional communities.
- **Timely referral for diagnosis of and intervention for suspected hearing loss in infants and children.** Barriers include the lack of support in rural areas, finances of the parents, cultural and linguistic obstacles, etc.
- **Consistent state and federal funding** to assure program sustainability.
- **Poor reimbursement for pediatric services.** Some states are initiating legislative efforts to improve reimbursement, but this is still a significant issue throughout the EHDI system.
- **Lack of access** to uniform Part C services.

The **What, Where, When, and How** are certainly critical components of the hospital or birthing facility UNHS program. Most important, however, is the **Who**—the people who make UNHS programs function.

- **Lack of integrated information management and tracking systems in many states.** Further information on this topic may be found in the *Information Management* chapter.
- **The inability of state tracking systems to follow individual infants with suspected or confirmed hearing loss through the EHDI program.**
- **The ever-changing cultural diversity of the population.** Translating educational materials, providing culturally appropriate services, and overcoming cultural barriers continues to be challenges.
- **Significant regulatory barriers to sharing information among providers and between states.** This is a particular issue for babies not born in their state of residence (i.e., “border babies”).
- **The lack of uniform performance and national standards** for the calibration of OAE or A-ABR instrumentation.

In spite of these challenges, infants **are** being identified and afforded the well-documented benefits of early intervention. The **What, Where, When, and How** are certainly critical components of the hospital or birthing facility UNHS program. Most important, however, is the **Who**—the people who make UNHS programs function. The program managers, newborn hearing screening personnel, hospital administrators, pediatricians, parents, and all the stakeholders that make up a UNHS program are key to the success of the EHDI process. If these stakeholders continue to work together, improve communication across professions, educate one another on the importance of hearing screening, and initiate improved legislation, they will make a significant impact on improving EHDI services for infants and their families.

References

- American Academy of Audiology. (2008). *Considerations for the use of support personnel for newborn hearing screening, Task force on early identification of hearing loss*. McLean, VA: AAA.
- American Academy of Pediatrics. (2011, February). Reducing loss to follow-up in out-of-hospital birth populations. *EHDI Email Express*. Retrieved January 21, 2011, from http://www.medicalhomeinfo.org/downloads/pdfs/Feb2011_EHDI_Email_Express.pdf
- Centers for Disease Control and Prevention. (n.d.). *Hearing loss: New online directory for parents/CDC features*. Retrieved May 13, 2013, from <http://www.cdc.gov/Features/hearinglossdirectory>.
- Centers for Disease Control and Prevention. (2012a). *EHDI national goals*. Retrieved January 21, 2012, from <http://www.cdc.gov/ncbddd/hearingloss/ehdi-goals.html>
- Centers for Disease Control and Prevention. (2012b). *Hearing loss, data, and statistics - NCBDDD*. Retrieved January 24, 2012, from <http://www.cdc.gov/ncbddd/hearingloss/data.html>
- Centers for Disease Control and Prevention. (2013). *2011 Annual data Early Hearing Detection and Intervention (EHDI) program*. Retrieved February 20, 2014, from <http://www.cdc.gov/ncbddd/hearingloss/ehdi-data2011.html>
- Joint Committee on Infant Hearing. (2009). *Year 2007 position statement: Principles and guidelines for Early Hearing Detection and Intervention programs*. Retrieved October 25, 2009, from <http://www.jcih.org/posstatemts.htm>
- Martin, J. A., Hamilton, B. E., Ventura, S. J., Osterman, M. J., Kirmeyer, S., Mathews, T., & Wilson, E. (2011, November). *Births: Final data for 2009* (USA). Centers for Disease Control and Prevention, National Center for Health Statistics). Retrieved January 21, 2012, from http://www.cdc.gov/nchs/data/nvsr/nvsr60/nvsr60_01.pdf
- National Center for Hearing Assessment and Management. (n.d.-a). *Early identification of hearing loss: Universal newborn hearing screening (An Implementation Guide)*. Retrieved October 25, 2009, from <http://www.infanthearing.org/impguide/appendices.html>
- National Center for Hearing Assessment and Management. (n.d.-b). *Newborn & infant hearing screening - Equipment manufacturers and products*. Newborn hearing & infant hearing—Early Hearing Detection and Intervention (EHDI) resources and information. Retrieved January 21, 2012, from <http://www.infanthearing.org/resources/linksequipment.html>
- National Center for Hearing Assessment and Management. (n.d.-c). *National EHDI Resource Center, Technical Assistance Network*. Newborn hearing & infant hearing—Early Hearing Detection and Intervention (EHDI) resources and information. Retrieved January 21, 2012, from <http://www.infanthearing.org/tas/network.html>
- National Center for Hearing Assessment and Management. (2012). *EHDI legislation. Newborn hearing & infant hearing—Early Hearing Detection and Intervention (EHDI) resources and information*. Retrieved January 21, 2012, from <http://infanthearing.org/legislation/>
- Russ, S. A., Hanna, D., DesGeorges, J., & Forsman, I. (2010). Improving follow-up to newborn hearing screening: A learning collaborative experience. *Pediatrics*, 126, S59-69.
- U.S. Department of Health and Human Services, Health Resources and Services Administration/Maternal and Child Health Bureau Division of Services for Children with Special Health Needs. (2013). *Reducing loss to follow-up after failure to pass newborn hearing screening*. Washington, DC. From <http://www.hrsa.gov/grants/apply/applicationguide/sf424guide.pdf>