Chapter 22

Early Childhood Hearing Screening: Not Just for Newborns

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Introduction

Over the past two decades, tremendous progress has been made in ensuring that newborns in the U.S. receive a hearing screening shortly after birth. As a result, 1 to 3 children per 1,000 are being identified with hearing loss shortly after birth, and these infants can potentially receive the benefits of early intervention. It is important to remember, however, that of the subgroup of children not passing the newborn screen, approximately 30% could not be documented as having received needed follow-up services (Centers for Disease Control and Prevention, 2013). Additionally, injury, illness, or genetic factors can cause hearing loss at any time in a child's life. By school age, approximately 6 to 7 per 1,000 can be expected to have a permanent hearing loss (Bamford et al., 2007; National Institute on Deafness and Other Communication Disorders, 2007).

Many parents erroneously assume that their child's hearing is being checked periodically as part of routine well-child visits. In reality, however, health care providers look for common middle ear disorders but are typically unable to screen for hearing loss. Consequently, the majority of children do not receive any additional hearing screening beyond newborn screening until they are in school.

This section will discuss recent progress in early childhood periodic screening and will review how Early Hearing Detection and Intervention (EHDI) professionals, pediatric audiologists, and speech-language pathologists can contribute to the development of periodic hearing screening in early childhood programs by:

- Introducing objective hearing screening.
- Identifying the most appropriate screening method and equipment.
- Establishing a screening protocol.
- Determining who should conduct the screening.

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- Establishing a tracking and follow-up system.
- Conducting training.
- Monitoring program quality.

Recent Progress in Periodic Screening and Opportunities for EHDI Involvement

One setting in which a number of young children are already receiving annual hearing screenings is in Head Start programs that serve economically disadvantaged children. Recognizing that hearing health is central to typical language development, educational achievement, socialization, and overall school readiness, Head Start has demonstrated a long-standing commitment to sensory screening (O'Brien, 2001). No specific guidance on appropriate hearing screening methodologies has been issued; therefore, each local program relies on advice from their local health services advisory committee. Unfortunately, individuals on these committees may know little about current hearing screening practices, and many programs continue to employ outdated, subjective methods, such as hand clapping, noisemakers, and parent questionnaires (Munoz, 2003).

Since 2002, the Office of Head Start has funded initiatives carried out by the National Center for Hearing Assessment and Management (NCHAM) to help Early Head Start, Migrant/Seasonal and American Indian/Alaska Native Head Start programs to update their hearing screening practices for children 0–3 years of age using otoacoustic emissions (OAE) technology. As a result, many Head Start programs across the country serving children 0-3 years of age have established OAE hearing screening practices with the assistance of the Early Childhood Hearing Outreach (ECHO) Initiative and often in collaboration with local pediatric audiologists and state EHDI coordinators. Data on screening and follow-up suggests that approximately 2 of every 1,000 children screened in early childhood settings are being identified with a permanent hearing loss (Eiserman et al., 2008).

The fact that Head Start programs are already routinely conducting hearing screening presents a great opportunity to expand EHDI outreach well beyond newborn screening.

The fact that Head Start programs are already routinely conducting hearing screening presents a great opportunity to expand EHDI outreach well beyond newborn screening. Forming partnerships with Head Start and other early childhood programs is a viable way to enhance a state's overall EHDI efforts, while at the same time providing critical information to early childhood programs on appropriate hearing screening methods and models. It is important to note that the number of children 0–3 years of age being served in Head Start programs nationwide continues to grow. Depending on the guidance they are given, programs serving these children will either implement reliable hearing screening practices or may continue to employ outdated strategies.

The materials developed and "lessons learned" as a part of NCHAM's ECHO Initiative are described below and can be utilized by anyone interested in supporting the implementation of appropriate, periodic hearing screening practices in a variety of early childhood educational and health care settings, including Early Head Start, home visiting programs, early intervention programs, or other early care and health care settings.

Implementing an Early Childhood Hearing Screening Program

When working with Head Start programs, it is valuable to contact the Head Start State Collaboration Office to coordinate activities within a given state. It is also important to discuss and coordinate implementation plans with all relevant individuals within the state EHDI program. A helpful, informative webinar presentation is available at http://www.kidshearing.org/webinar/june2013

One of the most valuable resources that EHDI professionals can offer to Early Head Start programs is contact with and support from pediatric audiologists in their local areas.

Strategically sequencing outreach efforts within a state rather than attempting to provide training and support to all early childhood programs simultaneously, it is often the wisest approach. Enlist a few individuals who are particularly interested in supporting periodic early childhood hearing screening and link them with specific Early Head Start programs that are eager for assistance. One of the most valuable resources that EHDI professionals can offer to Early Head Start programs is contact with and support from pediatric audiologists in their local areas.

Program components that EHDI professionals should discuss with early childhood care providers in implementing successful hearing screening programs with children 0–3 years of age are outlined below.

Introducing objective hearing screening. One of the first steps an audiologist or EHDI professional can take in promoting periodic hearing screening is to share the value of early identification of hearing loss. Although Head Start programs already have a federal mandate to ensure that all children receive a hearing screening, staff may not fully appreciate how high-quality screening and follow-up practices result in accurate identification and appropriate services. It is important to point out that when permanent hearing loss is identified early in a child's life, the detrimental effects of that loss can be minimized significantly through appropriate intervention and support.

Staff may need guidance in understanding that some screening techniques are inappropriate and inadequate, including subjective screening methods, reliance on newborn hearing screening outcomes beyond the first year of life, or medical records indicating an ear exam was completed (which typically includes only visual inspection). Ensuring that programs are committed to providing quality periodic hearing screening, using up-to-date methods throughout the early childhood period, is the first step in developing a sustainable screening program.

Identifying the most appropriate screening method and equipment. Audiologists and other EHDI professionals typically need to be involved in identifying the most appropriate screening method available for the population being served and the equipment that is the easiest and most reliable for lay screeners to use.

When screening infants and toddlers 0–3 years of age for hearing loss, OAE is usually the optimal tool, because it does not require a behavioral response from the child and is quick, painless, portable, and reliable (see *Figure 1*). Audiometry has traditionally been the preferred method for screening older children who are developmentally mature enough to respond to instruction and provide a consistent behavioral response. There are, however, many children 3-5 years of age who have developmental delays or difficulty following directions and are therefore unable to complete pure-tone audiometric screening. Thus, for a large percentage of young children, OAE is the most reliable screening method. A 6-minute video introduction to OAE screening can be found: kidshearing.org/videos/IntrotoOAEScreening

Figure 1
Child Being Screened Using OAE Technology

Children who manifest problems with receptive or expressive language skills, as well as those who do not pass the screening, should be referred to a pediatric audiologist for a comprehensive assessment.

Audiologists who have used OAE equipment exclusively in nursery or diagnostic settings may be surprised to learn that it can also function effectively in educational, home, and health care environments. In addition, nonaudiologists who are skilled at working with children can learn to use the technology effectively. It is always important for screening staff to be reminded that screening is not equivalent to a comprehensive audiologic evaluation.

Not all OAE equipment used with newborns is equally well designed to screen infants and toddlers in early childhood environments. In addition to overall cost of the equipment and associated disposables, key elements in equipment selection include:

- The capacity to screen quickly in settings where there is a modest amount of ambient noise.
- A probe that stays seated firmly in the ear canal when a child is in an upright or prone position. (Disposable foam tips that compress and conform to the ear canal are typically easier for lay screeners to use than plastic covers that have to be matched more precisely to individual ear canal size.)
- Easy-to-understand displays that convey screening results and prompt screeners on what to do if the screening is not proceeding.

Prior to buying equipment, a program's hearing screening coordinator may want to work with a local audiologist to arrange with equipment vendors to obtain several different brands of portable OAE equipment on loan for a short period of time. During the loan period, the audiologist and program staff can systematically try the equipment with children of different ages and vary the conditions under which the screening is conducted. Well-designed OAE screening equipment should allow the screening to be conducted successfully in the child's natural environment. Very loud sounds, such as a child crying or manipulating a very noisy toy nearby, may make it difficult/impossible to complete the screening, but in general, the sound of children talking or laughing within the room should not interfere with being able to complete the screen. This is significant, because helping very young children to feel comfortable with the overall screening procedure is one of the most important factors in screening success. The process of trying out equipment in a "real-world" environment will allow programs to purchase equipment that is able to perform well under a variety of screening conditions and with a variety of children. A more detailed list of equipment selection criteria can be found at kidshearing.org/resources/select-oae.

For programs that need assistance finding funds to purchase equipment, a template that can be helpful in applying for funding can be found at kidshearing.org/GrantTemplate.

Establishing a screening protocol. An effective OAE screening protocol balances the risk of over-referring children for assessment against the need for timely referrals. In other words, programs will not want to refer children for further follow-up based on screener error or temporary conditions that will naturally resolve within a short period of time (such as common head colds). The multistep screening protocol (shown in *Figure 2*) is similar to the two-step protocol often used in hospital-based newborn screening programs—with the exception that a health care provider is often involved in resolving common, temporary middle ear conditions prior to referral to a pediatric audiologist.

Completing the screening and follow-up protocol within an appropriate timeframe is critical to program success in identifying and treating children with hearing health needs (Eiserman, Shisler, & Hoffman, 2015). Detailed information about the recommended screening and follow-up protocol is available at kidshearing.org/resources/protocol-guides.

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Determining who should conduct the screening. EHDI professionals should be aware that health specialists, nurses, home visitors, and teachers can all successfully conduct OAE screening. The most important skill is to be able to work effectively with young children. More than one screener should be trained in a given program to help ensure continuity when personnel turnover occurs and, if possible, to permit for screening to occur in teams. It is also important to limit the number of individuals in a given program who are trained as screeners, so they can have ample opportunity to develop their competence by screening a significant number of children. Home- and center-based programs may also have different needs, depending on the access that screeners have to children. Thus, there is no specific formula for determining how many screeners or pieces of equipment are needed based on child enrollment. The individuals overseeing program planning need to carefully consider the protocol and availability of staff members to implement it. In general, it is probably wisest to train a small corps of screeners and then increase the number, as needed.

Establishing a tracking and follow-up system. Early Head Start programs often

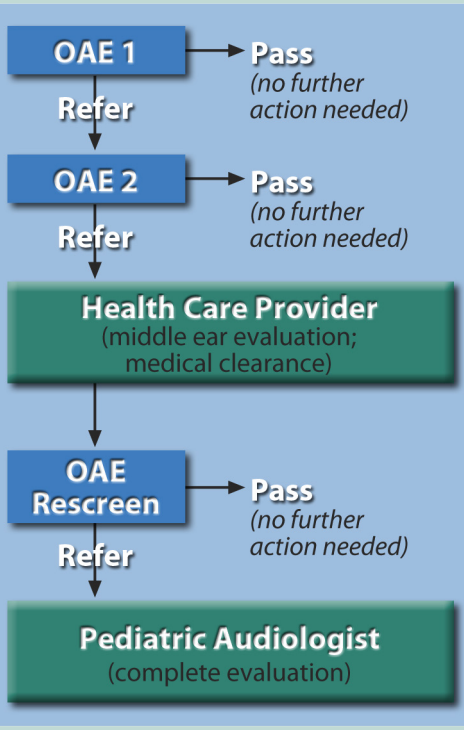
1 All children receive an initial OAE screening (OAE 1). Approximately 70–75% of children in the 0–3 age group can be expected to pass the screening in both ears, with 25-30% requiring a second OAE screening.

2 Children not passing the OAE 1 are screened again (OAE 2) within 2 weeks. Approximately 8-10% of the total number of children screened initially will not pass either the first or second screening and will therefore need to be referred to a health care provider for middle ear evaluation.

3 Children referred from the OAE screening should be evaluated as soon as possible by a health care provider for conditions affecting the outer or middle ear (such as otitis media or impacted ear wax—common causes of an OAE refer). Screening staff will need to communicate with the health care provider about the diagnosis and treatment process, so that when medical clearance is given (e.g., observable conditions interfering with OAE screening are no longer present), the child can receive an OAE rescreen. (***NOTE:*** If screening is being conducted where health care providers are present, the protocol may be streamlined, with a middle ear evaluation being performed immediately upon referral from OAE screening.)

4 Children not passing the OAE rescreen, when the outer and middle ear are clear, are referred to a pediatric audiologist for a full diagnostic evaluation. Approximately 1% of the total number of children screened typically requires referral to a pediatric audiologist.

Figure 2
OAE Screening Protocol



need assistance in establishing a mechanism for documenting screening outcomes and tracking children who need further screening or evaluation. Just like newborn screening, the success of an early childhood OAE screening program in identifying and serving children with hearing health needs is dependent on the program's capacity to accurately track children who do not pass the initial screening through subsequent, follow-up steps in the protocol. Therefore, as an initial part of program planning, program staff must think through how screening results will be documented and referrals made to ensure timely and appropriate follow-up.

Just like newborn screening, the success of an early childhood OAE screening program in identifying and serving children with hearing health needs is dependent on the program's capacity to accurately track children.

Many of the generic tracking systems that are used by Early Head Start programs do not allow staff to enter ear-specific data on hearing screening outcomes, nor to easily generate reports that help them to know which children are in need of further screening or referral. It may be helpful to review the materials available at kidshearing.org/resources/track with Early Head Start program staff to determine whether they already have an adequate hearing screening tracking system in place or need to take advantage of existing paper/pencil and online tools.

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Early Head Start programs should be instructed that any children identified with permanent hearing loss are to be reported to the state EHDI program. Some states have gone a step further to develop data-sharing agreements, permitting local Early Head Start programs to submit their screening outcomes to the state EHDI program as a mechanism for closing the loop on children lost to follow-up from newborn hearing screening.

Conducting training. Training materials developed by the ECHO Initiative, including training videos, guidebooks, and implementation tools, have proven to be effective in conveying essential information to screeners in a standardized way. These materials can be accessed at kidshearing.org/learn-to-implement.

Basic training information includes:

- Introduction to OAE hearing screening
- Screening in Early Head Start
- How OAE screening works
- OAE protocol
- Plan your OAE screening program
- Get to know your OAE equipment
- OAE screening step-by-step
- Develop your OAE screening skills
- Get ready to screen children
- Strategies for successful screening
- OAE protocol in detail

One essential training element is the opportunity for learners to receive supervised, "hands-on" experience screening children. Training, therefore, must be held in a location where children are present, so that instruction can include this practical component (see *Figure 3*).

It is highly desirable to have an experienced pediatric audiologist serve as a mentor and trainer. It is also very helpful to teach screeners to work in teams, with one person playfully keeping the child's attention while the other places the probe in the child's ear and conducts the screening. Each screener should have the opportunity to screen a number of children in this supportive, supervised training setting.

The future holds great potential for EHDI professionals to take the lead in a variety of venues that would allow more children to ultimately be identified with hearing loss at the earliest possible time.

Figure 3 Trainee Learning to Screen in a Natural Setting

Monitoring program quality. Similar to hospital-based screening efforts, there are a number of ways that Early Head Start program staff can be encouraged by EHDI professionals to monitor the quality of their screening programs. (Additional resources can be found at kidshearing.org/resources/track).

1 Monitor pass rates for the initial screening (OAE 1), which should be approximately 70-75%. This rate may be slightly lower when screeners are first learning to screen but should improve over time. Referral rates may be expected to increase during cold and flu season, as a larger percentage of children are likely to have middle ear issues.

2 Have an audiologist—or a highly skilled screener—observe screeners to ensure they are using the techniques they were taught during the training.

3 Monitor adherence to the screening and follow-up protocol in terms of the *sequence* of screening and follow-up activities (i.e., whether the steps for rescreening and referral are occurring in the recommended order) and the *timing* of follow-up activities (i.e., whether the steps for rescreening and referral are occurring within the recommended timeframe). The more closely programs comply with the sequence and timing of the steps recommended in the screening and follow-up protocol, the more effective they will be in identifying children with hearing health needs.

Exploring Periodic Screening in Other Early Care and Education Settings

The future holds great potential for EHDI professionals to take the lead in a variety of venues that would allow more children to ultimately be identified with hearing loss at the earliest possible time. The training and implementation materials found at www.kidshearing.org have been designed to assist program administrators and screeners in a variety of settings. For example, some health care providers have begun to explore the feasibility of providing OAE hearing screening as a part of well-child checkups for young children. A growing body of research suggests that screening in health care settings can successfully identify children with previously undiagnosed hearing loss.

In one 10-month study conducted at three federally-funded clinics, 846 young children (primarily under 5 years of age) received an OAE hearing screening during routine visits. A multistep protocol incorporating middle ear evaluation and treatment was implemented for children not passing the initial screening. This subset of children then received a second OAE screening, and any child not passing was evaluated by a pediatric audiologist. Of the 846 children screened, 3 were ultimately identified with permanent hearing loss. Two of the children had previously passed their newborn hearing screen, and one child was born outside the U.S. and was not screened at birth (Foust, Eiserman, Shisler, & Geroso, 2013).

In another study, medical assistants in seven federally-qualified health centers were trained to provide children 0-3 years of age with objective hearing screening during well-child visits. Of the 1,965 children screened, 5 were ultimately identified with permanent sensorineural hearing loss; 2 of these 5 children had previously passed the newborn hearing screen; while 1 had not passed the initial inpatient screen but had passed the subsequent outpatient screening (Bhatia et al., 2013).

These findings demonstrate that young children can be screened within health care settings, and that when such screening is implemented, children with postnatal hearing loss, as well children lost to follow-up from the newborn screen, can effectively be identified. However, there are obstacles to increasing the number of children who receive this service. Health care providers report limitations on the amount of time they are able to spend with children during well-child visits and reimbursement concerns as two of the primary reasons that early childhood hearing screening is not a standard of care.

Another area of need where state EHDI professionals are having a positive impact is in Part C and Part B/619 programs. Although Part C and Part B/619 regulations require that evaluation and assessments must include hearing, no guidelines specify how that should be carried out. Many professionals erroneously assume that children being assessed in these programs receive a comprehensive audiological evaluation. However, that is often not the case. A recent survey of 155 Part C providers from 17 states revealed that the most commonly used hearing screening methods were informal observations of the child's response to sounds/noisemakers and family-completed questionnaires. Similarly, of the 175 Part B/619 providers in 11 states who responded, 45% reported using subjective methods with the majority of the children enrolled (Eiserman, Behl, & Shisler, 2009). Less than 20% of the programs reported that most of their children received a full audiological evaluation, and only a quarter of the programs reported that they used OAE technology as a primary screening/evaluation method.

Reliance on outdated, subjective screening methods makes it likely that children with hearing loss will remain unidentified or receive inappropriate interventions.

Although subjective methods continue to be the primary hearing screening/evaluation tool used by many Part C and Part B/619 programs, research data does not support such strategies in identifying young children with hearing loss. One retrospective study found that only 25% of parents of children with significant hearing loss suspected that their child might have a hearing problem (Watkin et al., 1990). Even more worrisome, less than 10% of parents suspected that their child had such a hearing loss during infancy. Likewise, informal behavioral screening using soundmakers has been shown to be far less effective than objective OAE screening (Chan, 2004). Reliance on outdated, subjective screening methods makes it likely that children with hearing loss will remain unidentified or receive inappropriate interventions.

One obstacle to providing effective OAE screening in Part C and Part B/619 settings is related to the requirement that after the lead agency or early intervention service provider receives a referral on a child, the screening (if applicable), initial evaluation, initial assessments, and the initial Individual Family Service Plan meeting for that child must be completed within a 45-day timeline. Although the intention of the requirement is to ensure that children receive timely assessment and services, an audiologic evaluation to determine whether a permanent hearing loss is present may take longer than that, particularly if there are middle ear issues that need to be resolved before a child's hearing status can be determined. It is important that programs have ways to track children whose hearing evaluation is not completed within the 45-day timeframe and that they proceed with the overall assessment process once accurate information about the child's hearing is in hand.

Conclusion

In the decade ahead, there will be an ongoing need and more opportunities than ever before for EHDI professionals to become involved in periodic early childhood hearing screening initiatives in a variety of health and educational settings. Efforts in this area will yield positive benefits in reducing loss to follow-up from newborn screening and in identifying post-neonatal hearing loss at the earliest possible time.

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