

Screening for hearing loss in primary care

Early intervention and ongoing surveillance are key to the management of hearing loss in childhood. Here's why pediatricians should prioritize hearing screening at every well-child visit.

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It is important to identify newborns with hearing loss by age 3 months so that intervention can begin by age 6 months. However, not all hearing impairment is present at birth and all infants and children should receive ongoing surveillance of hearing and communication skills at health supervision visits.¹

This article will review the causes and consequences of hearing loss in childhood and describe how office-based technologies should be used to identify the hearing-impaired child. In addition, I will offer recommendations regarding the need to expedite evaluations by pediatric audiologists so that hearing-impaired children can be identified and treated in a timely fashion.

Overview of hearing loss in childhood

Childhood hearing loss is divided into 2 general categories, congenital and acquired (Table 1).

Congenital hearing loss is genetic in roughly 50% of cases. Approximately 70% to 80% of genetic hearing loss is autosomal recessive, 15% to 20% is autosomal dominant, and 2% is X-linked or mitochondrial. Fifteen percent of genetic hearing loss is part of a syn-

drome, such as Usher syndrome and Waardenburg syndrome, and more than 400 syndromes are associated with hearing loss.¹ Nongenetic causes include prematurity, central nervous system injury, drug/alcohol use by mothers during pregnancy, and those caused by congenital infections.²

Acquired hearing loss is a consequence of various circumstances that can affect children, including perforated eardrums, protracted otitis media, otosclerosis, and cholesteatomas. Additional causes include prolonged

TABLE 1
CHILDHOOD HEARING LOSS:
CONGENITAL AND ACQUIRED

CONGENITAL CAUSES	ACQUIRED CAUSES
Congenital infections (ie, CMV, toxoplasmosis, syphilis, rubella)	Perforated eardrum
Prematurity	Otosclerosis and cholesteatoma
CNS injury	Infections (meningitis, measles, mumps, herpes)
Maternal drug or alcohol use	Head injury
Genetic hearing loss	Loud noise exposure
Syndromes associated with hearing loss	Persistent or frequent otitis media
	Exposure to ototoxic medications

Abbreviations: CMV, cytomegalovirus; CNS, central nervous system.
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and repetitive exposure to loud noises, exposure to ototoxic medications, infections, and head injury.¹

Another way to view childhood hearing loss is to consider the anatomy involved. Conductive hearing loss involves problems between the external auditory canal and the cochlea, including vernix in newborns, cerumen in children, as well as aural atresia and otitis media. Sensory hearing loss is a consequence of cochlear dysfunction that may result from genetic causes, or exposure to ototoxic medications or infections. Neural causes of hearing loss include failure of function of the auditory nerve or disruption of auditory processing in the brain. Causes may include tumors, bleeding (intrapartum, postpartum or central nervous system [CNS] injury in childhood), infections, and auditory neuropathy.²

Incidence and consequences of hearing loss

As with any childhood-related medical issue, it is important for providers to be aware of the incidence of hearing impairment in childhood so the problem can be put into perspective and given an appropriate priority for screening during well visits.

According to data from the Centers for Disease Control and Prevention (CDC) from 2017, approximately 98% of newborns in the United States are screened for congenital hearing loss.³ The data indicate that 1.7 of every 1000 babies in the United States is born with hearing loss, and 25% of babies do not undergo follow-up testing (ie, are lost to follow-up). Neonatal intensive care unit (NICU) patients are at higher risk for neurosensory hearing loss with an incidence of 16.7/1000 infants and an auditory neuropathy incidence of



5.6/1000 infants.^{4,5}

According to some estimates, the incidence of childhood hearing loss increases to 6 of 1000 children in the United States by age 6 years.² The National Health and Nutrition Examination Surveys indicate that hearing loss greater than 25 dB affects 3% to 5% of American adolescents!⁶

The sooner a hearing impairment is identified in an infant or child, the sooner the child can receive hearing aids or, when appropriate, a cochlear implant as well as educational support should the family decide to adopt these options. Without detection of hearing impairment, even a moderate impairment, the child may perform poorly in school, develop a poor self-image, and consequently fail to achieve their potential. Numerous studies have shown that the sooner a hearing-impaired child receives hearing augmentation, the sooner they develop vocal communicative and linguistic skills.^{7,8}

When to be concerned

Primary care providers should be suspicious that a child may have a significant hearing loss if a child has a speech or developmental delay or if parents are concerned about a possi-

ble hearing loss. Other aspects of the history that should prompt consideration of an audiology referral include a family history of childhood hearing loss, neonatal intensive care of 5 days or longer, in utero infections, craniofacial anomalies, and other risk factors listed in Table 2.

Technologies for screening in primary care

The Joint Committee on Infant Hear-

TABLE 2 RISK FACTORS FOR CHILDHOOD HEARING IMPAIRMENT

- Caregiver concern
- Speech delay
- Family history of childhood hearing loss
- History of exposure to ototoxic medications (gentamycin, tobramycin or furosemide)
- Craniofacial anomalies
- Syndrome-associated hearing loss (eg, Usher syndrome, Waardenburg syndrome)
- Chemotherapy treatment
- Recurrent or persistent otitis media
- Head trauma

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► **Bio-logic AuDX PRO (Natus Medical)** is a modular, handheld device that facilitates OAE screening.



► **Bio-logic AuDX PRO FLEX** from Natus Medical adds tympanometry capability to screening.



ing (JCIH) updated its screening guidelines last year. The JCIH recommends 2 separate hearing screening protocols: 1) for those admitted to a NICU for more than 5 days; and 2) for babies born in well nurseries.¹

All NICU babies (representing 10% of the entire newborn population) may be at risk for neurosensory hearing loss and auditory neuropathy and should undergo hearing screening using an automated auditory brainstem response (AABR) test prior to discharge. Infants cared for in the NICU who do not pass the AABR should be referred directly to an audiologist for rescreening and, when indicated, given a comprehensive audiologic evaluation including diagnostic ABR.

In the well nursery, babies can undergo a screening using either AABR testing or otoacoustic emissions (OAE) testing with a rescreening by the hospital as outpatient with either technology. Alternatively, newborns in the well nursery can undergo an



▲ **Bio-logic AuDX PRO** can display cartoons to distract a child.

initial screen with either technology with a re-screen *before discharge* with either technology should the baby not pass the initial screen. All babies who refer from the well nursery should be re-screened by the hospital before aged 1 month or re-screened in the pediatrician's office (using OAE devices, see below). If this is not possible, they should be referred to a pediatric audiologist for follow-up.

It is the goal of Universal

Newborn Hearing Screening (UNHS) that screening is completed by age 1 month, audiologic diagnosis is completed by age 3 months, and that the hearing-impaired child is enrolled in early intervention by age 6 months.¹

Primary care providers have several tools at their disposal for screening young children for hearing loss. According the American Academy of Pediatrics (AAP) Bright Futures Guidelines, children should be screened for hearing loss at ages 4, 5, 6, 8, and 10 years; once

between the ages of 11 and 14 years; once between ages 15 and 17 years; and once between the ages of 18 and 21 years.⁹ Screening performed at age 10 years or younger usually is done at 2000 to 5000 Hz. Older children also should be screened at 6000 to 8000 Hz to detect high-frequency hearing loss. Screening also should be performed any time a provider is concerned about hearing loss, as would be the case with children presenting with delayed speech or those with prolonged or recurrent otitis media. In an office environment, OAE screeners are affordable and screening can be completed in minutes.

In the office setting, those children who refer on OAE screening should



▲ **Bio-logic AuDX PRO FLEX** also performs pure tone audiometry.

have an in-office tympanometry test (or screening with acoustic otoscope, see below) to exclude middle-ear effusion as a cause of the hearing loss. As OAE screeners generate a pass or refer result, pediatricians should consider performing a pure tone audiogram to determine the hearing threshold for the child. Be aware that 20% of 3- to 5-year-old children will not be able to be screened by pure tone audiometry and those unable to be screened should be evaluated by an audiologist.

Hearing screeners such as the **Bio-logic AuDX PRO** and **Bio-logic AuDX PRO FLEX** from Natus Medical (Pleasanton, California) are modular devices that facilitate screening in the primary care office. The Bio-logic AuDX PRO can be configured to display a cartoon to distract a child during the brief OAE screen. Additionally, it can be used to perform pure tone audiometry on children who refer on OAE screen or for those suspected as having auditory neuropathy. The Bio-logic AuDX PRO FLEX provides all the capabilities of the AuDX PRO as well as providing tympanometry capability. In the latter situation, one device provides all the hearing screening capability a practice needs.

Every child with hearing loss should have a visual inspection of the tympanic membrane and ear canal. Cerumen impaction, serous otitis, acute otitis, tympanic membrane perforation, otosclerosis, and cholesteatoma can contribute to conductive hearing loss. The inspection can be done with a standard otoscope using pneumatic otoscopy to check the mobility of the ear drum. In the real world, pneumatic otoscopy is rarely employed by pediatricians. Otoscopy also can be difficult in an uncooperative child or when ceru-



▲ **New Acoustic Otoscope** from Check My Ear LLC will be available by mid-2020.

BENEFITS OF OAE SCREENING

Otoacoustic emissions (OAE) technology was examined by Eiserman and colleagues in a study published in 2007.¹² In this study, 3486 children aged from birth to 3 years from 52 different Head Start Program sites were screened by Head Start staff, using OAE screening technology. Of the 3486 children screened, 183 (5%) were referred for medical or audiologic follow-up. Of these 183 children, 80 were identified with a hearing loss or disorder requiring treatment or monitoring. Six of these 80 were diagnosed as having permanent hearing loss; 63 were identified with otitis media; 2 were treated for occluded pressure equalization tubes; and 9 were treated for excessive earwax or congestion.

This study suggests that OAE screening in early childhood settings helps identify approximately 1 of every 43 children as needing audiologic treatment or monitoring, and 1 of every 600 children as having a permanent hearing loss that was not previously identified.

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men obscures the view of canal and tympanic membrane.

The **Wispr Digital Otoscope** from WiscMed (Madison, Wisconsin) allows one to insert a small speculum into the ear canal while guiding insertion by looking at the viewing screen. One can then capture images or select images from a video and share with parents. These videos can be imported into the medical record and shared with audiologists and otolaryngologists (ENTs), and used for comparison purposes when one decides to monitor the resolution of

a perforation or otitis.

Per the guidelines issued by the AAP in 2013, one needs to visualize a bulging tympanic membrane or intense erythema of the tympanic membrane *in addition to* documenting the presence of fluid in the middle ear space to diagnose otitis media.¹⁰ Assessment of fluid in the middle-ear space can be done with pneumatic otoscopy or with tympanometry. Both require a cooperative child in order to obtain and maintain a seal between the speculum or probe and the wall of the ear canal.

The **Acoustic Otoscope** from Check My EAR LLC (Lincoln, Nebraska) is expected to become available by mid-2020. It enables providers to determine if there is fluid in the middle-ear space in a matter of seconds. No seal is required and cerumen usually does not interfere with measurements (see “Must have gadgets for today’s pediatrician,” *Contemporary Pediatrics*, December 2019). Additionally, the Acoustic Otoscope provides a spectral gradient angle measurement that can be followed at subsequent visits to monitor the resolution of ear effusions.

There are 2 new devices that will be released in the near future that will facilitate diagnosis and monitoring of otitis media. I plan on reporting on these in my December 2020 “best tech” article for *Contemporary Pediatrics*.

Audiologist and ENT referrals

Pediatricians should not delay referral of children with suspected hearing loss to audiologists. Audiologists with expertise in treating children

have a range of methods to determine hearing thresholds in young children. These include Behavioral Observation Audiometry, Play Audiometry, and Visual Reinforcement Audiometry.¹¹

Part of the evaluation includes tympanometry and a determination whether hearing loss is conductive or central. When appropriate, an audiologist will refer to an ENT physician for further evaluation and generate a referral to a medical facility that can perform an ABR diagnostic study. The earlier a child is identified with hearing loss, the sooner the affected child can receive educational services and hearing augmentation when indicated. It is therefore important to establish a relationship with audiologists in your community and make an appointment for the patient before the patient leaves the pediatrician’s office.

In conclusion

It is imperative that pediatricians ensure that all patients in our care undergo appropriate screening for hearing loss and that we remain diligent in identifying patients who may be at

risk for developing permanent hearing loss in childhood. As discussed, we should utilize appropriate equipment to screen children for hearing impairment and determine if there is fluid in the middle ear. Lastly, we should err on the side of caution and refer to an audiologist promptly when hearing loss is suspected. ■

COMMENTS? E-mail them to cradwan@mjlifesciences.com



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Author’s note: A webinar complementing this article is available at medgizmos.com



For references, go to ContemporaryPediatrics.com/screening-for-hearing-loss

CONTEMPORARY PEDIATRICS CLINICAL VIDEO EXCLUSIVE

For *Contemporary Pediatrics*, Dr. Bobby Lazzara discusses recent cross-sectional analyses of the 2006-2016 National Health and Nutrition Examination Survey that identified impaired fasting glucose and impaired glucose tolerance among US adolescents and young adults to assess their cardiometabolic risk profile for developing type 2 diabetes, chronic kidney disease, and cardiovascular disease. The findings will surprise you.

ContemporaryPediatrics.com/prediabetes-risk-among-teens-video

