Promoting Hearing Loss Prevention in Audiology Practice

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An audiologist should be the principal provider and advocate for all hearing loss prevention activities. Many audiologists equate hearing loss prevention with industrial audiology and occupational hearing conservation programs. However, an audiologist's involvement in hearing loss prevention should not be confined to that one particular practice setting. In addition to supervising occupational programs, audiologists are uniquely qualified to raise awareness of hearing risks, organize public health campaigns, promote healthy hearing, implement intervention programs, and monitor outcomes. For example, clinical audiologists can show clients how to use inexpensive sound level meters, noise dosimeters, or phone apps to measure noise levels, and recommend appropriate hearing protection. Audiologists should identify community events that may involve hazardous exposures and propose strategies to minimize risks to hearing. Audiologists can help shape the knowledge, beliefs, motivations, attitudes, and behaviors of individuals toward self-protection. An audiologist has the education, tools, opportunity, and strategic position to facilitate or promote hearing loss surveillance and prevention services and activities. This article highlights real-world examples of the various roles and substantial contributions audiologists can make toward hearing loss prevention goals.

The National Institute on Deafness and Other Communication Disorders (NIDCD, 2010) estimates that 26 million Americans aged 20–69 years have hearing loss due to exposure to hazardous noise during work or recreational activities. Recent research has found evidence of

early noise-induced hearing loss (NIHL) in children aged 12–19 years (Henderson, Testa, & Hartnick, 2011; Niskar et al., 2001; Shargorodsky, Curhan, Curhan, & Eavey, 2010). The National Institutes of Health (NIH, 1990) has estimated that more than one-third of all hearing loss in the United States is at least partially attributable to noise exposure. Nearly all NIHL can be prevented. Audiologists have an enormous opportunity to reduce the burden of hearing loss in this country by providing evidence-based prevention services and advocating for hearing loss prevention as a public health initiative.

However, for too long, hearing loss prevention has been viewed as a specialized area of audiology practice relegated to a few professionals who manage industrial hearing conservation programs. In reality, all audiologists have a professional responsibility to incorporate hearing loss prevention services and advocacy into their practice. Hearing loss due to noise exposure represents a substantial portion of hearing impairments in the general population. Because most NIHL is permanent, preventing NIHL is the only way to reduce its burden on society. Without intervention, NIHL progresses and financial and social costs escalate. Audiologists have the tools, opportunity, and strategic position to advocate healthy hearing practices and facilitate hearing loss prevention. The public health nature of NIHL and the magnitude of the problem in today's society must be addressed. Industrial/occupational hearing loss prevention efforts provide an adaptable model that includes several elements: noise-hazard identification, noise avoidance or abatement, hearing testing, audiometric dataset analysis, hearing protector selection/fitting, and education/motivation. These practices can readily be extended to preventing hearing loss from community or recreational exposures as well.

Both the American Speech-Language-Hearing Association (ASHA) and the American Academy of Audiology (AAA) include prevention of hearing loss among an audiologist's primary responsibilities (AAA, 2004, 2012; ASHA, 2004). In this article, we will demonstrate ways in which every audiologist—regardless of practice setting—can contribute to hearing loss prevention efforts. We will identify specific ways for audiologists to get involved in promoting hearing health and highlight real-world examples of the various roles and substantial contributions audiologists have made to hearing loss prevention. Audiologists can be the driving force in the areas of NIHL surveillance; risk factor evaluation; noise protection strategies; hearing protector selection, fitting, and attenuation testing; education, motivation, and training; early detection of hearing risks through audiologic indicators beyond pure-tone audiometry; identification of underserved or susceptible populations; hearing health promotion campaigns; and evaluation of intervention effectiveness. In short, hearing loss prevention is and should be a part of every audiologist's scope of practice. All audiologists in every employment setting can make a contribution to these efforts.

Surveillance: The Track to Prevention

Effective prevention requires a clear picture of who develops hearing loss and why. The public health perspective involves an expansion of the clinical perspective. Clinically, the audiologist asks, "How well does this particular person hear?" From a public health standpoint, audiologists should ask, "How does this group of people hear? How is their hearing ability different from another group? Why?" These questions enable audiologists to target interventions to groups with identified rather than presumed risk factors. When noise exposure data exist, extensive surveillance is not necessary—you don't need to wait for a study that tells you that group ends up with hearing loss. However, prevention efforts based on assumptions instead of data may target the wrong individuals or miss those populations actually at risk for hearing loss.

Surveillance is the tool that tracks hearing loss cases and looks for patterns that point to prevention opportunities. Occupational hearing conservation programs incorporate audiometric surveillance to track how well individual workers, specific departments, and companies prevent hearing loss. Clinical audiologists can easily incorporate surveillance into

their practices as well. For example, tracking the schools, hobbies, or jobs of teens who present with early signs of NIHL might identify a school or event at which one might volunteer to present a talk or activity focusing on hearing loss prevention. Rather than allowing information on risk factors gathered on patient history forms to sit dormant in individual patient files, compile the information into a de-identified database and use it to identify and track trends in hearing risk behaviors that might be amenable to a community-based intervention. These kinds of surveillance activities can even find more clinical applications. Perhaps comparing clients with aidable hearing losses who do or do not purchase hearing aids could identify factors that lead some patients to accept amplification, while others do not. Audiologists collect much information in the course of their clinical activities; collating these data to answer basic questions is a first step toward making prevention a daily part of audiology practice.

Counseling Patients/Clients to Reduce Risk

Providing Risk Factor Information

Studies have shown that few physicians routinely inquire about their patient's hearing (Cohen, Labadie, & Haynes, 2005; Schneider et al., 2010). Audiologists have all the more responsibility to educate their clients about exposures or activities that can damage their hearing and how to prevent hearing loss. Patients/clients should be informed of the risk that noise and other agents (e.g., organic solvents, lead, and carbon monoxide) can pose to hearing, as well as the strategies that exist to protect against such risks. (For information on the damaging effects of ototoxic chemicals, see Johnson & Morata, 2010.)

Audiologists should remember that hearing risks are not confined solely to workplace noise exposures. Each case history should investigate risk factors in all aspects of the client's daily activities and be followed by appropriate counseling. Additionally, the existence of a hearing loss (regardless of etiology) should not dissuade the audiologist from encouraging protection of residual hearing. Each patient visit offers a teachable moment that should not be wasted. Make a point to seek out potential risks to your clients' hearing and counsel them appropriately.

Many professional organizations have readily available materials to help guide your counseling activities. The following are just a few that may serve as a starting point:

- *American Speech-Language-Hearing Association: www.asha.org.* The ASHA store markets several posters—"How to Destroy Your Ears Slowly," "The Sounds of Life," and "Noise Levels for Everyday Sounds"—that can provide a framework of talking points about hearing loss prevention. A brochure titled "How to Protect your Hearing" is also available. ASHA designates May as Better Hearing and Speech Month.
- *National Hearing Conservation Association: www.hearingconservation.org.* NHCA has produced a very instructive poster illustrating cochlear damage from noise, which is otherwise invisible. NHCA has a number of consumer-oriented brochures on topics including selecting and fitting hearing protection and hearing loss prevention for specific groups (such as musicians, farmers, hunters, and children). A short course on preventing hearing loss from recreational firearm use is available on DVD.

  A very useful tool for counseling patients about risk is the NHCA Noise Navigator spreadsheet, available on their website (above). This resource provides sound level information for over 1,700 occupational, recreational, and military noise sources. NHCA is continually adding to this spreadsheet as data become available, and invites contributions from anyone who can provide documentation of other noise levels.
- *American Academy of Audiology: www.audiology.org.* AAA markets October as National Audiology Awareness Month and National Protect Your Hearing Month. Their website offers downloadable fact sheets, posters, bookmarks, and other tools

that can be customized to reflect your practice or provide additional information suitable to a particular audience.

- *Better Hearing Institute: www.betterhearing.org.* BHI has developed a number of consumer education booklets that provide more extensive information than shorter brochures. "Prevention of Hearing Loss from Noise" and "Your Guide to Better Hearing" are particularly suited to patient counseling about hearing risk. Both booklets can be downloaded for free from the BHI website.

A quick Internet search will point out many additional resources for patient counseling from other advocacy groups, government agencies, and even vendors of hearing health products. Keep in mind that information accuracy varies greatly between sources, so a critical review of online resources should be undertaken before using information taken from a particular website.

Self-Monitoring of Noise Exposure

While accurate sound level measurements require calibrated instruments and a well-trained operator to use them, advances in technology have made it possible for consumers to easily monitor their own noise exposures. Several inexpensive sound level meters in the $25–$80 price range may be used as a cursory survey tool for identifying and measuring hazardous sound levels in situations where a more accurate sound level meter is not necessary or is cost prohibitive. A search of online retailers will find numerous examples. These devices are often marketed to audiophiles as a tool for checking the output of home audio equipment. Although their readings may never be relied upon for absolute accuracy or regulatory compliance, they are able to provide enough information either to rule out a possible noise hazard or to recommend further investigation. In addition, they make useful tools for educating the public about the range of noise sources to which they are exposed.

An even simpler way to identify potential noise hazards is to use a device such as the 3M™ Noise Indicator. This device is about the size of a key ring, clips to a person's clothing, and uses red/green flashing lights to alert users to potentially dangerous noise levels. Noise levels are above 85 dBA (*hazardous*) when the red LED is flashing and the levels are below 85 dBA (*safe*) when the green LED is flashing. These monitors cost approximately $50 each (as little as $30 each when purchased in bulk). Another example is the ER-200 Personal Noise Dosimeter available from Etymotic Research, Inc. For $149, this screening dosimeter provides an estimate of one's noise dose and alerts the user to the risk of overexposure. An audiologist should consider keeping a supply of these types of devices in the office and offer them for short-term loans to clients interested in finding out more about the sound levels they encounter. This approach also will enable the audiologist to make better informed decisions regarding intervention strategies and devices.

All sound level measurements should be interpreted by referencing the National Institute for Occupational Safety and Health (NIOSH, 1998) recommended exposure limit (REL) to determine hearing risk. This is defined as an 85 dBA time-weighted average using a 3 dB exchange rate. The NIOSH REL is more protective than the current Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL), which is 90 dBA for an 8-hour day and is computed using a 5 dB exchange rate (OSHA, 1971, 1983).

Sound Measurement Apps

Smartphone software application developers have begun to offer sound measurement applications using the device's built-in microphone (or through an external microphone for more sophisticated applications). Most of these apps are well under $20 and some are free. Sound measurement apps have generated a great deal of interest among audio enthusiasts, educators, acoustical and environmental researchers, and the public in general. In 2009, several European countries commissioned the largest participatory noise pollution monitoring study using mobile phones, relying on the public to report data using their phones' audio and GPS capabilities (Maisonneuve, Stevens, & Ochab, 2010). The adoption of smartphones and

availability of smartphone sound measurement apps can have a tremendous and far-reaching impact in this area, as nearly every smartphone now can be turned into a dosimeter/sound level meter.

Little information is available about the accuracy or limitations of these new smartphone sound measurement applications. NIOSH is currently investigating the accuracy of smartphone apps by comparing their results against the results from more sophisticated sound measurement instruments. The intent of the study is to increase awareness of these powerful features, promote understanding of the risk to hearing, and provide appropriate recommendations for developers and users to protect their hearing. One of the major issues for all of these applications is the appropriate method for calibration. The NIOSH study will generate accuracy information for each device/application and provide users (and future developers) with the tools to address proper calibration techniques for these applications. In the meantime, we recommend benchmarking the sound measurement app on each smartphone against a calibrated instrument.

Noise Protection Strategies

Standard preventive medicine principles suggest that the elimination of the physical hazard (e.g., noise) is the first and best approach to be taken to prevent injury and illness. Therefore, strategies such as noise avoidance and noise abatement/control should be considered before reliance upon hearing protective devices as an alternative. Perhaps the noise source(s) can be replaced with quieter machinery, or perhaps the equipment simply needs repair to reduce the noise level. Often, sound-enclosures or sound absorptive materials located in proximity to the noise source may reduce sound levels sufficiently to eliminate the risk to hearing. Other simple strategies such as “walking away” and “turning it down” also can lower the person’s exposure from a dangerous level to a safe level.

It is important to recognize that successful noise control efforts do not always involve the purchase of expensive “soundproofing” materials or products, and no single approach to noise control is applicable in all situations. Practical noise control solutions combine the exact science of acoustics with the production, maintenance, and economic constraints imposed upon a particular situation. Successful noise control projects are usually the result of a joint effort involving a group of knowledgeable individuals with technical as well as operational/administrative expertise. An audiologist can provide the link between the different individuals who are involved in this effort. In cases where engineering solutions are not technically or economically feasible, then the use of hearing protection is warranted.

Selection, Fitting, and Attenuation Testing of Hearing Protectors

Because hazardous sound does not have to be painful to be potentially harmful, many people do not understand the need for wearing hearing protection devices. If personal hearing protectors are properly selected, fitted, and worn, they can provide adequate protection against noise-induced hearing impairment. In many cases, however, they are not worn effectively, if at all. All audiologists should be aware of the various types of hearing protection available, their suitability to particular uses, techniques for achieving a proper fit, and methods to evaluate the specific level of protection on a given individual. Audiologists should also inform noise-exposed individuals that cotton balls, tissue, cigarette butts, hearing aids (except in very specific circumstances), and other small objects are not hearing protectors and should not be used in place of an approved device.

Hearing protectors come in three basic forms: earplugs that are inserted into the ear and seal against the ear canal walls, earmuffs that seal against the head around the ear, and concha-seated protectors (often called *canal caps* or *semi-aural devices*) that provide an acoustic seal right at the entrance to the external ear canal. There is no single “best” type for all individuals or situations, although some types are better than others for use in specific

noise environments, for some activities, or for certain environmental conditions. For several years, NIOSH has maintained a Compendium of Hearing Protection Devices (HPDs) that includes descriptions and laboratory attenuation data for all the HPDs marketed in the United States (Franks, Graydon, Jeng, & Murphy, 2003; NIOSH, 1994). The Compendium also provides data about protector construction, materials, and other features that may aid in selection of protectors for specific situations. The Compendium is designed to be actively used on the Internet (www.cdc.gov/niosh/topics/noise/hpcomp.html) and is continually updated as new data are received from hearing protector manufacturers. It has a search engine that identifies protectors by type, manufacturer, features, and desired Noise Reduction Rating (NRR), or it may be searched by inputting noise exposures in octave-band levels or overall dBA. It is a very useful tool for helping audiologists select appropriate hearing protectors.

Selecting an Appropriate Hearing Protector

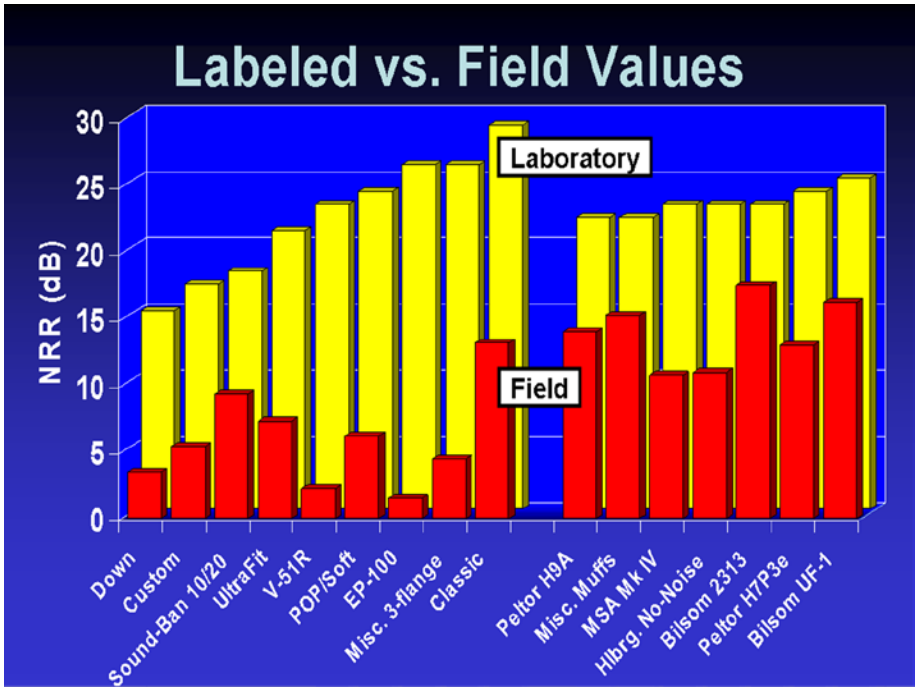
Earplugs, earmuffs, and canal caps all have distinct advantages and disadvantages. Insert-type protectors are convenient to carry and store, and can be worn effectively without interference from eyeglasses, headgear, earrings, or long hair. They are practical to wear in hot environments and do not restrict head movement in close quarters. The initial cost of earplugs is usually significantly less than muffs or canal caps, although, if used frequently, the long-term cost depends on how often the earplugs are replaced. Plugs may not be appropriate for use during very dirty activities because dirt or foreign substances from one's hands may be introduced into the ear canal during insertion. For this reason, malleable and foam plugs (and to a somewhat lesser extent, all earplugs) may be a poor choice if the area is excessively dirty and intermittent noise levels make it necessary to frequently remove HPDs.

Earmuffs are often easier to fit than insert types because one size fits most wearers. Comfort is also better for muff-type protectors in some environments; however, earmuffs may be uncomfortable to wear during vigorous activity or in hot areas, but are warming in cold environments. Muff-type protectors also may feel cumbersome or restrict head movement when worn in confined spaces (i.e., areas having limited headroom). Earmuffs normally provide less protection when worn over long hair or eyeglasses, and they may not be compatible to wear with helmets or other head-worn equipment. Because skin oil and perspiration can have adverse effects on cushion materials, earmuff cushions tend to become stiff or brittle over time and require periodic replacement.

Almost all insert protectors require more time and effort for proper fitting than do earmuffs, and a small percentage of employees cannot effectively wear any off-the-shelf plugs due to the shape/size of their ear canals. Differences in the amount of training and fitting experience cause the amount of protection provided by earplugs to be quite variable between wearers. Conversely, muffs are easier to fit properly and provide relatively consistent attenuation across users. Some wearers deliberately bend the headband to reduce pressure on the skull and increase comfort, which can significantly reduce the level of protection. Some concha-seated ear canal caps can also exert a substantial amount of pressure on the ears and become uncomfortable; therefore, this type of protector is usually better suited for brief, intermittent noise exposures.

All hearing protectors sold in the United States are currently labeled with an estimate of the sound attenuation they provide, called the *Noise Reduction Rating (NRR)*. Many purchasers of hearing protection have fallen into the trap of thinking that a higher NRR is always better. In reality, the labeled NRR is a poor indicator of the actual attenuation obtained by an individual wearer (see Figure 1). The NRR is derived from laboratory test methods designed to estimate attenuation afforded to a population, not to an individual. Laboratory performance ratings generally represent a best-fit situation using trained and motivated subjects under closely supervised conditions, and consequently do not always correlate with the attenuation achieved in field situations (Berger, 2000). It is important to note that a revised NRR labeling regulation is currently being developed, which will address problems with the current labeling system.

Figure 1. Comparison of advertised NRRs as measured in the laboratory (yellow bars) and actual NRRs obtained during field studies (red bars). Note the lack of correlation between the laboratory and real-world data, including the discrepancy in relative ranking. From Berger (2000), p. 421, and www.e-a-r.com/pdf/hearingcons/earlog20.pdf. Used with permission.



Instead of automatically selecting a device with the highest available NRR, a better approach is to consider the noise level in which the device will be used. A moderate amount of attenuation may afford adequate protection in many industrial and recreational noise environments. Once protectors with sufficient attenuation characteristics have been identified, other aspects of the HPD actually become more important in determining the "best" protector. These aspects include comfort, convenience, communication needs, and cost—known as the *four Cs* of hearing protection (Stephenson, 2009). The "best" protector is the one that the noise-exposed individual will wear consistently and correctly, and the four Cs are at least as important as achieving the needed noise attenuation.

Uniformly attenuating (flat) hearing protectors provide an advantage in some situations. These are devices with a moderate amount of attenuation and are available in both muff and insert styles. A flat attenuation device distorts the incoming sound less than a conventional HPD because approximately equal attenuation is provided across all frequencies. This is in contrast to most other hearing protectors, where more attenuation is provided in the high frequencies and, consequently, the balance between the low and high frequencies is altered. Flat attenuation earplugs are sometimes sold as hearing protection for musicians, as they are intended to maintain the music's spectral balance while providing a moderate amount of sound attenuation. Thus, the resulting effect is that all frequency components of the music are heard, but at a uniformly reduced level. Industrial workers also can benefit from these types of HPDs, because machine/equipment sounds can essentially be heard undistorted. It is important to note that, like any other HPD, if these protectors are not fitted properly, it is likely that the low-frequency attenuation will decrease, and the overall attenuation will not be as uniform as intended.

Many other "special purpose" hearing protectors are available, which are designed for use in certain noise environments (e.g., impulse noise) or to enhance speech communication.

These devices include level-dependent/non-linear protectors, active noise reduction devices, and sound restoration or sound transmission devices, among others. Custom-molded earplugs are frequently relied upon to provide the "best" fit and the most attenuation, because they are individually made for each user. However, this assumption may not always be true. As Figure 1 indicates, field attenuation of custom earplugs may fall far short of the attenuation predicted by the NRR. Studies indicate that wearers do not always rate custom-molded earplugs as more comfortable than non-custom plugs (Davis, Murphy, Byrne, & Shaw, 2011; Wagoner et al., 2007). Although this seems counterintuitive, the accuracy of the ear impression, the quality of the manufactured earplug, and the wearer's ability to properly insert the device have considerable impact on the comfort and amount of attenuation obtained (Berger, 2000).

Communication Issues

Performance and safety aspects of a job often depend on a worker's ability to hear warning signals, machine sounds, and speech in the presence of high noise levels. These same needs apply to individuals engaging in hobbies, sports, or other activities where communication, environmental awareness, and safety are important. Interference with communication is one of the most common and legitimate complaints related to hearing protector use. The effect of noise on communication depends to a large extent on the spectrum of the noise, the hearing sensitivity of the listener, and the attenuation characteristics of the particular hearing protectors that are worn.

Hearing protectors attenuate both speech and background noise by equal amounts, and therefore should not adversely affect the speech reception ability of normal-hearing listeners. In fact, wearing hearing protection in high noise areas above 85 dBA actually improves speech recognition by lowering the overall sound level reaching a normal-hearing listener's ear, which reduces the potential for auditory distortion (Suter, 1992). There are situations, however, where a particular hearing protector may attenuate high frequencies substantially more than the low frequencies. In these cases, the residual low frequency sounds will mask or obscure the high frequency components, and cause the important consonant sounds to be unintelligible. Similarly, when hearing-impaired individuals wear hearing protection, the higher-frequency sounds may be attenuated to a point below the level of audibility. Therefore, too much attenuation (i.e., inadequate hearing protector selection or the use of hearing protection in areas with sound levels below 80 dBA) may cause communication problems for normal-hearing as well as hearing-impaired persons. Communication is usually enhanced when hearing protectors are selected to match the overall level and noise spectrum of the environment where they will be worn.

To address these issues, hearing protectors should be selected to provide sufficient protection against NIHL without unnecessarily inhibiting the natural perception of warning signals, machine operating sounds, speech, and the like. Unfortunately, few hearing protectors are chosen with communication requirements in mind. Overprotection may be considered as acceptable—even desirable—against many health and safety hazards, but overprotection against noise exposure may cause significant communication problems and also can lead to the deliberate misuse or rejection of hearing protectors and jeopardize safety. Properly fitted individuals are more likely to wear their protectors consistently because they will not be unnecessarily "isolated" from others, and they will be less likely to intentionally disable protectors to decrease attenuation.

Hearing Protector Fit-Testing

Fit-testing is emerging as a "best practice" in hearing loss prevention programs (Hager, 2011). These efforts are fueled by the development of several commercially available field monitoring systems that allow the measurement of hearing protector attenuation on an individual wearer in an office or field-setting. This personalized approach eliminates the need for single-number ratings (e.g., NRR) and the rough approximations associated with them. Fit-testing also provides the wearer with immediate feedback on the level of protection received, as the user is learning to fit the protector on him/herself.

Quantitative and qualitative results can be derived from hearing protector fit-testing. Quantitative methods typically estimate attenuation at one or more frequencies and compute a personal attenuation rating (PAR). Qualitative methods may provide just a pass/fail indication of fit. For insert-type protectors, field monitoring systems are available that essentially replicate the laboratory attenuation tests used to determine the NRR, except that the stimuli are presented via headphones rather than loudspeakers in a diffuse sound field. These systems measure the hearing thresholds of the HPD wearer at selected test frequencies with and without the HPD in place; the difference in hearing threshold at each test frequency is equal to the amount of noise attenuation provided by the hearing protector. A different type of field measurement system uses a loudness balance procedure that permits testing of earplug attenuation in environments where the background noise might not be suitable (i.e., low enough) for threshold-based methods. The user sequentially performs a loudness balance between unoccluded and occluded conditions to estimate the attenuation of the device.

For muff-type protectors, field measurement systems typically include two microphones, one located under the muff at the entrance to the ear canal and the second located outside the cup of the muff. The difference in sound pressure level between the two microphones represents the attenuation provided by the earmuff. Testing may be conducted in a location where the hearing protectors will be worn; therefore, the attenuation measured will be accurate while the wearer is in that particular noise environment. Use of the protector in noises with differing spectral characteristics will likely affect the amount of noise attenuation provided.

Acoustic measurements with earplugs are also possible, using a microphone-in-real-ear (MIRE) technique. Similar to field measurements of earmuffs, the sound level in the ear canal under the hearing protector is simultaneously measured with the level outside the earplug. MIRE measurements are usually conducted with probe measurement systems similar to those used for evaluating hearing aid performance. The probe tube may be situated between the earplug and the canal wall or may be inserted through a hole drilled through a test earplug specifically for this purpose. Instructing the user to insert the earplug as it is normally worn will enable the examiner to obtain attenuation for the individual user.

Individual/field measurement systems are, in general, well received by HPD wearers. People are typically interested in how well their protectors function, and they appreciate the attention to their individual needs. Individual HPD attenuation measurements are particularly valuable as a training tool during the initial selection of insert-type HPDs (Schulz, 2011). Assistance can be provided to the wearer during initial fitting, and an on-the-spot attenuation measurement can be obtained. If the measured attenuation is insufficient, the person should re-fit the HPD and repeat the measurement procedure until a satisfactory result is achieved. These measurements document that adequate and proper protection was provided to the wearer and empower individuals to take on the responsibility of effective HPD usage.

Field measurement systems perform several functions for the hearing conservation program administrator, including (a) training of wearers in correct fitting procedures, (b) random as well as routine (e.g., annual) field sampling of protector effectiveness, (c) documentation that training was provided and that proper protection was provided to the employee, and (d) identification of failing or deteriorating protectors and changes in ear physiology. Careful hearing protector selection and periodic checks with a field monitoring system should result in a successful hearing protector management program. These systems also validate the choice of hearing protection should potential liability issues arise in the future.

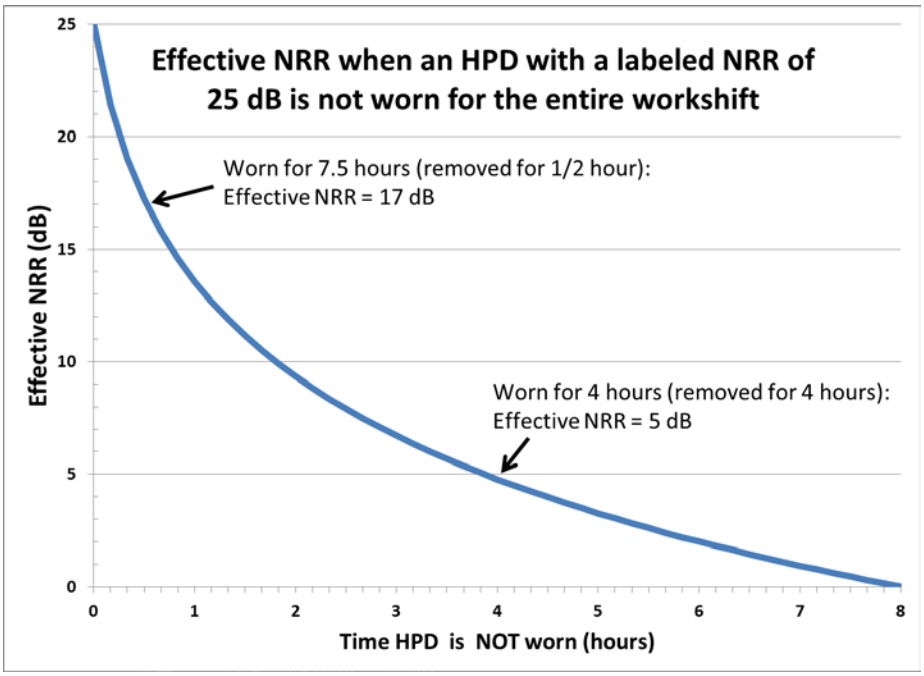
To prevent future cases of NIHL, clinical audiologists have the responsibility to ensure that noise-exposed patients can correctly demonstrate how to fit their own hearing protectors. Considering that new field attenuation measurement systems are both portable and relatively inexpensive, virtually every audiology clinic could own one. Current Procedural Terminology (CPT) Code 92596 is used for the evaluation of a hearing protector. The Healthcare Common

Procedure Coding System (HCPCS) Code V5264 (ear mold/insert, not disposable, any type) could be used for the hearing protector itself. Insurance coverage varies, so be sure to check whether these costs will be reimbursed for each particular case.

Importance of HPD Wear-Time

Perhaps the major reason why hearing protective devices fail to protect individuals from noise exposure is because protectors are not always worn when they should be. Failure to wear hearing protection for even a small fraction of the total exposure time will greatly reduce the effective protection received from an earplug/earmuff. For instance, a HPD with a NRR of 25 dB not worn for 30 minutes out of an 8-hour workday will lose nearly 8 dB of its labeled attenuation (see Figure 2). The same HPD with a 25 dB NRR will effectively provide only 5 dB of attenuation if worn for only half of an 8-hour workshift. Of course, the effective attenuation will be even less if the protector is not inserted/adjusted correctly when it is being worn.

Figure 2. Graph showing the "effective" NRR as a result of removing the hearing protector for different amounts of time. (Note: This graph is based on an OSHA 5 dB exchange rate; the decrease is even more dramatic when a NIOSH-recommended 3 dB exchange rate is used.)



Education and Training Considerations

Providing a person with appropriate hearing protection is no guarantee that the person will actually wear it. Education/training is needed to ensure that the noise-exposed individual understands the importance of wearing HPDs. Here again, industrial audiology provides a good model for hearing loss prevention in other contexts. The OSHA Hearing Conservation Amendment (OSHA, 1983) specifies that employee training should cover the effects of noise on hearing; the purpose of hearing protectors; the advantages, disadvantages, and attenuation of various types; and instructions on their selection, fitting, use, and care. Obviously, educational materials must be factual and impart appropriate knowledge and skills. However, to be truly effective, the information should be presented such that it will positively impact hearing loss prevention behaviors within an individual. It is not enough simply to present the facts associated with NIHL and expect people to change their attitudes, beliefs, and behaviors regarding the use of hearing protection—the rising obesity epidemic, despite widespread

knowledge of the importance of proper diet and exercise, illustrates that! Knowledge and skill competency is a necessary, but not sufficient, factor leading to lasting behavior change. Addressing motivational aspects of behavior change is also required (Robson et al., 2010).

Message Framing

Health communication research can guide the development of persuasive messages targeting all types of health issues from smoking to obesity (NIH, 2005). Much can be gained by applying lessons learned in this discipline to hearing health promotion. One such lesson is the need to carefully and precisely word health and safety messages so that they influence group social norms, individual beliefs, and corresponding behaviors. *Message framing* is one important aspect of targeting messages that affects how people perceive a health threat. Simply put, training can emphasize the consequences of a health behavior in terms of either the benefits associated with changing one's behavior (i.e., *gain-framing*) or the harm associated with not changing one's behavior (i.e., *loss-framing*). Health communication research suggests that gain-framed messages are generally better for promoting prevention behaviors (e.g., "Wear hearing protection and keep your hearing and quality of life") and loss-framed messages are better at promoting detection behaviors (e.g., "If you don't take your yearly hearing test, you can lose your hearing and won't even realize it until it is too late."). The difference is related to the level of risk in the proposed behavior. In risky situations, people worry more about suffering losses than gaining benefits, so they pay attention to loss messages and are more willing to act. Asking a noise-exposed person to take a hearing test involves psychological risk—the test may force them to confront a hidden, potentially serious hearing problem. However, encouraging noise-exposed people to wear hearing protection is less risky and even gives them some control over what they can do to stay well. Promoting HPD use, therefore, is suitable for gain framing. When educating and counseling clients about hearing loss prevention, audiologists should be careful to frame the message in the way most likely to achieve the desired outcome. For example, Rothman, Salovey, Antone, Keough, and Martin (1993) found that gain framing (e.g., "Using sunscreen prevents cancer") resulted in more sunscreen usage than loss framing (e.g., "Not using sunscreen doubles your risk of cancer").

Health Promotion Models

Using health communication practices within the theoretical framework of a health promotion model leads to the development of even more effective hearing conservation interventions (Borchgrevink, 2003; Kerr, Lusk, & Ronis, 2002; Lusk, Ronis, & Baer, 1995; Lusk et al., 2003; Williams, Purdy, Storey, Nakhla, & Boon, 2007). Health promotion models predict behavior change by identifying factors associated with individual's knowledge, attitudes, beliefs, and behavioral intentions. One of the earliest of these models, with a lengthy body of research supporting its validity, is the Health Belief Model (Rosenstock, 1974). This model suggests that behavioral responses to a health risk (such as NIHL) are strongly related to several measurable constructs:

1. *Susceptibility:* Beliefs about one's vulnerability to a particular health risk.
2. *Seriousness:* Beliefs regarding the seriousness of developing the health problem; that is, how seriously would the health issue affect one's quality of life?
3. *Benefits of taking action:* Firmness of beliefs regarding whether steps taken to protect oneself will be effective.
4. *Barriers:* Beliefs regarding the barriers to adopting protective behaviors, and one's ability to overcome those barriers.

The Health Belief Model predicts that individuals cognitively process these constructs in order to assess the consequences of taking action or doing nothing. Later iterations of the model added that an understanding of "cues to action" and personal "self-efficacy" to perform the desired behavior were modifying factors in the model's framework. The Health Belief Model served as the foundation for work by NIOSH researchers developing a comprehensive hearing

loss prevention training program for carpenters (Stephenson & Stephenson, 2011). Summarizing their findings, hearing protector use—or non-use—boils down to four issues:

- Am I aware of the problem?
- Is it relevant to me?
- Is it important to me?
- Can I do anything about it?

Education and training must be designed to positively influence behavioral intentions to perform an activity (e.g., reduce noise exposures, use hearing protection). Without first establishing this behavioral intention, the actual behavior is unlikely to follow. Likewise, behavioral intentions are influenced by several antecedents. For example, in order to foster behavioral intentions to use hearing protectors, education and training must ensure that individuals understand the risks associated with their exposures; their susceptibility to hearing loss; the impact of hearing loss on quality of life; and the benefits of preventive actions, including when and how to wear hearing protectors. Patient counseling must focus on the specific individual barriers to hearing protector use (as voiced by the client) and develop mastery of needed skills so that a high degree of self-efficacy is felt by participants upon completion of training (e.g., the individual can properly insert the earplugs).

Clinical Indicators of Hazardous Noise Exposure

Pure-tone audiometry identifies existing hearing loss, but it is not an effective tool for early detection and prevention. Audiologists should include additional tests that may allow early identification and/or point to potential risks before permanent hearing loss occurs. Proactively identifying red flags that indicate potential damage to hearing early on could prevent further loss. Look for:

- Evidence in the case history of:
  - Impulse noise exposure from fireworks or firearms
  - Routine participation in noise hazardous activities
  - Ototoxic drug or chemical exposure
  - Aural fullness, tinnitus, or pain after loud sound exposure
- Reduced otoacoustic emission (OAE) magnitude
- Poor speech discrimination in noise unexplained by pure tone thresholds (Giguère, Laroche, Vaillancourt, & Soli, 2009; Killion, Niquette, Gudmundsen, Revit, & Banjerjee, 2004)
- Delayed acoustic reflex offset time (Gorga & Stelmachowicz, 1983)
- Abnormal findings on ultra-high frequency audiometry and retrocochlear/central auditory processing tests, which could indicate either noise-induced or chemically induced hearing changes

Targeting Special Populations

Some individuals are particularly vulnerable to hearing risks or have inadequate access to hearing loss prevention services. These underserved populations include:

- Young children
- Elderly individuals
- Persons with pre-existing hearing impairment
- Non–English-speaking clients and those with poor literacy
- Patients treated with ototoxic medications

- Self-employed workers and workers in small businesses
- Seasonal, temporary, or mobile workers
- Workers in unregulated industries, such as music/entertainment, agriculture, oil and gas extraction, or construction
- Uninsured or underinsured individuals
- Persons who live in remote locations without easy access to health care

Audiologists should make a special effort to reach out to these populations and design hearing loss prevention strategies that meet their unique needs. One example of targeting a very select group of individuals is the Musicians' Hearing Center at the University of Pittsburgh Medical Center, which has focused on school-age band/orchestra students (Palmer, 2007). In many cases, these populations will not initiate an audiology consultation; health-care professionals must seek them out and look for opportunities to offer hearing education and services. Furthermore, due to access issues or personal/cultural aversions, repeat visits may be unlikely. In such situations, leaving the client with the necessary skills and self-efficacy to continue following a path toward hearing health is particularly important (Smith, 2009).

Promoting Hearing Loss Prevention Locally & Globally

Public health initiatives are organized community efforts to prevent disease and promote health. Public health campaigns have been successful in reducing other risky health behaviors—for example, smoking: 42% of the U.S. population were current smokers in 1965 and only 19% were in 2010 (Centers for Disease Control and Prevention [CDC], 2012). Presumably, most Americans are aware that tooth-brushing prevents tooth decay, seatbelts reduce traffic fatalities, and exercise reduces obesity. However, how many Americans have ever heard a public service announcement about using hearing protection devices to prevent hearing loss? Audiologists must be more proactive in creating and supporting campaigns that increase the awareness of the value of good hearing and the ways to preserve it. Many organizations have ready-made materials for such efforts. Examples of public health interventions, awareness campaigns, and other initiatives include the following.

- *Dangerous Decibels©, www.dangerousdecibels.org*: The Dangerous Decibels project is a public health campaign spearheaded by the Oregon Hearing Research Center at the Oregon Health & Science University. It combines education, museum exhibits, and basic research to reduce the incidence and prevalence of NIHL and tinnitus by changing knowledge, attitudes, and behaviors of school-aged children. Project partners conduct Educator Training Workshops to prepare potential instructors to deliver their own 50-minute Dangerous Decibels evidence-based intervention. The workshop is intended for nurses, teachers, audiologists, health professionals, and anyone else who is interested in teaching this valuable lesson.
- *Safe-in-Sound™ Excellence in Hearing Loss Prevention Award, www.safeinsound.us*: NIOSH, in partnership with NHCA, created this awards program for industry. The objectives of this award are to recognize organizations that document measurable achievements in hearing loss prevention and to obtain and disseminate information on their real-world successes. The awards facilitate the sharing of leading-edge best practices to improve hearing loss prevention programs in the workplace.
- *WISE EARS!®, www.nidcd.nih.gov/health/wise*: For the past 13 years, WISE EARS! has been a popular national public education campaign sponsored by the National Institute on Deafness and Other Communication Disorders (NIDCD) to prevent NIHL. The NIDCD expanded its NIHL prevention efforts by launching "It's a Noisy Planet: Protect Their Hearing" (www.noisyplanet.nidcd.nih.gov). This national public education campaign is designed to increase awareness among parents of children ages 8 to 12 years about the causes and prevention of NIHL. With this information,

parents and other adults can encourage children to adopt healthy hearing habits before and during the time that they develop listening, leisure, and working habits.

- *Listen To Your Buds, www.listentoyourbuds.org*: ASHA developed the award-winning "Listen To Your Buds" campaign to raise awareness about hearing health. The campaign educates the very young about practicing safe listening habits, such as turning down the volume and taking listening breaks when they use personal audio technology, so they can avoid the devastating, lifelong effects that can accompany hearing loss.

Many more awareness campaigns are sponsored locally by speech and hearing clinics or other organizations. Ideas and information from the national or government-sponsored initiatives can be tailored to meet local objectives. Support for these efforts may come from local businesses or charities. Online blogs or periodic newsletters can be used to promote upcoming events. A good place to start is the opportunities ASHA provides to raise awareness about communication disorders during the annual Better Hearing and Speech Month celebration. Other professional organizations sponsor similar campaigns throughout the year. As an additional incentive, these types of events may be viewed as an alternative to marketing or advertising when the activity publicizes the local audiology practice at the same time.

Evaluation of Intervention Effectiveness: Are You Making a Difference?

Although patient education and public health campaigns are important to preventing hearing losses, simply conducting these activities is no guarantee of their effectiveness. Outcomes must be measured in order to know if the efforts have been successful. Many people continue to eat high-fat diets despite the many campaigns promoting health eating; outcome data are necessary to evaluate past efforts and adjust the approach for future activities as needed (Pietranton & Baum, 1995).

Parameters to evaluate when considering intervention effectiveness include:

- What was accomplished?
- How long did it take to accomplish it?
- What were the associated costs?
- How did patients/participants react?

Audiologists routinely collect a wealth of information on their patients/clients, which, in a de-identified manner, provides a strong foundation for evaluating outcomes. Audiologists have readily available clinical measures (pure tone thresholds, speech audiometry, immittance, OAEs, auditory evoked potentials) from which changes in health outcomes can be directly evaluated. Audiologists also have case history and interview information on risk factors, health behaviors, hearing protector comfort, and patient satisfaction, from which functional benefit can be measured and long-term hearing outcomes inferred (Robinson, 1999). Using existing data will provide useful initial measures. As practitioners become more experienced with evaluating outcome data, they may add specific measures in advance to answer specific questions about an intervention. Outcome measures will also provide the evidence necessary for securing and expanding financial and organizational support for future prevention initiatives.

In addition to measuring the effectiveness of their own interventions, audiologists should utilize data provided by other practitioners in deciding the best approach at both the clinical (individual patient) and population level. *Evidence-based practices* are health practices that use the best available scientific evidence in clinical decision-making, policy-setting, and public health campaign content. This approach requires an assessment of the strength of all scientific evidence available regarding the risks and benefits of each intervention (including

lack of intervention) and diagnostic procedure. The evidence-based approach is relevant not just to clinical audiology but to all areas of audiological practice, including research and public health outreach.

The Cochrane Collaboration publishes systematic reviews of specific clinical issues, providing an unbiased assessment of the effectiveness of various interventions and treatments (www.cochrane.org/cochrane-reviews). Cochrane Reviews are available on such issues as:

- Interventions to prevent hearing loss caused by noise at work
- The effectiveness of interventions to promote the wearing of hearing protection to reduce exposure to noise among workers
- Pre-employment health examination of workers to prevent injuries and disease
- Using e-mail for providing information on disease prevention and health promotion

Making use of evidence-based practices will increase the likelihood of success by implementing procedures and programs that have been proven to be successful.

Conclusion

Audiologists are aware of the impact of hearing loss on an individual and how that affects social interactions. As hearing professionals, audiologists have a professional obligation to rise to the challenge of prevention—both in the clinic with individual patients and in the community with society at large. Hearing loss prevention efforts should not be limited to workplace hearing conservation programs. Opportunities exist to get involved in reducing the burden of hearing impairment by expanding your efforts to reach a larger audience. Evidence-based practices should guide service delivery and enable the application of effective intervention strategies. Audiologists are in a unique position to advocate for better hearing by focusing not only on rehabilitation but also prevention. Other clinical disciplines include a strong preventive focus (e.g., dentists advocate for the prevention of tooth decay, oncologists promote smoking cessation, etc.). Our status as an autonomous profession demands that audiologists become an equally strong force for hearing loss prevention.

References

American Academy of Audiology. (2004). *Scope of practice*. Available online at www.audiology.org/resources/documentlibrary/Pages/ScopeofPractice.aspx

American Academy of Audiology. (2012). *Standards of practice for audiology*. Available online at www.audiology.org/resources/documentlibrary/Documents/StandardsofPractice.pdf

American Speech-Language-Hearing Association. (2004). *Scope of practice in audiology* [Scope of Practice]. Available from www.asha.org/policy

Berger, E. H. (2000). Hearing protection devices. In E. H. Berger, L. H. Royster, J. D. Royster, D. P. Driscoll, & M. Layne (Eds.), *The noise manual* (5th ed., pp. 379–454). Fairfax, VA: American Industrial Hygiene Association.

Borchgrevink, H. M. (2003). Does health promotion work in relation to noise? *Noise & Health, 5*(18), 25–30.

Centers for Disease Control and Prevention. (2012). *Trends in current cigarette smoking among high school students and adults, United States, 1965–2010*. Available online at www.cdc.gov/tobacco/data_statistics/tables/trends/cig_smoking/index.htm

Cohen, S. M., Labadie, R. F., & Haynes, D. S. (2005). Primary care approach to hearing loss: The hidden disability. *Ear, Nose, and Throat Journal, 84*(1), 26, 29–31, 44.

Davis, R. R., Murphy, W. J., Byrne, D. C., & Shaw, P. B. (2011). Acceptance of a semi-custom hearing protector by manufacturing workers. *Journal of Occupational and Environmental Hygiene, 8*(12), D125–D130.

Franks, J. R., Graydon, P. S., Jeng, C., & Murphy, W. J. (2003). *NIOSH Hearing Protector Device Compendium*. Available through www.cdc.gov/niosh/topics/noise/hpcomp.html

Giguère, C., Laroche, C., Vaillancourt, V., & Soli, S. (2009, August). *A predictive model of speech intelligibility in noise for normal and hearing-impaired listeners wearing hearing protectors*. Presented at Inter-Noise 2009, Ottawa, Canada.

Gorga, M. P., & Stelmachowicz, P. G. (1983). Temporal characteristics of the acoustic reflex. *Audiology, 22*(2), 120–127.

Hager, L. D. (2011). Fit-testing hearing protectors: An idea whose time has come. *Noise & Health, 13*(51), 147–151.

Henderson, E., Testa, M. A., & Hartnick, C. (2011). Prevalence of noise-induced hearing-threshold shifts and hearing loss among US youths. *Pediatrics, 127*(1), e39–46.

Johnson, A. C., & Morata, T. C. (2010). 142: Occupational exposure to chemicals and hearing impairment. The Nordic Expert Group for Criteria Documentation of Health Risks from Chemicals, Nordic Expert Group, Gothenburg. *Arbete och Hälsa, 44*(4), 177 pp. Available online at http://hdl.handle.net/2077/23240

Kerr, M. J., Lusk, S. L., & Ronis, D. L. (2002). Explaining Mexican-American workers' hearing protection use with the Health Promotion Model. *Nursing Research, 61*(2), 100–109.

Killion, M. C., Niquette, P. A., Gudmundsen, G. I., Revit, L. J., & Banjerjee, S. (2004). Development of a quick speech-in-noise test for measuring signal-to-noise ratio loss in normal-hearing and hearing-impaired listeners. *Journal of the Acoustical Society of America, 116*(4, Pt. 1), 2395–2405.

Lusk, S. L., Ronis, D. L., & Baer, L. M. (1995). A comparison of multiple indicators: Observations, supervisor report, and self-report as measures of workers' hearing protection use. *Evaluation & the Health Professions, 18*(1), 51–63.

Lusk, S. L., Ronis, D. L., Kazanis, A. S., Eakin, B. L., Hong, O. & Raymond, D. M. (2003). Effectiveness of a tailored intervention to increase factory workers use of hearing protection. *Nursing Research, 52*, 289–295.

Maisonneuve, N., Stevens, M., & Ochab, B. (2010). Participatory noise pollution monitoring using mobile phones. *Information Polity, 15*(1), 51–71.

National Institute on Deafness and Other Communication Disorders. (2010). *Quick statistics*. Retrieved November 5, 2012, from www.nidcd.nih.gov/health/statistics/Pages/quick.aspx

National Institute for Occupational Safety and Health. (1994). *The NIOSH Compendium of Hearing Protection Devices*. Publication No. 95-105. Cincinnati, OH: Author.

National Institute for Occupational Safety and Health. (1998). *NIOSH criteria for a recommended standard: Occupational noise exposure; revised criteria.* Publication No. 98-126. Cincinnati, OH: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Institute for Occupational Safety and Health. Available online at www.cdc.gov/niosh/docs/98-126/pdfs/98-126.pdf

National Institutes of Health. (1990, January 22–24). Noise and hearing loss. *NIH Consensus Statement, 8*(1), 1–24.

National Institutes of Health. (2005). *Theories at a glance: A guide for health promotion* (2nd ed.). Washington, DC: U.S. Department of Health and Human Services.

Niskar, A. S., Kieszak, S. M., Holmes, A. E., Esteban, E., Rubin, C., & Brody, D. J. (2001). Estimated prevalence of noise-induced hearing threshold shifts among children 6 to 19 years of age: The third National Health and Nutrition Examination Survey, 1988–1994, United States. *Pediatrics, 108*(1), 40–43.

Occupational Safety and Health Administration. (1971). *Occupational noise exposure, 29 CFR 1910.95, Federal Register 36(105), 10518*. Available online at www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9735

Occupational Safety and Health Administration. (1983). *Hearing Conservation Amendment; Final Rule, 29 CFR 1910.95, Federal Register 48(46), 9738-9785.* Available online at www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=9735

Palmer, C. V. (2007). Hearing protection for young musicians: Focusing on life-long habits. *NHCA Spectrum, 24*(3), 1, 8–9.

Pietranton, A. A., & Baum, H. M. (1995). Collecting outcome data: Existing tools, preliminary data, future directions. Task Force on Treatment Outcome and Cost Effectiveness. *Asha, 37*(11–12), 36–38.

Robinson, K. (1999). Evidence-based medicine and its implications for audiological science. *British Journal of Audiology, 33*, 9–16.

Robson, L., Stephenson, C., Schulte, P., Amick, B., Chan, S., Bielecky, A., . . . Grubb, P. (2010). A systematic review of the effectiveness of training & education for the protection of workers. Toronto, Canada: Institute for Work & Health; Cincinnati, OH: National Institute for Occupational Safety and Health. DHHS (NIOSH) Publication No. 2010-127.

Rosenstock, I. M. (1974). The Health Belief Model and preventive health behavior. *Health Education Monographs, 2*, 354–386.

Rothman, A. J., Salovey, P., Antone, C., Keough, K., & Martin, C. D. (1993). The influence of message framing on intentions to perform health behaviors. *Journal of Experimental Social Psychology, 29*, 408–433.

Schneider, J. M., Gopinath, B., McMahon, C. M., Britt, H. C., Harrison, C. M., Usherwood, T., . . . Mitchell, P. (2010). Role of general practitioners in managing age-related hearing loss. *Medical Journal of Australia, 192*(1), 20–23.

Schulz, T. Y. (2011). Individual fit-testing of earplugs: A review of uses. *Noise & Health, 13*(51), 152–162.

Shargorodsky, J., Curhan, S. G., Curhan, G. C., & Eavey, R. (2010). Change in prevalence of hearing loss in US adolescents. *The Journal of the American Medical Association, 304*(7), 772–778.

Smith, S. (2009). Reaching the underserved. *Advance for Hearing Practice Management.* Retrieved August 7, 2012, from http://audiology.advanceweb.com/Article/Reaching-the-Underserved-2.aspx

Stephenson, C. M., & Stephenson, M. R. (2011). Hearing loss prevention for carpenters: Part 1—Using health communication and health promotion models to develop training that works. *Noise & Health, 13*(51), 113–121.

Stephenson, M. R. (2009). Hearing protection in the 21st century: They're not your father's earplugs anymore. *Seminars in Hearing, 30*(1), 56–64.

Suter, A. H. (1992). *Job performance in noise: A review* (ASHA Monograph 28). Rockville, MD: American Speech-Language-Hearing Association.

Wagoner, L., McGlothlin, J., Chung, K., Strickland, E., Zimmerman, N., & Carlson, G. (2007). Evaluation of noise attenuation and verbal communication capabilities using three ear insert hearing protection systems among airport maintenance personnel. *Journal of Occupational and Environmental Hygiene, 4,* 114–122.

Williams, W., Purdy, S. C., Storey, L., Nakhla, M., & Boon, G. (2007). Towards more effective methods for changing perceptions of noise in the workplace. *Safety Science, 45*(4), 431–447.

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In This Issue

Coordinator's Column

Roberta Aungst

Greetings, Affiliates!

Welcome to our 2012 issue of *Perspectives on Public Health Issues Related to Hearing and Balance*. The focus for SIG 8 for 2012 has been noise. You will find three excellent articles in this issue of *Perspectives* dealing with this 2012 focus area. Noise is a major public health issue. We are inundated with sound everywhere these days, even at the supermarket, and though these sounds (usually music) are generally not too loud, they can be annoying. Does this affect our buying habits, positively or negatively? How many of us are able to tune it out? There seems to no longer be such a thing as peace and quiet unless you create it at home.

At the 2012 ASHA Convention in Atlanta, SIG 8 sponsored two sessions related to noise and coordinated the Joint Audiology session, with all audiology SIGs participating and presenting on topics related to noise.

As a heads-up, our focus for our 2013 issue will be falls prevention. Let us know if you have anything that would be of interest to our members and if you have any ideas for *Perspectives* articles or other continuing education (CE) opportunities.

I would like to take this opportunity to thank Ann Dix and Mary McDaniel, members of our inaugural Coordinating Committee; they are rotating off the Committee at the end of this year. Their contributions in getting the new SIG 8 off the ground have been immense. But, they are not going to ride off into the sunset. They have agreed to serve on our CE Committee and will be working with Tina Penman, our new CE Content Manager; Ted Madison has also joined the CE Committee, along with Christa Thiemann (who is on for 2012 only). I'd like to give a welcome to Christa Thiemann and Barbara Weinstein, who will be joining the Coordinating Committee in 2013. The other members of the Coordinating Committee are Roberta Aungst, Coordinator; Ingrid Blood, Associate Coordinator; and John Ribera, *Perspectives* Editor.

As a new policy in 2012, all SIG affiliates can read all SIGs' issues of *Perspectives*. Remember that as a SIG 8 affiliate, you can obtain CE credits (CEUs) by passing the self-study exam for this issue through the ASHA Store at a cost of $5.00 per exam.

And lastly, I encourage you all to check out the SIG 8 ASHA Community page; there have been many interesting posts this year. I encourage you to jump in and post any thoughts and ideas you may have; your fellow affiliates and the Coordinating Committee are eager to hear from you. Sharing thoughts, ideas, and information is what this is all about. Let's hear from you!