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## Noise-Induced Hearing Loss in Children

What Educators Need to Know

By Anne Kathryn Haller and Judy K. Montgomery

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To benefit from our education programs, children and youth must be able to hear adequately and consistently. Sound like common sense? But read on to discover some surprising, even alarming, facts about hearing loss.

Hearing loss caused by exposure to recreational and occupational noise results in devastating disability that is virtually 100 percent preventable. Noise-induced hearing loss (NIHL) is the second most common form of sensorineural hearing deficit, after presbycusis (age-related hearing loss). (Rabinowitz, 2000, p. 1)

According to Kulman (1999), in her article, "What'd you say?" for nearly one third of the 28 million Americans with hearing loss, "Toxic noise is the main culprit" (p. 2). But perhaps more alarming was her identification of the sources as tools and toys of recreation. Americans are pounding their ears with gas-powered leaf blowers and high-amplified stereos, with NASCAR races and 1,875-watt hair dryers, even, remarkably, with children's playthings. (p. 2)



H.E.A.R., or "Hearing Educators and Awareness for Rockers," an organization started in 1988 by rock and roll musician Kathy Peck and physician Dr. F. Gordon in San Francisco, has a special appeal for students. Peck's motivation to start the organization came from having her own hearing damaged from repeated exposure to excessively loud music. This happened as a result of her work as a bass player and singer for the San Francisco punk band, The Contractions. H.E.A.R. is dedicated to educating the public regarding the awareness of hearing damage. They provide public service announcements in mainstream media and earplugs to those attending concerts. Musician Pete Townshend of the rock group The Who is a leading supporter of H.E.A.R. A passage in a feature article from the House Ear Institute Internet site states:

***Americans are pounding their ears with gaspowered leaf blowers and high-amplified stereos, with NASCAR races and 1,875-watt hair dryers, even, remarkably, with children's playthings. (Kulman, 1999)***

In 1987, an article in the Los Angeles Times told the world of Pete Townshend's battle with tinnitus and his hearing loss. In the last line of the article, Townshend said that the saddest circumstance of his hearing loss was not being able to hear his children speak to him. The high frequencies, where children's voices are pitched, are usually the first to be affected by noise-induced hearing loss. <http://web.archive.org/web/20020913041122/www.hei.org/>

In this article, we define noise-induced hearing loss (see box, “What is Noise-Induced Hearing Loss?”), discuss what can cause it, and describe what effects it can have on those who have incurred a hearing loss. We outline how educators can assist a student with hearing loss in the classroom, and how teachers might educate other students in socially interacting with the student. Educators also need to work with parents and other adults to help them understand the effects of hearing loss and how they can prevent it. Teachers and parents can insist that students practice preventative techniques to protect their hearing. It is more than turning down the volume; it is about understanding why the volume needs to be turned down—to ensure that it always will be turned down.

We offer preventative techniques to ensure that children and young adults will have an equal opportunity for academic success, that educators and families can make informed decisions, and that communication professionals in schools can contribute to the 2010 health objectives for the nation (see “Healthy People 2010” by the U.S. Department of Health and Human Services, 2000).

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### **What Is Noise- Induced Hearing Loss?**

What is noise-induced hearing loss, and how does it differ from other forms of hearing loss? In general, it is a hearing loss that comes on gradually so that the individual may not even realize it is happening. It is caused by frequent exposure to loud noises. Loud is defined by the number of decibels the noise generates. Noise above 75 to 85 decibels can cause damage (Noise and Hearing Loss, NIH consensus Statement Online 1990). The most significant aspect of noise-induced hearing loss is that it is preventable. Rabinowitz (2000), defined noise-induced hearing loss as a high-frequency sensorineural hearing deficit caused by chronic exposure to excessive sound levels. A panel of biomedical and behavioral scientists, health care providers, and the public was brought together for the National Institutes of Health Consensus Development Conference on Noise and Hearing Loss in January of 1990. The panel reported on the definition and impact of noise-induced hearing loss as follows:

Sounds of sufficient intensity and duration will damage the ear and result in temporary or permanent hearing loss. The hearing loss may range from mild to profound and may also result in tinnitus. The effect of repeated sound over-stimulation is cumulative over a lifetime and is not currently treatable. Hearing impairment has a major impact on one’s communication ability and even mild impairment may adversely affect the quality of life. Unfortunately, although [noise-induced hearing loss] NIHL is preventable, our increasingly noisy environment places more and more people at risk. (Noise and Hearing Loss, NIH consensus Statement Online, 1990, p. 3)

### **Public Awareness**

According to the National Institute on Deafness and Other Communication Disorders (NIDCD, 1999), “Approximately 10 million Americans have permanent, irreversible hearing loss from noise or trauma” (p. 22). Further, the National Institute on Occupational Safety and Health announced:

Additionally, 30 million people are estimated to be exposed to injurious levels of noise each day. Noise-induced hearing loss is the most common occupational disease and the second most frequently self-reported occupational illness or injury. (American Speech-Language- Hearing Association, 2000, p. 22; Griffith, 2003).

The public needs to be educated about noise-induced hearing loss to protect themselves from hearing loss. Children especially need to be protected because noise-induced hearing loss can cause permanent hearing damage, and it can be completely prevented. Herer, Knightly, and Steinberg (2002) specifically addressed educators who are responsible adults in place of parents during school hours. These authors cautioned:

Mild to moderate sensorineural hearing losses also may result from traumatic noise levels. In children and adolescents, sources of excessive impact noise include firecrackers, fireworks, and air guns. Transient or permanent sensorineural hearing loss may occur also with exposure to very loud sound over time. For example, using stereo headphones at high-intensity levels, playing in school bands, and attending rock concerts where noise levels may exceed 100 dB–110 dB are each highly suspect for causing permanent or temporary hearing loss. (p. 17)

In "When Is Life Too Loud?" Brown (2001) discussed a study that was conducted by Evans and his colleagues at Cornell University. The study compared 60 students attending an elementary school in the flight path of a major New York City airport with students in the same district and grade who were not subjected to this daily noise. Evans reported that the students performed lower on reading and language tests when compared to children from a less noisy neighborhood. He went on to suggest:

Kids cope with a loud world by tuning out the background so much that they begin filtering out the finer sounds of speech as well. That, in turn, affects their ability to learn to read, since speech recognition—"sounding out" words—is a big part of early reading. (p. 3)

***Approximately 10 million Americans have permanent, irreversible hearing loss from noise or trauma. (NIDCD, 1999)***

All of us are constantly exposed to sounds in our environment. The intensity of those sounds and the duration of exposure to loud sounds are what are most important when attempting to avoid hearing loss. According to the health consensus panel (Noise and Hearing Loss, 2001)

The most widely used measure of a sound's strength or amplitude is called "sound level," measured by a sound-level meter in units called "decibels" (dB). For example, the sound level of speech at typical conversational distances is between 65 and 70 dB. There are weaker sounds, still audible, and of course much stronger sounds. Those above 85 dB are potentially hazardous. (p. 5)

See Table 1 for a comparison of noise levels (in decibels) of typical activities. This chart can help educators, families, and the public understand what constitutes various degrees of noise.

Loud music is one area of concern, especially with teenagers who seem to enjoy their music more if the volume is turned up. Who hasn't sat in a car at a stoplight with the windows rolled up and still heard the "boom, boom, boom" from a neighboring car radio? Other areas of recreation can also be of concern. Kulman discussed the growing phenomenon of hearing loss in younger people. In her article, "What'd You Say?" Kulman (1999) stated:

The movies Armageddon and Saving Private Ryan had sound tracks that reached 118 decibels. A study from the mid 1990s found that 80 percent of the health clubs and fitness spas surveyed cranked up the music in group exercise classes from 105 to 110 decibels, and a few exceeded 120 decibels. (p. 4)

Kulman continued:

Some people are actually addicted to listening to loud music, a new study shows. But toxic noise is not always voluntary. The shelves in Nadler's office at the League for the Hard of Hearing are lined with toys, some testing as loud as 135 decibels with a sound meter. Among them is a Playskool clock that registers 79 decibels at adult arm's length but 125 decibels at close range each time it tells infants, "Let's have fun." Even if the toys don't sound as loud to adults, Nadler argues that kids tend to hold them up to their ears when they play. "And they are not going to say, "Mommy, I have tinnitus." (p. 4)

Herer et al. (2002) gave three warning signs of a noise-hazardous area: "having to shout to be understood within 3 feet of the listener; experiencing ringing, (i.e., tinnitus) in ears after leaving the noisy area; and hearing only muffled/softer sounds for about 1 to 2 hours following the noise exposure" (p. 17).

### **Effects on Children**

Although hearing loss would be devastating to anyone, hearing loss in children can affect their language acquisition. Kuder (1997) stated, The development of spoken language is usually delayed in children who are deaf. Some children fail to develop spoken language at all. Even children with relatively mild hearing impairments often experience delays in some aspects of languagedevelopment. (p. 145)

In her article, Kulman used a notation by Laurie Hanin of the League for the Hard of Hearing:

While there is no clear evidence that children's ears are more vulnerable to noise than adults', children have more to lose. Children are going to suffer more than adults because they're still learning language. (p. 5)

As reported by Bess, Dodd-Murphy, and Parker (1998), a hearing loss of even a minimal amount can have an effect on a student's educational performance, as well as on his or her psychosocial development. A hearing loss of any kind can have a major effect on one's life. One can experience anxiety, stress, and fatigue trying to understand other people's speech. This problem not only affects the individual with the hearing loss but also those around the individual. It can be a social behavioral complexity when trying to decide how to interact with an individual who cannot hear what is being said.

### **Suggestions for Prevention**

For school-age children, Montgomery & Fujikawa (1992) made several suggestions in their article, after reporting the reduced hearing thresholds of students in the 2nd, 8th, and 12th grades:

- A. Schools should monitor the noise levels in classrooms, gymnasiums, and at school functions such as dances. Suggestions for physical modifications of certain areas to dampen sounds may be necessary.
- B. Education regarding the potential dangers of high decibel levels for students should begin in the elementary grades.
- C. Because of the alarming increase in noise exposure, this group of students should be routinely examined to identify early onset of noise induced hearing loss. Hearing screening in the schools must go beyond screening for educational disability. Testing to identify those with the beginnings of noise induced damage is an important step in awareness and possible reduction of further hearing loss.
- D. The use of personal noise protection during high-level noise exposure should be encouraged as part of the educational program. (p. 62)

An audiologist may assess the student's hearing levels periodically, provide appropriate amplification if warranted, or suggest classroom accommodations. This often includes a discussion with the student of ways to avoid noisy environments, and thereby prevent further loss of hearing. Because of their reduced auditory acuity, persons with noise-induced hearing loss are more likely to turn up the volume to excessive levels, and are less likely to recognize exposure to toxic levels. Not surprisingly, students with noise-induced hearing loss often report a greater number of noise-hazardous activities in their lives than do their peers (Montgomery & Fujikawa, 1992).

Both the teacher and the speech-language pathologist (SLP) who have a student with a hearing loss can help by adding "visuals" to their lesson plans. Strategies for hearing in noisy environments can be offered by the SLP. In addition, the classroom teacher can make some minor accommodations to help the student. These include: (a) having the student sit toward the front and side of the classroom so that he or she can turn to track conversation and activities; (b) the teacher should face the class and not the blackboard when giving a lesson; and (c) the teacher should use as many pictures, charts, and graphs as possible. Students can also be given additional information in written form about the subject matter. Another student in the class can be assigned as a "buddy" who helps with additional notetaking. Videos, especially ones with captions, can be used as supplemental material. Students in the class and on campus should be educated about the different needs that people (and fellow students) may have. Knowledge can be a powerful tool to help the student's peers understand hearing loss so that they may be more likely to show compassion and even seek out the student for more understanding.

Parents and educators need to be more aware of activities that can cause damage to children's hearing. Music concerts, movies, car and motorcycle races, and other spectator events often produce sound levels that warrant hearing protection. Parents should teach children the proper volume at which to listen to music (less than 85 dB hearing level) and monitor their child's use of headphones. There are a number of strategies to prevent hearing loss caused by overexposure to loud noise. These include individual hearing protection devices, consumer guidance, increased product noise labeling, hearing conservation programs for occupational settings, public awareness, and education programs beginning with school-age children. According to the panel at the 1990 conference on Noise and Hearing Loss.

High-visibility media campaigns are needed to develop public awareness of the effects of noise on hearing and the means for self-protection. Prevention of NIHL should be part of the health curricula in elementary through high schools. Self-education materials for adults should be readily available. (p. 10)

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In a publication on the Internet, updated April 1999, NIDCD suggested ways noise-induced hearing loss can be prevented :

- Noise-induced hearing loss is preventable. All individuals should understand the hazards of noise and how to practice good health in everyday life.
- Know that noises above 75 dB can cause damage.
- Wear earplugs or other hearing protective devices when involved in an activity with excessively loud noise.
- Be alert to hazardous noise in the environment.
- Protect children who are too young to protect themselves.
- Educate family, friends, and colleagues on the hazards of noise.
- Have a medical examination by an otolaryngologist and a hearing test by an audiologist.

The NIDCD also offers a consumerfriendly Web site <http://www.nidcd.nih.gov/health/wise> called Wise Ears that provides information for both parents and professionals about prevention of noise-induced hearing loss.

Simply being aware of how to prevent noise-induced hearing loss isn't enough. Preventions must actually be practiced. Kids are not jumping at the chance to wear such protective devices as a helmet when riding a bike or kneepads when roller-skating, but they do wear them. It is a matter of both the law and parents' insistence that their child follow the proper guidelines for safety. Adolescents will probably not be too keen on wearing earplugs to a concert or turning the volume down on their headphones, but they can be taught that to engage in the activities sought, they must follow certain rules or guidelines. Simply leaving a noisy environment like a dance in an echoing gymnasium for 10 minutes each hour will reduce the danger (Montgomery & Fujikawa, 1992). Kulman quoted Willis Ann Ross, a flutist with the Omaha Symphony, in her article, "It's very different to play with earplugs...just like a lot of motorcyclists don't like to wear helmets because it's not as much fun" (1999, p. 6). Kulman noted that John Wheeler of the Deafness Research Foundation compared toxic noise to secondhand smoke:

Twenty years ago, few took the problem seriously; today, virtually all states have smoking bans. What's needed is a "cultural shift," where carrying earplugs becomes as much of a habit as wearing your seat belt or brushing your teeth. (p. 6)

***The Web site Wise Ears <http://www.nidcd.nih.gov/health/wise> provides information about prevention of noise-induced hearing loss.***

Perhaps a 14-year-old boy named Nate Schneider who was an advocate for H.E.A.R can sum up one of the best explanations of why one should be cautious. Kulman stated that Schneider was a guitar player who had his own band and had custom earplugs made when his ears started ringing in 1998. It had not only concerned him that Pete Townshend, a celebrity musician of The Who, had "gone deaf" (p. 7), but what further unnerved Schneider was the fellow who runs the local guitar store. He could hear Schneider only with his good ear.

### **Final Thoughts**

Noise-induced hearing loss is serious not only because of the damage it can do to one's hearing but perhaps more so because its effects are not widely known to the general public. The severity of the damage can be devastating, whereas the prevention can be relatively easy. Students are particularly vulnerable and teachers are relatively naive in this area. SLPs need to share this information to protect children. Education is the key. More parents and educators need to be aware of the proper exposure to noise levels and when those levels can be toxic. Protective devices need to become commonplace among children and teens, and education about noise-induced hearing loss needs to be extended to young school-age children.

Teachers, speech language pathologists, audiologists, administrators, students, families, and the media should do all they can to raise the awareness of dangerous noise levels and prevent hearing loss. This can be done in many ways, including local and national actions. Each year Congress declares "International Noise Awareness Day" on April 25 and attention is focused on the concerns noted by the authors. Schools, healthcare facilities, and government buildings post announcements about potential hazards and try to reduce the amount of dangerous noise in our environment. We must bring this to the attention of students

and school authorities. Posters that appeal to students are available from professional organizations, such as the American Speech-Language-Hearing Association <http://www.asha.org/shop/brochures-posters.htm#post> and the League for the Hard of Hearing's Web site [www.lhh.org/noise/kit](http://www.lhh.org/noise/kit). One of the posters shows a high school student with a large speaker system next to his ear and entreats "Pump Down the Volume." Another offers tongue-in-cheek suggestions entitled "How to Destroy Your Ears Slowly." Schools and individual teachers need to discuss these issues and support their statements with the facts from articles like this one. Attempting to scare or badger students into changing their music listening habits has little success and often engenders disdain or anger at authorities. Information provided in a matter-of-fact manner to turn the music volume down, not enjoy it less, is the better approach. Public awareness is a must in order to avoid or reduce the effects of noise-induced hearing loss. Children have a lot to do to learn how to survive in this world. If children and young adults don't understand why they should turn the volume down, chances are they won't.

***If children and young adults don't understand why they should turn the volume down, chances are they won't.***

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