

NIDCD Fact Sheet | **Hearing and Balance****Noise-Induced Hearing Loss****What is noise-induced hearing loss?**

Every day, we experience sound in our environment, such as the sounds from television and radio, household appliances, and traffic. Normally, these sounds are at safe levels that don't damage our hearing. But sounds can be harmful when they are too loud, even for a brief time, or when they are both loud and long-lasting. These sounds can damage sensitive structures in the inner ear and cause noise-induced hearing loss (NIHL).

NIHL can be immediate or it can take a long time to be noticeable. It can be temporary or permanent, and it can affect one ear or both ears. Even if you can't tell that you are damaging your hearing, you could have trouble hearing in the future, such as not being able to understand other people when they talk, especially on the phone or in a noisy room. Regardless of how it might affect you, one thing is certain: noise-induced hearing loss is something you can prevent.

**Who is affected by NIHL?**

Exposure to harmful noise can happen at any age. People of all ages, including children, teens, young adults, and older people, can develop NIHL. Based on a 2011–2012 CDC study involving hearing tests and interviews with participants, at least 10 million adults (6 percent) in the U.S. under age 70—and perhaps as many as 40 million adults (24 percent)—have features of their hearing test that suggest hearing loss in one or both ears from exposure to loud noise. Researchers have also estimated that as many as 17 percent of teens (ages 12 to 19) have features of their hearing test suggestive of NIHL in one or both ears, based on data from 2005–2006. For more information, see *Pediatrics* at <http://pediatrics.aappublications.org/content/127/1/e39.long>. 

**What causes NIHL?**

NIHL can be caused by a one-time exposure to an intense "impulse" sound, such as an explosion, or by continuous exposure to loud sounds over an extended period of time, such as noise generated in a woodworking shop.

Recreational activities that can put you at risk for NIHL include target shooting and hunting, snowmobile riding, listening to MP3 players at high volume through earbuds or headphones, playing in a band, and attending loud concerts. Harmful noises at home may come from sources including lawnmowers, leaf blowers, and woodworking tools.

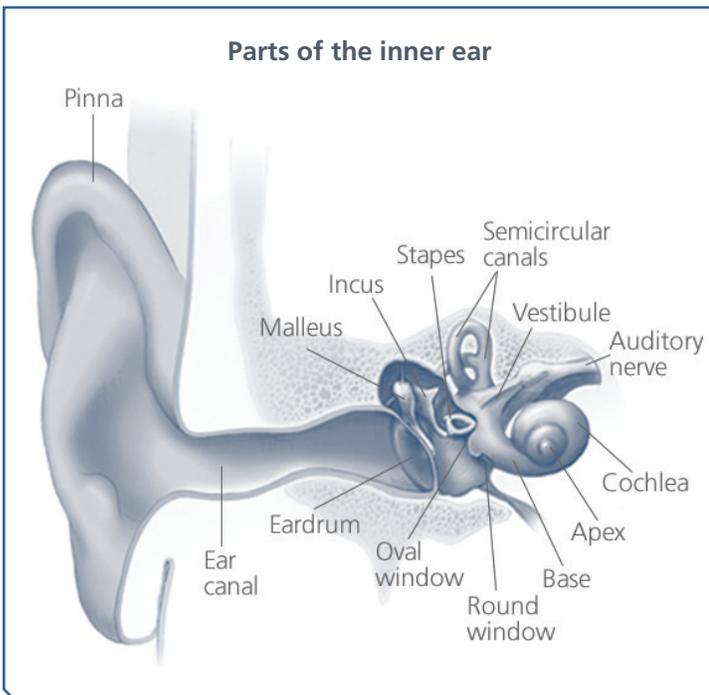
Sound is measured in units called decibels. Sounds of less than 75 decibels, even after long exposure, are unlikely to cause hearing loss. However, long or repeated exposure to sounds at or above 85 decibels can cause hearing loss. The louder the sound, the shorter the amount of time it takes for NIHL to happen.

Here are the average decibel ratings of some familiar sounds:

▶ The humming of a refrigerator	45 decibels
▶ Normal conversation	60 decibels
▶ Noise from heavy city traffic	85 decibels
▶ Motorcycles	95 decibels
▶ An MP3 player at maximum volume	105 decibels
▶ Siren	120 decibels
▶ Firecrackers and guns	150 decibels

Your distance from the source of the sound and the length of time you are exposed to the sound are also important factors in protecting your hearing. A good rule of thumb is to avoid noises that are too loud, too close, or last too long.

## How can noise damage our hearing?



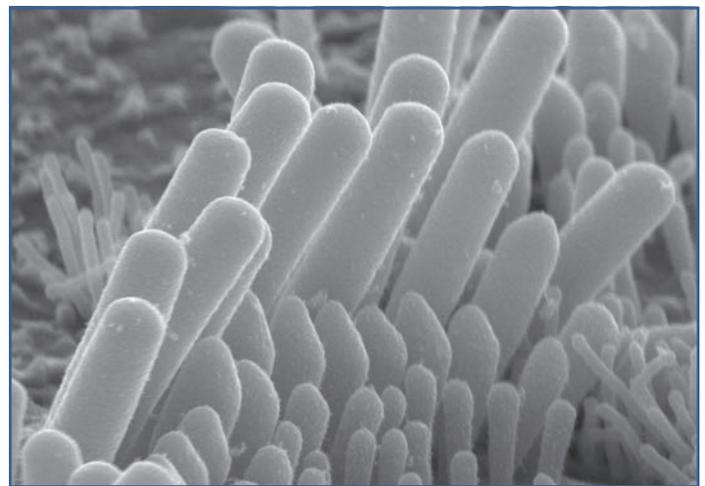
Credit: NIH Medical Arts

To understand how loud noises can damage our hearing, we have to understand how we hear. Hearing depends on a series of events that change sound waves in the air into electrical signals. Our auditory nerve then carries these signals to the brain through a complex series of steps.

1. Sound waves enter the outer ear and travel through a narrow passageway called the ear canal, which leads to the eardrum.
2. The eardrum vibrates from the incoming sound waves and sends these vibrations to three tiny bones in the middle ear. These bones are called the malleus, incus, and stapes.
3. The bones in the middle ear couple the sound vibrations from the air to fluid vibrations in the

cochlea of the inner ear, which is shaped like a snail and filled with fluid. An elastic partition runs from the beginning to the end of the cochlea, splitting it into an upper and lower part. This partition is called the basilar membrane because it serves as the base, or ground floor, on which key hearing structures sit.

4. Once the vibrations cause the fluid inside the cochlea to ripple, a traveling wave forms along the basilar membrane. Hair cells—sensory cells sitting on top of the basilar membrane—ride the wave.
5. As the hair cells move up and down, microscopic hair-like projections (known as stereocilia) that perch on top of the hair cells bump against an overlying structure and bend. Bending causes pore-like channels, which are at the tips of the stereocilia, to open up. When that happens, chemicals rush into the cell, creating an electrical signal.
6. The auditory nerve carries this electrical signal to the brain, which translates it into a sound that we recognize and understand.



*Stereocilia perch atop sensory hair cells in the inner ear.*  
Credit: Yoshiyuki Kawashima

Most NIHL is caused by the damage and eventual death of these hair cells. Unlike bird and amphibian hair cells, human hair cells don't grow back. They are gone for good.

## What are the effects and signs of NIHL?

When you are exposed to loud noise over a long period of time, you may slowly start to lose your hearing. Because the damage from noise exposure is usually gradual, you might not notice it, or you might ignore the signs of hearing loss until they become more pronounced. Over time, sounds may become distorted or muffled, and you might find it difficult to understand other people when they talk or have to turn up the volume on the television. The damage from NIHL, combined with aging, can lead to hearing loss severe enough that you need hearing aids to magnify the sounds around you to help you hear, communicate, and participate more fully in daily activities.

NIHL can also be caused by extremely loud bursts of sound, such as gunshots or explosions, which can rupture the eardrum or damage the bones in the middle ear. This kind of NIHL can be immediate and permanent.

Loud noise exposure can also cause tinnitus—a ringing, buzzing, or roaring in the ears or head. Tinnitus may subside over time, but can sometimes continue constantly or occasionally throughout a person's life. Hearing loss and tinnitus can occur in one or both ears.

Sometimes exposure to impulse or continuous loud noise causes a temporary hearing loss that disappears 16 to 48 hours later. Recent research suggests, however, that although the loss of hearing seems to disappear, there may be residual long-term damage to your hearing.

## Can NIHL be prevented?

NIHL is the only type of hearing loss that is completely preventable. If you understand the hazards of noise and how to practice good hearing health, you can protect your hearing for life. Here's how:

- ▶ Know which noises can cause damage (those at or above 85 decibels).
- ▶ Wear earplugs or other protective devices when involved in a loud activity (activity-specific earplugs and earmuffs are available at hardware and sporting goods stores).

- ▶ If you can't reduce the noise or protect yourself from it, move away from it.
- ▶ Be alert to hazardous noises in the environment.
- ▶ Protect the ears of children who are too young to protect their own.
- ▶ Make family, friends, and colleagues aware of the hazards of noise.
- ▶ Have your hearing tested if you think you might have hearing loss.

## What research is being done on NIHL?

The National Institute on Deafness and Other Communication Disorders (NIDCD) supports research on the causes, diagnosis, treatment, and prevention of hearing loss. NIDCD-supported researchers have helped to identify some of the many genes important for hair-cell development and function and are using this knowledge to explore new treatments for hearing loss.

Researchers are also looking at the protective properties of supporting cells in the inner ear, which appear to be capable of lessening the damage to sensory hair cells upon exposure to noise.

The NIDCD sponsors *It's a Noisy Planet. Protect Their Hearing®*, a national public education campaign to increase awareness among parents of preteens about the causes and prevention of NIHL. Armed with this information, parents, teachers, school nurses, and other adults can encourage children to adopt healthy hearing habits.



## Where can I find additional information about noise-induced hearing loss?

The NIDCD maintains a directory of organizations that provide information on the normal and disordered processes of hearing, balance, taste, smell, voice, speech, and language. Visit the NIDCD website at <http://www.nidcd.nih.gov> to search the directory.

Use the following keywords to help you find organizations that can answer questions and provide printed or electronic information on NIHL:

- ▶ Noise-induced hearing loss
- ▶ Hard of hearing
- ▶ Tinnitus

### More NIDCD fact sheets on Hearing and Balance:

- ▶ Age-Related Hearing Loss
- ▶ How Loud Is Too Loud? How Long Is Too Long?
- ▶ Otosclerosis
- ▶ Ten Ways to Recognize Hearing Loss
- ▶ Tinnitus

Visit the NIDCD website at <http://www.nidcd.nih.gov> to read, print, or download fact sheets.

For more information, contact us at:

### NIDCD Information Clearinghouse

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<http://www.nidcd.nih.gov>

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