

HEARING LOSS

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Results per page: ▾

Hearing loss is the third most prevalent chronic condition in older Americans. Between 25 and 40% of the population aged 60 and older is hearing impaired. Not only is hearing loss more common in older persons, hearing loss is also increasing with time (Yueh et al, 2003) This page provides a general overview for the diagnosis and evaluation of hearing loss.

How we hear

The healthy ear processes sound frequencies ranging from 20 Hz to 20,000 Hz. It detects sounds as soft as .0002 dynes/cm² (0 DB HL) and can tolerate sounds a million times more intense (200 dynes/cm² or 120 DB HL). Sound frequencies between 500 and 4000 Hz include the frequencies most important for speech.

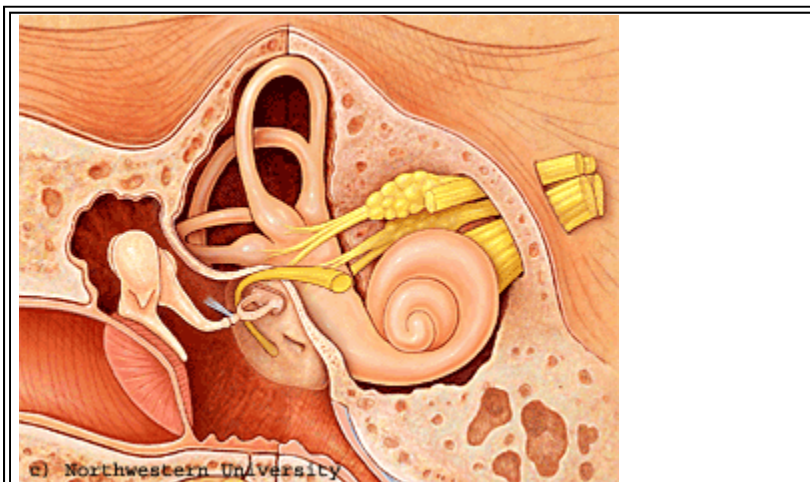


Figure 1: *Animation of normal hearing.* Sound waves are first collected in our outer ear (called the auricle or pinna), pass through our ear canal and cause our eardrum to vibrate. These vibrations are in turn transmitted to our inner ear by the bones of our middle ear. Our inner ear plays a vital role in the transformation of these mechanical vibrations into electrical impulses, or signals, which can be recognized and decoded by our brain. When the vibrations reach the cochlea through movement of the bones in the middle ear, the fluid within it begins to move, resulting

in back and forth motion of tiny hairs (sensory receptors) lining the cochlea. This motion results in the hair cells sending a signal along the auditory nerve to the brain. Our brain receives these impulses in its hearing centers and interprets them as a type of sound.

Anatomy

The most important structures involved in hearing are shown on the figure below. The outer ear (pinna or auricle) may provide a modest (10db) amplification of sounds at the upper range of speech processing frequencies. The middle ear, bounded by the eardrum (1) and the bony labyrinth, provides an additional 20-30 Db of mechanical amplification by coupling the large eardrum (tympanic membrane) to the oval window into the fluid filled inner ear. The 20 to 30 db of amplification is approximately the difference in sound intensity between a whisper and normal conversation.

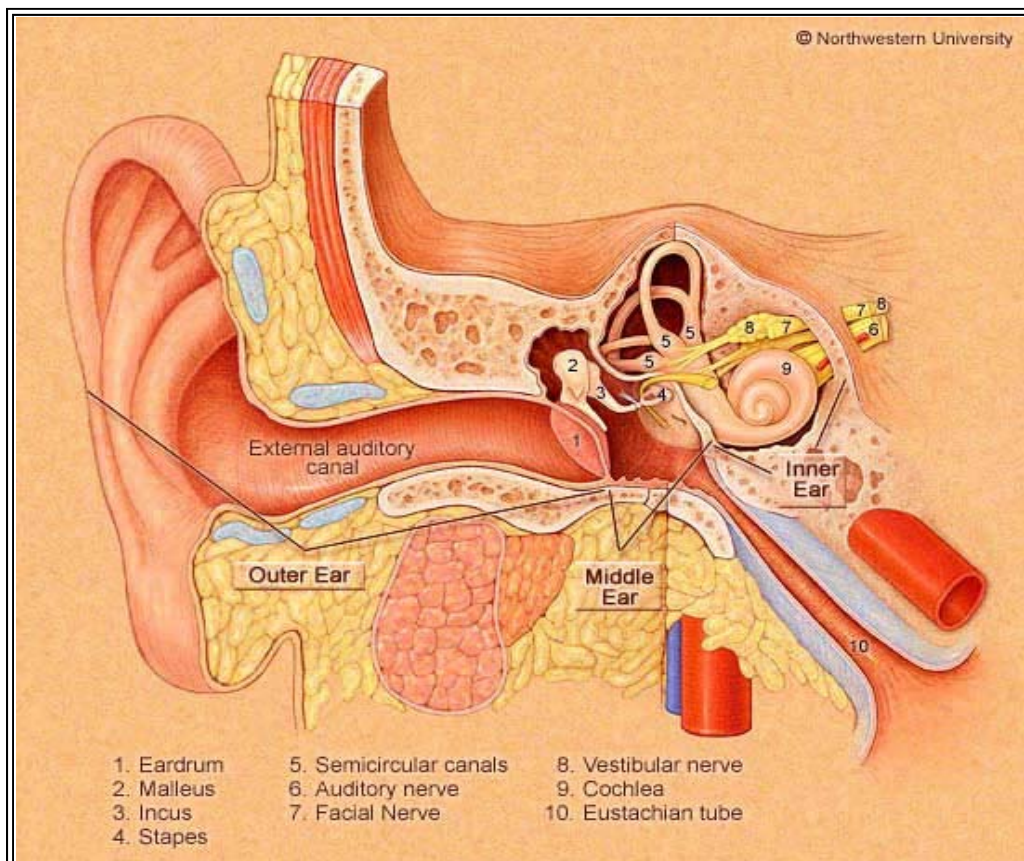


Figure 2: The outer ear consists of the auricle (unlabelled), the external auditory canal, and the tympanic membrane (TM). The middle ear includes the malleus, the incus, the stapes, the Eustachian tube, and the tympanic segment of the facial nerve. The inner ear includes the auditory system (cochlea) and the vestibular system (semicircular canals). The auditory nerve, also called the cochlear nerve, carries signals from the cochlea to the brain.

Early Warnings of hearing loss

- Do people "mumble" ?
- Do you frequently say "what?" or "Huh?"
- DO you misunderstand names and numbers ?
- DO you like the TV/radio volume louder ?
- Do you have trouble hearing in noisy rooms ?

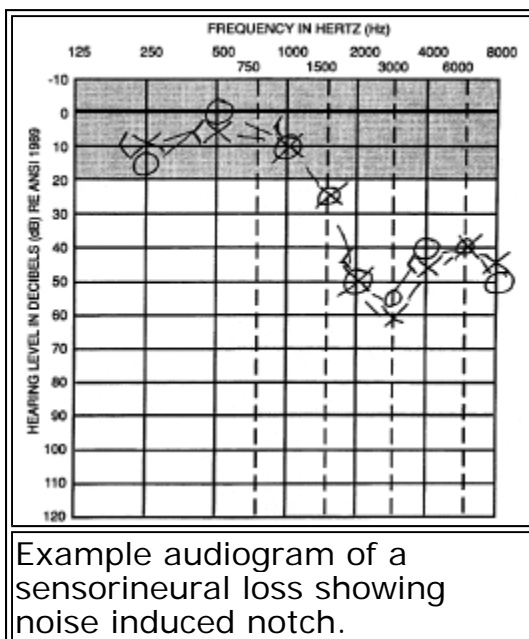
Overview of types and causes of hearing loss

There are three "pure" types of hearing loss encountered commonly in clinical practice: [sensorineural](#), [conductive](#), and [central](#). A fourth type, denoted "mixed", is simply a combination of sensorineural and conductive.

SENSORINEURAL [HEARING LOSS](#)

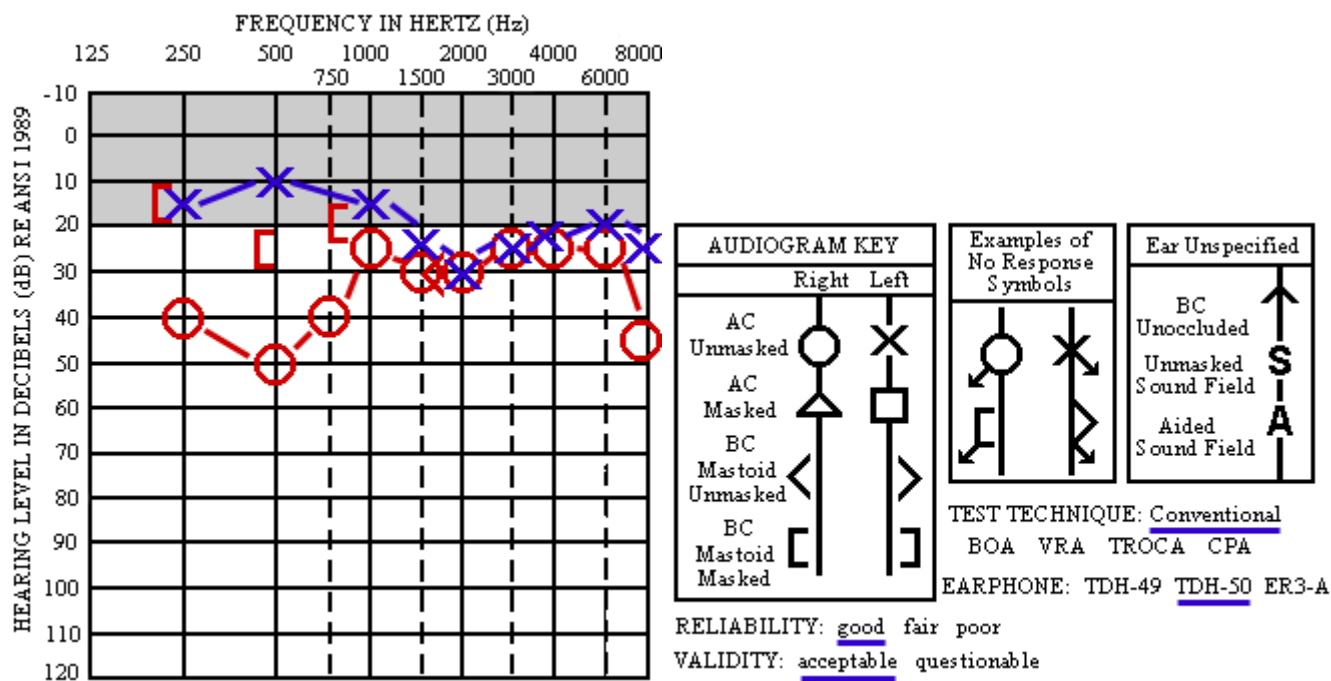
Sensorineural hearing loss (SNHL) accounts for about 90% of all hearing loss. [It is covered in more detail here.](#)

This is sometimes also called "nerve deafness", although the term is not entirely accurate, leaving out disorders of the hair-cells of the inner ear. It is found in 23% of population older than 65 years of age. The term "sensorineural" is used to indicate that there is either a cochlear or an eighth nerve lesion. The diagnosis of a sensorineural pattern hearing loss is made through [audiometry](#), which shows a significant hearing loss without the "air-bone gap" that is characteristic of conductive hearing disturbances. In other words, air conduction is equal to bone conduction. Persons with cochlear deficits fail [OAE testing](#), while persons with 8th nerve deficits fail [BAER testing](#).



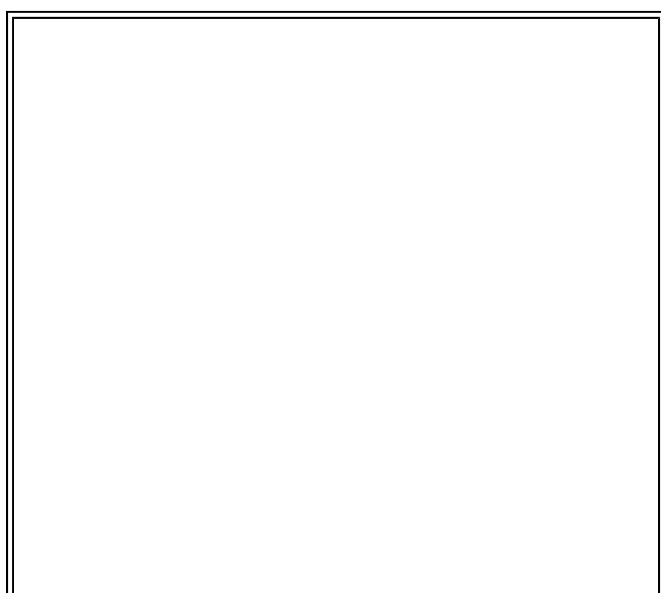
CONDUCTIVE HEARING LOSS

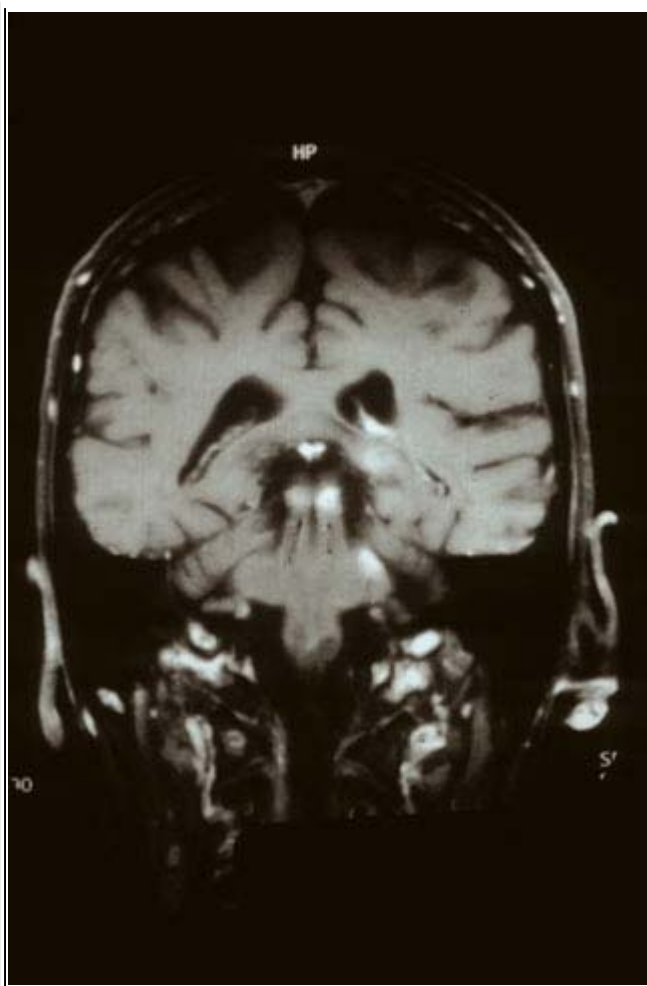
In conductive hearing loss, the second most common form of hearing loss, sound is not transmitted into inner ear. Diagnosis is ordinarily made via observation of an "air-bone gap" on [audiometry](#), meaning that hearing is superior when sound is transmitted in such a way that it bypasses the middle ear ossicular chain. [Conductive hearing loss is considered in much more detail here.](#)



Central Deafness

Central deafness is extremely rare compared to conductive and sensorineural. A discussion of central deafness is found [here](#).





MRI scan of person with central hearing loss, showing high-signal (white spots) in inferior colliculi

Other methods of organizing hearing loss.

Another common way to organize hearing loss is by the timing. [Sudden hearing loss](#) as well as [Congenital hearing loss](#) may be due to sensorineural, conductive or central mechanisms. Follow these links for more detail.

REFERENCES

- Dichgans M and others. Bacterial meningitis in adults. Demonstration of inner ear involvement using high-resolution MRI. *Neurology* 1999, 52:1003-1009.
- Harris J. Hearing loss. *Audio-Digest Otolaryngology*, 31, #2, 1998
- Hu CJ and others. Traumatic brainstem deafness with normal brainstem auditory evoked potentials. *Neurology* 1997;48:1448-51
- Kitajiri S, Tabuchi K, Hiraumi H, Hirose T. Is corticosteroid therapy effective for sudden-onset

sensorineural hearing loss at lower frequencies ? Arch Otolaryngol HNS 2002;128:P365-367.

This paper says that there is no difference between the treated and untreated group.

- Smith BS and others. Thrill or Threat ? The sound of movies. The Hearing Review, Nov 1999, 50-54
- Yueh, B., N. Shapiro, C. H. MacLean and P. G. Shekelle (2003). "Screening and management of adult hearing loss in primary care: scientific review." Jama 289(15): 1976-85.

Useful links:

- The [Chicago Hearing Society](#) offers many services to the local hearing impaired
- The [American Hearing Research Foundation](#) supports research into hearing disorders.
- National Center for Health Statistics: [Hearing levels of adults by age and sex](#), United States, 1960-1962. Vital and Health Statistics. PHS Pub No. 1000-Series 11. Public Health Service. Washington. U.S. Government Printing Office, Oct 1965
- [raisingdeafkids.org](#)
- [Florida Early Hearing Program](#): This site has video's and other material. A spanish version is available [here](#).

Acknowledgments and sources of figures

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