Hearing Loss

Hearing Loss

Introduction

This section contains information about some of the medical aspects of hearing and hearing loss and information about audiology. It explains the following:

- sound
- how the ear works
- audiology and the audiogram
- the types and degrees of hearing loss
- the effects of hearing loss
- how to meet the needs of students with hearing loss

Questions about a student's hearing loss can be answered by their audiologist. A teacher of the Deaf and hard of hearing, auditory-verbal therapist, and/or speech-language pathologist will also be able to provide more information.

Hearing

Sound

Sound is an invisible vibration that begins from movement. Sound is measured in both intensity (loudness) and frequency (pitch).

Intensity is measured in decibels (dB). Frequency is measured in hertz (Hz). Most sounds are made up of a range of different frequencies.

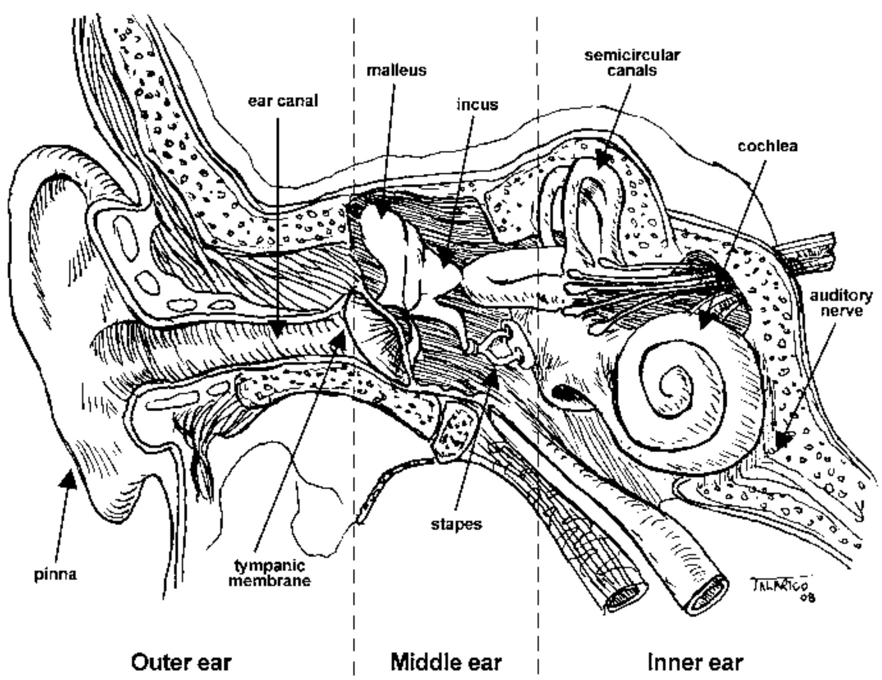
An example of a high frequency, or high-pitched sound, is the noise made by a whistle. An example of a low frequency, or low-pitched sound, is the noise made by a big drum.

Speech is usually a mix of high, middle, and low frequency sounds. Consonant sounds, like /p/, /k/, and /s/, tend to be higher in frequency than some vowel sounds, like /aa/ as in *part*.

The Ear

The ear has two main functions. It receives sound and converts it into signals that the brain can understand. It also helps us to balance. The two functions are closely connected.

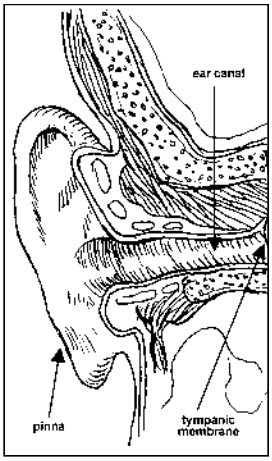
Figure 2 **The Ear**



The ear is divided into three main sections:

- the outer ear
- the middle ear
- the inner ear

Sound passes through all three sections of the ear before it goes to the brain. The brain interprets the sound and tells us what we are hearing. It tells us if we are hearing music, noise, a voice, a car horn, a dog, or other sounds.



The outer ear

The Outer Ear

Sound goes into the outer ear. The part of the outer ear that we can see is called the pinna.

The outer ear picks up sound waves and directs the sound down the ear canal to the eardrum.

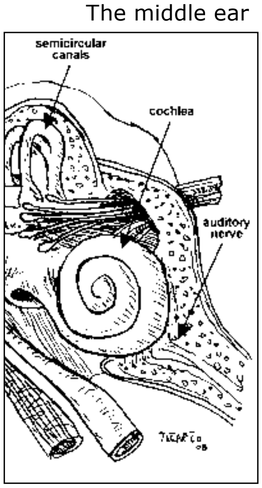
The eardrum (tympanic membrane) is a thin membrane stretched over the end of the ear canal that separates the outer ear and the middle ear. When sound hits the eardrum, it begins to vibrate much like the membrane of a drum when it is struck with a drumstick.

The middle ear

The Middle Ear

The middle ear contains the three smallest bones in the body, each about the size of a grain of rice. Together these bones are called the ossicles. Individually, they are called the malleus (hammer), the incus (anvil), and the stapes (stirrup).

This chain of bones is attached to the eardrum on one end and the inner ear on the other end. The ossicles form a lever mechanism that conducts sounds from the eardrum to the inner ear.



The inner ear

The Inner Ear

The inner ear is housed in the bone of the skull. This part of the ear contains the semicircular canals, the cochlea, and the auditory (hearing) nerve.

The semicircular canals are fluid-filled bony structures that are responsible for balance. When you feel dizzy on a fair ride, this is because the fluid in the semicircular canals has been disturbed.

The cochlea is shaped like a snail and is filled with fluid. It is lined with thousands of tiny nerve endings called hair cells. These hair cells are tuned somewhat like the keys on a piano. Some of the hair cells respond to low-pitched sounds, and some respond to high-pitched sounds.

These hair cells are connected to the auditory nerve that connects the cochlea to the brain.

Hearing tests occur in an ideal, soundproof listening environment. Consult an audiologist to determine what the student can and cannot hear in the real world.

Audiology

Audiology is the medical term for the study and measurement of hearing and hearing loss.

An **audiologist** is a professional who is qualified to assess hearing loss and to recommend and fit amplification systems (e.g., hearing aids, wireless audio systems, cochlear implants).

An annual hearing assessment is recommended for students who are DHH because not all hearing losses are stable.

The Audiogram

The **audiogram** is a graph that represents a person's responses to sound. It is used to document the softest sound a person can detect at a variety of different frequencies (pitches).

Frequency

The frequency or pitch of sound is shown by the numbers across the top of the audiogram. Low pitches are on the left-hand side of the graph and high pitches are on the right, somewhat like the keys of a piano, which range from low pitches on one end of the keyboard to high pitches on the other end. The whistle of a bird usually has a high pitch; the growl of a dog has a low pitch.

The frequencies included on an audiogram are chosen because they are important for understanding speech.

Different speech sounds have different pitches, so it is important to know how well a person hears across the frequency range. A good example of different frequencies is the word *moose*. The /m/ sound is a low-frequency sound, the /oo/ sound is a middle-frequency sound, and the /s/ sound is a high-frequency sound. In order to hear the word completely, a person must have appropriate levels of hearing at low, middle, and high frequencies.

Intensity

The intensity or loudness of sound is shown by the numbers down the side of the audiogram. The small numbers at the top are soft sounds (–10, 0, 10 decibels [dB]), and the large numbers at the bottom are loud sounds (90, 100, 110 dB).

With a complete audiogram, an audiologist can determine the type, degree, and configuration (or shape) of the hearing loss.

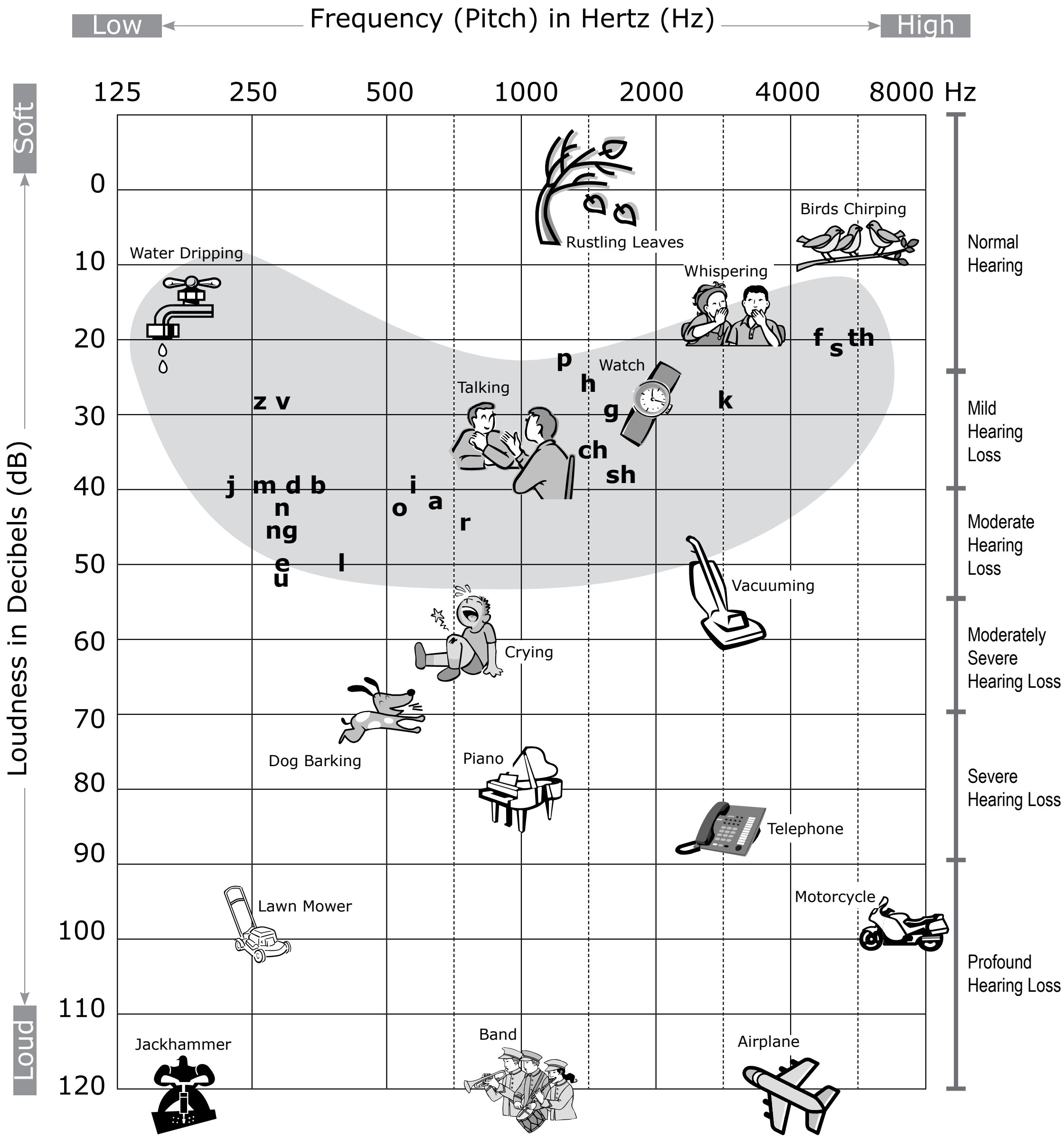
Examples of Sounds on the Audiogram

The figure on the next page, "Audiogram," shows the pitch and loudness of several environmental sounds as well as typical speech sounds. Examples of sounds plotted on the audiogram include the following:

- Water dripping is a very low pitch (185 Hz) quiet sound (15 dB).
- Birds chirping is a very high pitch (6000 Hz) quiet sound (5 dB).
- People talking at a conversational level (i.e., all speech sounds) crosses all pitches at low to mid volumes (40 to 60 dB).
- A piano playing is a mid-pitch (1000 Hz) loud (80 dB) sound.
- An airplane is a high pitch (4000 Hz) extremely loud (120 dB) sound.

The shape the speech sounds make on this audiogram is commonly called the *speech banana*. The speech banana represents the area of pitch and loudness in which the majority of speech sounds will occur when a person is talking in a normal conversational voice.

Figure 3 **Audiogram**



Hearing Loss

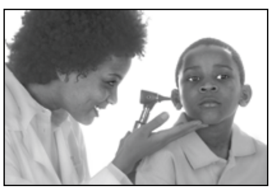
Types of Hearing Loss

Conductive Hearing Loss

A **conductive hearing loss** occurs when one or more of the structures of the outer or middle ear are not working properly. For example, conductive hearing loss may be caused by the following conditions:

- wax buildup in the ear canal
- a hole in the eardrum
- fluid in the middle ear
- problems with the bones of the middle ear

Having a conductive hearing loss is like wearing earplugs: you only hear loud sounds. Most types of conductive hearing loss can be medically corrected.



Otitis media is a medical term that refers to middle ear infections or inflammation of the middle ear. Fluid in the middle ear is usually, but not always, found with this condition. This fluid may be watery or like mucus, and may or may not be associated with infection.

Otitis media is very common in children, especially young children, and is the most common cause of conductive hearing loss.

The symptoms of otitis media may include the following:

- fever
- ear pulling
- irritability
- inattentiveness
- earaches
- difficulty hearing in one or both ears

Frequent otitis media is cause for concern because of the long-term effects on a person's ability to listen, process sounds, communicate, and socialize.

Some individuals who have permanent, sensorineural hearing loss (see next page) also get otitis media, resulting in additional loss of hearing sensitivity. It is advisable to check young children's hearing after they have been treated for otitis media.

Sensorineural Hearing Loss

A **sensorineural hearing loss** may result from problems in the following:

- the cochlea
- the auditory nerve
- the hearing centres of the brain

Damage to the hair cells in the cochlea is the most common reason for sensorineural hearing loss. If damaged, the hair cells cannot detect sounds.

Most types of sensorineural hearing loss are permanent and cannot be corrected by surgery or medication.

Mixed Hearing Loss

A hearing loss is classified as **mixed** when both conductive and sensorineural hearing loss are present. For example, someone with a permanent sensorineural hearing loss with a middle ear infection may have additional hearing loss (called "conductive overlay"). After the ear infection clears, and the conductive overlay disappears, the person would be said to have only a sensorineural hearing loss.

See Appendix A for information on potential impacts of a unilateral hearing loss.

Unilateral Hearing Loss

If only one ear is affected with a hearing loss, it is referred to as a **unilateral hearing loss**.

A review of the literature indicates that some students with unilateral hearing loss may be at risk for speech and language delays and/or academic challenges. It is not known at precisely what age the unilateral hearing loss has an impact. While some students will never exhibit an effect from the unilateral hearing loss, others may experience some challenges.

Children with unilateral hearing loss "have more difficulty in academic situations or in school than children with normal hearing. They are 10 times more likely to repeat a grade, and five times more likely to need additional educational resources" (Bowers).

Bilateral Hearing Loss

When both ears are affected, it is known as **bilateral hearing loss**.

Progressive Hearing Loss

A **progressive hearing loss** is one where, over time, the hearing becomes progressively worse in one or both ears. Some individuals have risk factors for late onset or progressive hearing loss (e.g., prolonged mechanical ventilation at birth, congenital diaphragmatic hernias, large vestibular aqueducts, certain syndromes).

An annual hearing assessment is recommended for students who are DHH because not all hearing losses are stable. An annual review helps the school team detect changes in hearing acuity and adjust hearing aids as needed.

Hearing Levels

are the softest sounds people can hear.

Please refer to Appendix A for information regarding the impact of these hearing losses.

Degree of Hearing Loss

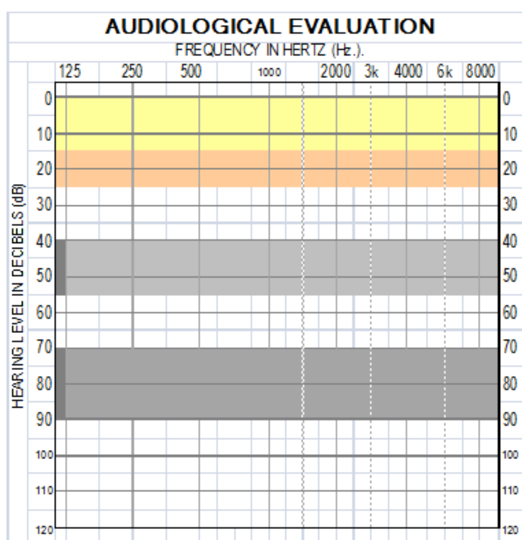
The level of a person's hearing loss can be described in two ways:

- as a decibel (dB) **hearing level**
- as slight, mild, moderate, moderately severe, severe, or profound hearing loss

Hearing loss is not described as a percentage (e.g., 60 percent Deaf).

The chart below shows the terms used to describe hearing levels and the decibel ranges that they refer to:

Figure 4 ***Audiological Evaluation***



Classification of Degree of Loss

0–15 dB	Normal Hearing for Child
16–25 dB	Slight Loss
26–40 dB	Mild Loss
41–55 dB	Moderate Loss
56–70 dB	Moderately Severe Loss
71–90 dB	Severe Loss
>90 dB	Profound Loss

An illustration of hearing loss is available in Appendix B.

Examples of listening with a hearing loss are available online. Search "What a hearing loss sounds like" in the search engine of your choice. For example, the following websites provide simulations of hearing loss:

- www.hearinglikeme.com/facts/what-hearing-loss/hearing-loss-simulator-understanding-mild-and-moderate-hearing-loss
- www.hear-the-world.com/en/hearing-and-hearing-loss/hearing-loss-what-it-sounds-like.html

- https://successforkidswithhearingloss.com/for-professionals/demonstrations-simulated-listening-with-hearing-loss-devices/

Residual hearing

is the amount of usable hearing.

Most individuals with a hearing loss will have some amount of **residual hearing**. The audiologist, SLP, TDHH, or AV therapist will be able to give more information about a person's degree of hearing loss and can explain the sounds that the person may hear and the sounds that the person may not hear.

Deaf, Hard of Hearing, and Deafened

Students who have a hearing loss are referred to as *hard of hearing* or *Deaf* according to their communication skills and cultural affiliation. Generally, students who use ASL (American Sign Language) and who have identified culturally with members of the Deaf community are considered *Deaf*. (The word is capitalized to indicate a distinct cultural group similar to the capitalization of English, Spanish, or Hebrew.) Students who have a hearing loss but do not have a cultural affiliation with the Deaf community are generally referred to as students who are *hard of hearing*.

Individuals who had hearing and have subsequently lost their hearing, through illness or accident, are referred to as *deafened*. These individuals choose either Deaf or hard of hearing support organizations, based on the degree of their acquired hearing loss.

Effects of Hearing Loss on Speech and Language without Intervention

A minimal hearing loss may not be a problem for an adult, but it can seriously affect the overall development of a person who is in the process of learning language, developing communication skills, and acquiring knowledge. In general, the more significant the loss, the greater the difficulty.

(Irwin)

Students with **minimal or slight hearing loss or unilateral hearing loss** may

- miss some consonants
- experience mild difficulty with auditory language learning
- experience difficulty listening at a distance or in noisy situations

Students with **mild hearing loss** may

- miss quiet speech sounds
- experience difficulty with auditory learning
- experience speech/language delays
- appear to be inattentive

Students with **moderate hearing loss** may

- hear almost no speech sounds at normal levels

- make speech sound errors
- experience language delays
- experience learning difficulties related to language delays
- appear to be inattentive
- need to be less than two metres away from speaker for best listening distance

Students with **severe hearing loss** may

- hear no speech sounds at normal levels
- speak, but their speech may be difficult to understand
- experience language delays
- experience learning difficulties related to language delays
- appear to be inattentive to verbal communication (may not realize that speaker is speaking)

Students with **profound hearing loss** may

- hear no speech or other sounds
- experience extreme difficulty understanding speech
- produce little or no verbal language
- experience learning difficulties related to language delays
- learn by visual cues or ASL
- appear to be inattentive to verbal communication (may not realize that speaker is speaking)

Amplification

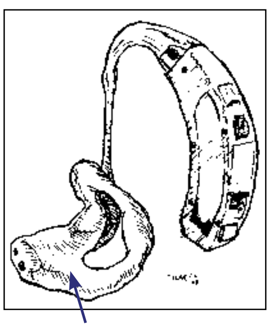
Amplification devices such as hearing aids, cochlear implants (CIs), and wireless audio systems help to meet the needs of students with hearing loss. The goal of all hearing technology is to enhance the reception of speech.

The technology for a student is chosen, based on individual needs and school team observations, by the audiologist in consultation with the parents. Factors including the type of hearing loss, the degree of hearing loss, and the size and shape of the ears are considered in the decision-making process. When amplification has been recommended, consistent use is important.

Information about the use and care of hearing aids, CIs, and wireless audio systems should be provided to the student's support team. As technology changes, ongoing information sharing is needed to support each student. For example, if a student gets new hearing aids, the wireless audio system may require an upgrade.

> Hearing technology should be checked daily, as young students often cannot report malfunctions in their amplification. Management of amplification is the student's responsibility, although support from the school team may be required in Early Years. See page 20 for information on listing checks.

Hearing aids



Earmold

is the part of a hearing aid that is custom-made to fit into the outer ear.

Hearing Aids

Hearing aids are electronic devices that amplify sound. Speech and background noise are amplified by a hearing aid.

Hearing aids work best in a quiet listening situation where the distance between the person speaking and the student is six feet or less. As distance and background noise increase, the benefit provided by a hearing aid is greatly decreased.

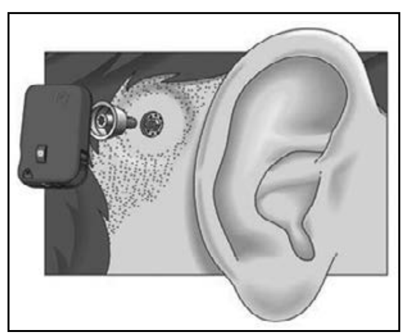
It is important to keep in mind that hearing aids do not restore normal hearing. They amplify all sounds. They need to be kept in good working condition and worn consistently. A daily listening check is needed to ensure that hearing aids are working properly. Refer to Listening Check on page 21.

Bone-Anchored Implants (BAI)

Bone conduction hearing aids are often used in cases where someone has a malformed ear with no ear canal, or has chronic ear infections that do not allow for the use of traditional hearing aids with **earmolds**. The bone-anchored implant is surgically implanted and conducts sound to the ear through direct bone vibration. The BAI consists of a small titanium implant, an abutment, and a sound processor.

Figure 5 ***Bone-anchored implant***

The sound processor can easily be snapped in and out of the abutment but allows for secure attachment.



The surgery is very minor and is often done under local anaesthesia. There is a period of three to six months following surgery during which the sound processor cannot be worn, in order to allow the implant to be integrated with the bone of the skull. It is important that the area surrounding the implant is kept clean to avoid infection. This can be done using soap and water or saline wipes (baby wipes).

Implantation is not recommended for children under the age of five because of the thickness and development of the skull. A soft elastic headband with a connector for the sound processor can be used for these children until they are able to undergo surgery. The band can be adjusted to the child's head size.

Figure 6 ***Softband***

Cochlear Implants

A cochlear implant (CI) is a device that is surgically implanted into the inner ear and that stimulates the hearing or auditory nerve directly, bypassing the damaged cochlea. It can provide useful hearing for individuals who have a severe to profound sensorineural hearing loss and who receive limited benefit from hearing aids. A CI will not restore normal hearing, but it will greatly improve access to sound.

Components

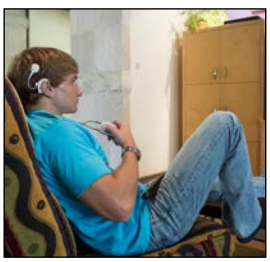
There are two components of a CI: an internal device and an external device.

The internal device consists of a magnet, a receiver, and a band of electrodes.

- During surgery, an incision is made behind the ear, and the magnet and receiver are secured in place under the skin.
- A hole is drilled into the inner ear and the band of electrodes is inserted into the cochlea.
- The skin is then stitched and the implant remains under the scalp of the individual.

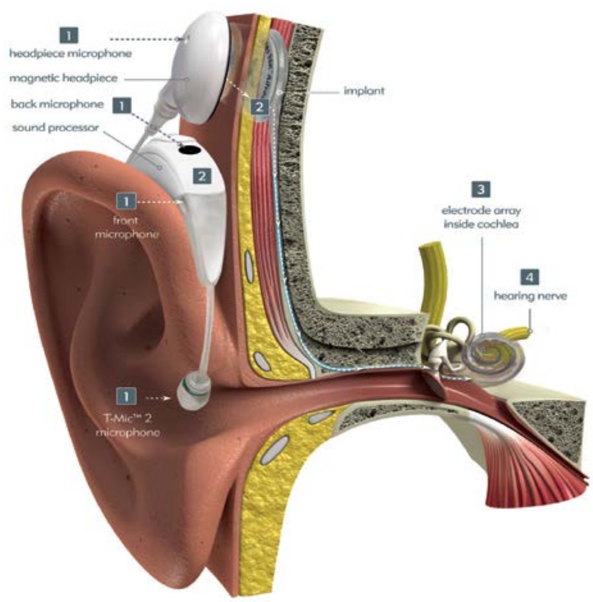
The external device consists of a microphone, a speech processor, a transmitter, and batteries.

- The microphone picks up sound, which is then converted to an electric signal by the speech processor.
- The transmitter sends the signal through the scalp to the internal device using radio frequency.
- When the signal reaches the electrodes, they send out a small electric current that stimulates the auditory nerve and is interpreted by the brain as sound.



Cochlear implant

Figure 7 **How the processor couples, internal/external**



Candidacy

Not all individuals with hearing loss are candidates for CIs. Any decisions regarding candidacy are discussed by the cochlear implant team.

Bimodal Hearing/Bilateral Implantation

Individuals with CIs often wear a hearing aid in the opposite ear. This is known as **bimodal** hearing. For many of these people, a hearing aid will provide only low frequency information, but this is information that a CI does not always pick up. The hearing aid and CI work together to provide as much speech information as possible.

It is also becoming more common to receive bilateral CIs, or one in each ear. **Bilateral implantation** can provide advantages in sound localization and speech discrimination in noise. The candidacy criteria remain the same for bilateral implantation as for single-sided surgery.

Acoustical Issues within the Classroom

Understanding speech in noisy environments can be difficult for any student, but for a student with hearing loss, it is even more challenging. Students need access to speech to develop their listening, language, and learning skills. Background noise, distance from the person speaking, and reverberation (echo) are common obstacles that significantly reduce the student's access to crucial speech information. Although today's advanced hearing aids and CIs can improve the quality, audibility, and clarity of the speech signal, they cannot remove all obstacles to speech understanding.

Students with hearing loss, even a mild hearing loss, may not express their inability to understand family members or teachers. They may not even be aware that they missed a question or misunderstood directions. If they are young and still learning language, they may be unable to tell when speech is unclear or buried in background noise. Students with hearing loss, and sometimes students with normal hearing, demonstrate difficulty in understanding speech when there is background noise, increased distance between the speaker and the student, and/or reverberation or echoes.

Noise

Ambient noise

is background noise, which competes with the main speech signal.

(Colorado School for the Deaf and Blind)

Ambient noise is present in most listening environments including classrooms. Hearing aids and CIs cannot selectively amplify only the speaker's voice: they also pick up background sounds. In many difficult and noisy situations, hearing aids and CIs alone cannot make the speaker's voice clearer or even louder. With background noise present, the loudness level of the speech signal may be barely above, and often may be lower, than the loudness level of the noise.

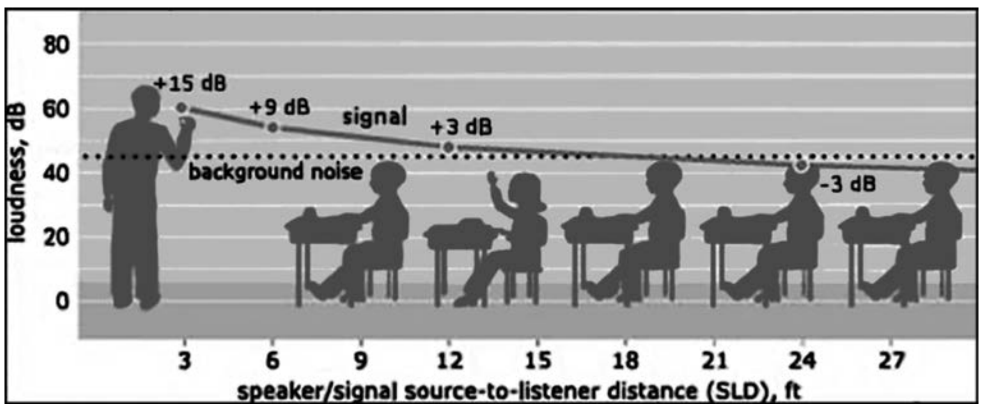
The comparison of speech and noise levels is referred to as the **signal-to-noise ratio** (SNR) and it represents the difference in loudness between the primary signal (e.g., a teacher's voice) and the background noise. A student with a hearing loss needs the speech signal to be substantially louder than the background noise—a higher SNR is required—even higher than the level required by his or her hearing peer in the same situation. Amplification set at +15 decibels helps the student to hear the teacher's voice in a noisy setting.

Distance

Be inside your student's listening bubble!

A student with a hearing loss has a reduced hearing range compared to a student with normal hearing. This hearing range can be referred to as a "listening bubble" (Anderson, *ELF*). As distance from the speaker increases (e.g., when listening to someone speaking from another room), loudness decreases. For the student with a hearing loss, distance becomes an obstacle to understanding speech. The greater the distance between the speaker and the listener, the less intense the speech signal becomes. This makes it more difficult for the listener to hear properly, since background noise often remains the same.

Figure 8 **Distance-Loudness Relationship***



* Source: The Institute for Enhanced Classroom Hearing. "Problems: Poor Acoustics." www.classroomhearing.org/acoustics.html. Accessed 27 Nov. 2008. Reproduced with permission.

Research has shown that a student should be within one to two metres of the speaker for maximum speech understanding. This is not always possible to achieve either in the classroom or at home.

Reverberation

Another obstacle to speech understanding is reverberation or echo. When sound “bounces” off a surface, it can actually mask, or muffle, the main signal. It can reduce the clarity of speech, decrease the signal-to-noise ratio, and make speech more difficult to understand.

Using ceiling tiles, small carpeted areas, and muffling devices on the feet of chairs improves acoustic conditions in the classroom.

Personal and Soundfield Wireless Audio Systems

Personal FM System

As mentioned earlier, distance, background noise, and reverberation make hearing difficult in a classroom. Personal or soundfield/classroom wireless audio systems can be used in addition to the hearing aid(s) or CI(s) to help overcome these factors and make communication easier.

- A **personal wireless audio system** uses a transmitter, microphone, and receivers to send the teacher’s voice to the student’s hearing aid(s) or CI(s) by either FM or digital (similar to cordless phones, WiFi, etc.) wireless radio transmission signals. The teacher wears a microphone and transmitter. The receivers may be integrated into the student’s amplification equipment or attached externally through an adapter called an AI boot or audio shoe. The student hears the teacher as if the teacher were standing right next to them, overcoming the problems of distance and background noise. Daily listening checks of the audio system are needed. Refer to Daily Care and Listening Checks on page 21.
- **Soundfield/classroom wireless audio systems** use a microphone and transmitter to send the teacher’s voice to speakers in the classroom. Students with mild hearing loss or unilateral hearing loss benefit from these systems because the teacher’s voice is heard equally throughout the classroom and is louder than the background noise. Soundfield systems use an FM, digital, or infrared (sound via light) transmission signal.

Soundfield Systems

These systems increase the size of your student’s listening bubble.

A soundfield system and a personal audio system can be linked to work together if both are needed in the same classroom. These systems can also be connected through a cable or via a streamer (e.g., Bluetooth) to other technologies (e.g., computer, television, cell phone, tablet) to provide a more direct sound signal.

The audiologist will select the correct hearing aids or CI and wireless audio system for the student. The audiologist, TDHH, or AV therapist can provide support for the daily use of the hearing aids, CI, and the personal or soundfield audio system.

For more information about FM wireless audio systems, see Appendix C.

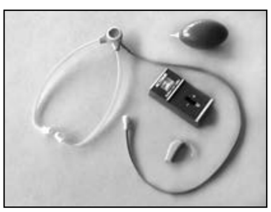
Public venues such as theatres, churches, or museums may provide headsets that amplify the sound through an FM, a digital, or an infrared system. Alternately, some venues use an induction loop system. An induction loop wire installed in the venue connects to the speaker's microphone. The microphone signal creates an electromagnetic field in the room that can be detected by hearing aids that are set to receive the signal. Students may encounter these systems when they attend plays or concerts.

Care of Hearing Aids, Cochlear Implants, and Wireless Audio Systems

Assign someone to maintain the system and ensure that it is working acoustically.

It is important that hearing aids, CI processors, and wireless audio systems are kept in good working order to ensure the student has optimum access to auditory input throughout the day. Daily maintenance, system checks, troubleshooting, and listening checks are recommended. See page 21 for a step-by-step guide for performing daily care and listening checks.

Care and Maintenance



Stethoset, battery tester, and earmold blower

Systems should be kept clean, dry, and away from heat sources. They can be worn all day during sports and play, but care must be taken not to drop them on hard surfaces during handling or cleaning.

Over time, students learn to independently manage their amplification needs, including care. In the Early Years, students may require assistance. Individual education plan (IEP) goals regarding use and care of equipment are available on page 78.

To care for a hearing aid, a listening tube or stethoset, a clean cloth, a battery tester, and an earmold blower are required.

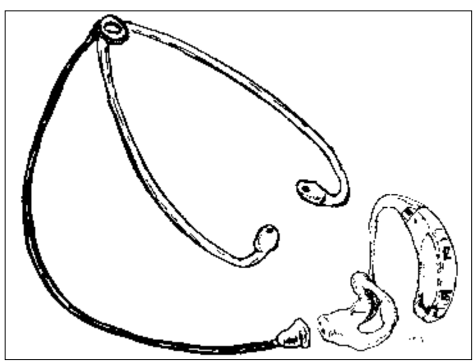
To check a CI processor, specific equipment from the manufacturer (headphones, a specialized adapter) are required, as well as a clean cloth and battery tester.

It is recommended that teachers, educational assistants, or other appropriate school personnel perform daily listening checks of the amplification equipment and troubleshoot problems as appropriate. Staff should become familiar with how the equipment sounds when it is functioning optimally so that they can recognize when a problem occurs.

Care and cleaning recommendations and troubleshooting guides for hearing aids, cochlear implants, and amplification equipment are available online on the manufacturer's website. The audiologist, TDHH, or AV therapist can provide printed copies or website addresses.

Daily Care and Listening Checks

Hearing Aid Care	Cochlear Implant Care	Personal System Care	Listening Check
1. Test the battery with a battery tester. 2. Have a supply of spare batteries and replace as needed. Be aware that hearing aid batteries come in different sizes. 3. Do a listening check (see last column). 4. If changing battery does not restore or improve the sound signal, the cause may be condensation or wax/ debris in the earmold/ tubing. 5. Remove the earmold from the hearing aid. 6. Use the earmold blower to force air through the earmold tubing. 7. Wash the earmold in warm water and mild hand soap to remove wax or debris. 8. Rinse the earmold in warm water and dry well. 9. Be sure no water is in the tubing (use earmold blower). 10. Reattach the earmold to the hearing aid.	1. Test the batteries with a battery tester. 2. Check cables for wear, and replace if broken/worn. 3. Wipe CI with a dry, non-abrasive cloth if exposed to high levels of humidity or excessive perspiration. 4. Clean and replace microphone covers regularly.	1. Make sure the transmitter and receivers are on the same channel. 2. Use only rechargeable batteries. 3. Ensure that system is charged nightly. 4. Avoid twisting/ tying/ pinching the teacher microphone transmitter cord. 5. Store boots/ receivers in a secure place when not in use.	**Hearing Aid** Use the stethoset to listen to the hearing aid. **Cochlear Implant** Use specialized equipment provided by manufacturer. 1. Listen to the system while saying the following Ling 6 sounds: /ah/, /ee/, /oo/, /sh/, /sss/, and /mmm/. 2. Listen to the sound quality. Are all sounds clear and accessible? If not, check equipment as per care columns. 3. If problems persist, contact audiologist, TDHH, or AV therapist. 4. Now attach audio boot and repeat steps above. 5. Present Ling 6 sounds to student in random order and ask them to repeat (to establish which sounds the student can hear). See next page for steps.



Stethoset with hearing aid and earmold

Ling 6 Sound Test and Listening Checks

The Ling 6 sound test, developed by Dr. Daniel Ling, is a simple screening tool that is used to check if a student has auditory access to the full range of speech sounds and to detect any changes in a student's hearing. It can also be used to check if the student's amplification equipment is functioning appropriately. Students are asked to repeat six different sounds that represent speech sounds from low to high pitch (frequency). These sounds are as follows:

Ling 6 Sound	As in the Word	Frequency of the Sound
m	mom	very low frequency
oo	boo	low frequency
ee	bee	some low frequency
ah	car	mid-frequency
sh	ship	moderately high frequency
s	mitts	very high frequency

This test or listening check should be completed with the student on a daily basis. Regularly performing the Ling 6 sound test will ensure any problems with the student's auditory access or with the amplification are identified early.

How to conduct the test:

1. Find a quiet environment.
2. Remove the student's amplification equipment and ensure it is working appropriately (conduct a listening check).
3. Test each ear separately. Put the amplification on the student's right ear.
4. Stand or sit 3 feet away from the student and ensure the student cannot see your face for visual cues (sit behind them or cover your mouth).
5. Say each of the following sounds one at a time with irregular pauses between each: /ah/, /ee/, /oo/, /mm/, /shh/, /ss/. Present the sounds in random order at a normal conversational level. Say each sound in the same length of time (so one is not longer than another) and without using any changes in pitch. After you present a sound, the student should indicate they have heard it by raising their hand or pointing to a visual representation of the sound or repeating the sound.
6. Record if the student is able to hear and, in time, identify each of the sounds. If a student is not able to respond to one or more of the sounds, this may indicate an ear infection or a change in hearing. Try saying the sounds closer or louder. If the student still cannot access the sounds and you cannot determine the cause, it is best to inform the student's parents, and the audiologist or doctor may need to be consulted.
7. Remove the amplification from the right ear, and put the appropriate amplification on the left ear. Test the left ear.

8. When finished, put the student's amplification on both ears, ensuring both sides are turned on and at the appropriate settings.

Your TDHH or AV therapist should model the process, and then observe to ensure you are not providing the student with additional clues about the sounds.

Assistive Technology

Advances in technology have greatly improved access to communication for people who are DHH. A variety of devices and technology can be used to enhance auditory or visual communication in all aspects of life. These include the following:

- technology to enhance auditory communication—assistive listening devices (ALDs)
  - FM, digital, infrared, induction loop systems (Please see page 19 for further information.)
  - Bluetooth connections to televisions, cell phones, tablets, mp3 players, computers, et cetera
  - amplified alarm clocks, fire alarms, and telephones, and portable phone amplifiers
- technology to enhance visual communication
  - captioning—on television, DVDs, online (e.g., YouTube videos), and in movie theatres (e.g., CaptiView device)
  - computerized notetaking, computer-assisted real-time transcription or communication access real-time translation (CART), notetaking services (e.g., TypeWell, C-Print)—live translation of the spoken word into English (See pages 109 to 111.)
  - speech-to-text apps and software
  - email, texting, video chat
  - video relay service—a service that allows people who use ASL to communicate through an interpreter with those who do not use ASL (The interpreter communicates with the person who is DHH via video and with the person who does not use ASL via phone.)
  - teletypewriting devices (TTYs)—used in the past, to provide communication between land-line phones via text communication—rarely used now due to the prevalence of cell phones and access to texting, email, and video chat—telephones with captioning capability are also now available

- alerting devices
  - vibrating watches, alarm clocks with loud sounds/flashing lights/ bed or pillow vibrators
  - flashing light smoke detectors/CO2 alarms/motion detectors
  - flashing lights which indicate doorbells, knocks at the door, timers, telephones, and the baby cry monitor
  - flashing lights on cell phones to indicate a message has been received
- hearing ear dogs
  - though not a "technology," included here as they are trained to alert a person who is Deaf to a variety of sounds in their environment

For detailed information regarding these technologies, please consult your audiologist, TDHH, AV therapist, or ASL specialist. These technologies are available for purchase online, through some hearing aid centres, and through Deaf Centre Manitoba (which partners with the Canadian Hearing Society).

Students who are DHH and their families should be made aware of the variety of technologies available to them. Use of these technologies will help to foster student independence and equitable access to communication.