



HEARING BASICS

Section 4

The Ear

The ear is made up of three main sections (Figure 1):

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

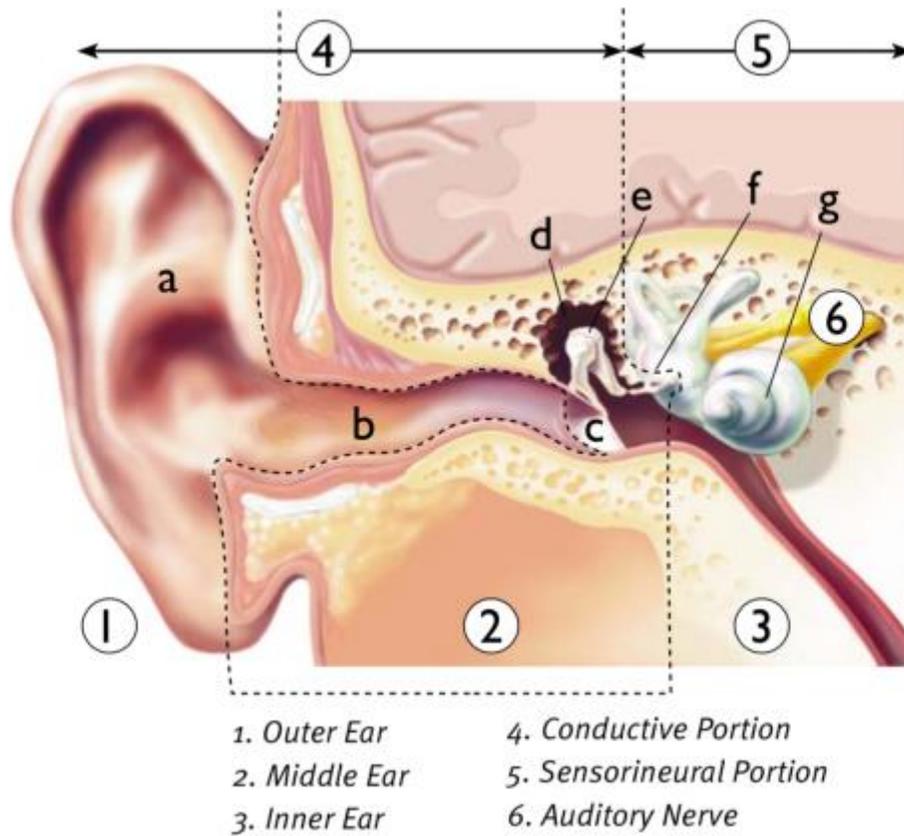


Figure 1. Cross-section of the Human Ear.

From [Parents' Guide: A Guide for Parents of Children with Hearing Loss, Oticon Paediatrics](#)

How We Hear

The two main parts of the **outer ear** are the pinna (a) and the ear canal (b) (see Figure 1).

Sound waves enter the ear canal and travel towards the eardrum (c) (see Figure 1). When sound reaches the eardrum, it vibrates - just like a real drum does when you hit it.

When vibrations reach the **middle ear**, or the air-filled space behind the eardrum, three tiny bones called the ossicles (also known as the hammer (d), anvil (e) and stirrup (f)) begin to vibrate. They amplify the sound even more.

When sound waves reach the **inner ear**, they enter the cochlea (g). This looks like the circular shell of a snail. Inside, there is a system of tubes filled with fluid. The sound vibrations make this fluid move and thousands of tiny hair cells are set in motion. These cells are tuned to respond to different pitches, tuned somewhat like the keys on a piano. When they respond, they bend, generating small electrical pulses that travel up the auditory nerve to the auditory centres of the brain. The brain interprets these signals and that is how we hear.

Adapted from
[*-Parents' Guide: A Guide for Parents of Children with Hearing Loss, Oticon Paediatrics*](#)

Types of Hearing Loss



Some types of conductive hearing loss can be medically treated.

Problems in the outer ear and ear canal can prevent sound from travelling normally to the inner ear. This is **conductive hearing loss**.

There are many causes of conductive hearing loss. The outer ear may form in an atypical way at birth, closing off the ear to hearing, or the ear canal may be blocked by earwax.

Middle ear infections can also cause conductive hearing loss. The space behind the eardrum (the middle ear) is normally air-filled but sometimes with ear infections, fluid can collect there. This build-up of fluid prevents the eardrum from vibrating normally. A conductive hearing loss can also be caused by a hole in the eardrum.

Another cause of conductive hearing loss includes damage to the three tiny bones inside the middle ear.



Eardrum movement can be tested or measured by sending a puff of air into the ear canal to vibrate the eardrum (tympanometry). Having a conductive hearing loss is like wearing earplugs: you won't hear soft sounds. Some types of conductive hearing loss can be medically corrected.

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

In the inner ear, missing or deformed hair cells prevent sound from being sent normally to the brain. A **sensorineural hearing loss** happens when there are problems with the hair cells.

The auditory or hearing nerve starts in the cochlea and travels to the auditory centres of the brain. All of the tiny electrical pulses sent by the cochlea must be processed and interpreted by the brain. Sometimes nerve pathways in the

auditory nerve get damaged. If the pulses are not passed efficiently from one part of the brain to another, sound processing can seem unclear, muffled or distorted. This is also described as a sensorineural hearing loss. Auditory Brainstem Response testing (ABR) looks for brain waves that indicate that sound of a certain pitch and loudness is being received by the brain.

Permanent hearing loss is usually referred to as sensorineural because it is hard to establish exactly how the cochlea and the brain are contributing to the hearing problem, especially in a young child. Sensorineural hearing loss may cause reduced tolerance to loud sounds and may make it difficult to understand words even when they are loud enough. Most types of sensorineural hearing loss are permanent and cannot be corrected by surgery or medication.

A **mixed hearing loss** is a combination of conductive and sensorineural loss. In this type of loss, sound is not being transmitted normally from the outer or middle ear to the inner ear, and there are problems with the inner ear and/or neural parts of the auditory system as well. 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.

Adapted from:

[-Parents' Guide: A Guide for Parents of Children with Hearing Loss, Oticon Paediatrics](#)

[-Things You Need to Know About Your Child's Hearing, Oticon Paediatrics](#)

[-Educators' Resource Guide, Manitoba Education, 2009](#)

Other Ways to Describe Hearing Loss

There are many different ways to talk about the different types of hearing loss. We can describe hearing loss by categorizing it - that is, to organize the

information into categories. Each category is described in more detail below this list.



- One way is based on whether or not a baby is born with hearing loss. If the baby is born with hearing loss it is called **congenital**. If the hearing loss occurs after the baby is born it is called **acquired**.

The term congenital hearing loss means that the hearing loss is present at birth.

- Another way depends on whether or not the hearing loss gets worse over time. Hearing loss that gets worse over time is called **progressive**. Hearing loss that does not change is called **non-progressive**.

Fluctuating hearing loss changes over time, sometimes getting better, sometimes getting worse.

Sudden hearing loss is hearing loss that happens very quickly. Such a hearing loss requires immediate medical attention to determine its cause and treatment.

- A third way depends on whether or not other symptoms are present; that is, is it **syndromic** (other symptoms are present) or **non-syndromic** (other symptoms are not present).
- A fourth way depends on whether or not hearing loss runs in the family. If it does, it is called **familial**; if it does not it is **sporadic**.
- A fifth way is based on where in the ear the hearing loss occurs. If the loss occurs in the outer or middle ear it is **conductive**. If it occurs in the inner ear it is **sensorineural**. If the loss occurs in both areas, it is **mixed**.
- A sixth way depends on whether the hearing loss appeared before or after the child developed language. If hearing loss occurs before language development it is called **prelingual**. If the loss occurs after it is **postlingual**.

What Caused my Child's Hearing Loss?

This question can be one of the most pressing for parents when they learn that their child is Deaf or Hard of Hearing.

This section answers many of the questions that families have about the causes of hearing loss, including genetic causes.



The exact cause of a child's hearing loss can be difficult to pinpoint.

About 1 in 500 infants has hearing loss during early childhood. Hearing loss has many causes: some are **genetic** (that is, caused by a baby's genes) or non-genetic, outside factors, often called **environmental factors** (like injuries, illness or certain medications).

For many babies, the cause of hearing loss is unknown. In approximately 25% of all children, it is not possible to determine the cause of hearing loss.

Environmental Factors

Environmental factors account for about 25% of **congenital** hearing loss (hearing loss is present at birth). Let's first take a look at some non-genetic factors that can cause congenital hearing loss:

- maternal infections, such as rubella (German measles), cytomegalovirus, or herpes simplex virus. Now that there is a vaccine for rubella, the most common non-genetic cause of hearing loss at birth is cytomegalovirus.
- prematurity
- low birth weight
- birth injuries
- toxins including drugs and alcohol consumed by the mother during pregnancy

- complications associated with jaundice
- maternal diabetes
- lack of oxygen (anoxia)

Hearing loss can occur at any time in one's life, as a result of an illness or injury. Below are some environmental factors that can cause hearing loss after birth (**acquired hearing loss**):

- ear infections (very common in children)
- medications that are toxic to the ear
- meningitis
- measles
- encephalitis
- chicken pox
- flu
- mumps
- head injury
- noise exposure

Genetic Hearing Loss

Almost 60% of hearing losses are caused by genetics. Genetics is the process of a parent passing certain **genes** to their children. Genes tell the cells of the body how to grow and work. Genetic hearing loss is caused by changes in genes. A person's appearance - height, hair color, skin colour, and eye colour - is determined by genes. Other characteristics affected by heredity are:

- likelihood of getting certain diseases
- mental abilities

- natural talents

A trait that is passed down through families (inherited) may:

- have no effect on your health or well-being - for example, the trait might just cause a white patch of hair or an earlobe that is longer than normal
- have only a minor effect - for example, colour blindness
- have a major effect on your quality or length of life

For some genetic disorders, genetic testing can pinpoint the cause.

There are many genes that are involved in hearing. Sometimes, a gene does not form in the way it should. When this happens, it is called a mutation. Some mutations cause **syndromic hearing loss** and others cause **nonsyndromic hearing loss**. Scientists are working to find all of the genes involved in hearing loss.

Sometimes, both genes and environment work together to cause hearing loss. For example, there are some medicines that can cause hearing loss, but only among people who have certain mutations in their genes.

Why is it Important to Know the Cause of Hearing Loss?

Where possible, it is helpful to know the cause for medical reasons. For example, if cytomegalovirus is the cause, then parents will need to be watching for **progressive** hearing loss (hearing loss can get worse over time). In addition, parents can be given information that might prevent or reduce the likelihood of progressive hearing loss. For example, minor head trauma can lead to hearing loss progression in children with enlarged vestibular aqueducts. Avoidance of contact sports may reduce this risk.

Sometimes, knowing the cause can help families to know how well different communication approaches will work. For example, children with profound hearing loss because of a Connexin 26 mutation (a common genetic cause) typically do very well with cochlear implants. This diagnosis may help a family

decide to pursue cochlear implant technology. (This does not mean that a family *should* pursue cochlear implants if there is a Connexin 26 mutation. If they *did* decide to pursue cochlear implants, the outcome is typically positive in terms of developing spoken language.)

Doctors begin by looking at a person's physical features, medical history, and family history. Based on this, they classify the hearing loss in the ways described earlier:

- congenital or acquired
- prelingual or postlingual
- progressive or nonprogressive
- conductive or sensorineural
- syndromic or nonsyndromic
- familial or sporadic

The classifications often point to certain causes. The doctors might ask for more medical tests to look for signs of **syndromic** hearing loss, and they might ask for genetic tests.

What are GJB2 and Connexin 26?

The GJB2 gene contains the instructions for a protein called Connexin 26; this protein plays an important role in the functioning of a part of the ear called the cochlea. The cochlea is a very complex and specialized part of the body that needs many instructions to guide its development and functioning. These instructions come from genes such as the GJB2, GJB3, and GJB6. Changes in any one of these genes can result in hearing loss.

About 40% of newborns with a **genetic** hearing loss (who do not have a syndrome) have a mutation in the GJB2 gene. There are many different mutations in this gene that can cause hearing loss.

Most of the GJB2 mutations are recessive, meaning that a person can have one usual copy of the gene and one copy of the mutation and will have full hearing function. (Everyone has two copies of the GJB2 gene, one from each parent). However, a child who has two copies of a gene with a mutation, one mutation inherited from each parent, will have hearing loss. This means that if both parents have a copy of the gene with a mutation, they can have a child with hearing loss, even though both parents can hear. In fact, most babies with hearing loss are born to parents with typical hearing.

About Genetic Testing

What Is Genetic Testing?

A genetic test involves looking to see if certain mutations are present. A sample usually is taken from one of two different sources: (1) a small sample of a person's blood, or (2) cheek cells from a person's mouth. To get the cheek cells, a small, toothbrush-like swab is rubbed inside a person's mouth. The cheek swab is easy and painless, but the sample obtained from this method is sometimes unstable and might not be usable.

What Are the Benefits of Genetic Testing?

If a mutation is found, it might explain why the person has a condition such as hearing loss. In some cases, knowing what mutation a person has will allow doctors to predict how severe the condition might become and what other symptoms can be expected. Then, the person can get any other medical care that might be needed. Also, knowing the cause of a person's condition will let him or her know what the chances are of passing the condition on to his or her children. It also lets other family members know the chances that they might have a child with the same condition.

What Are the Limits of Genetic Testing?

- Not all of the genes that cause conditions are known. So, even if a condition runs in a family, it might not be possible to find the mutation that causes it.

- Some tests are hard to do. For example, the bigger a gene is, the harder it is to study the whole gene.
- Sometimes, it is not possible to tell if a mutation is the cause of a condition, or just a coincidence.

What Are the Risks of Genetic Testing?

Some people have strong feelings when they get the results of a genetic test. Some people feel angry, sad, or guilty if they find out that they or their child has a mutation. **It is important to remember that everyone carries mutations of some kind, and that a person's genes are no one's "fault."**

Genetic tests are different from other medical tests in that the results provide information about other members of the family, and not just the person being tested. Some family members do not want to know that a mutation runs in their family. Also, because children get their genes from their parents, genetic tests that involve several family members can reveal personal information, such as a child having been adopted or having a different biological father.

Sometimes, people are concerned about keeping the results of their genetic tests private. For example, they do not want their friends, relatives, or co-workers to find out. Genetic testing results are kept private. Test results cannot be seen by anyone who is not involved in the testing unless the person tested or his or her parents or guardians give permission.

Emotional Response

For many parents, understanding the cause helps them to deal with their emotions about hearing loss. In our experience, it is common for parents to feel guilt, because they believe that their own actions caused the hearing loss.

When parents believe that their child's hearing loss is caused by something under their *perceived* control, they may feel guilt. The emphasis is on *perceived*, because we can't control life's events.



Many of us think that "good things happen to good people, and bad things happen to bad people." If this is true, why did hearing loss happen to us? In what ways have we been "bad"?

We may believe that some action (or non-action) could have prevented hearing loss.

In what ways do our expectations about life become violated when something bad happens? Is hearing loss "bad"?

Mothers in particular are prone to guilt where their children are involved, and often do try to take responsibility for causing hearing loss. Fathers can feel guilty about not being able to protect the family.

If you can relate to these feelings, know that you are not alone. If you connect with other parents through Alberta Hands & Voices, you find that what you are going through is not so unusual.

Adapted from:

[-A Parent's Guide to Genetics & Hearing Loss, Centers for Disease Control and Intervention \(CDC\)](#)

-Clark, JG & English KM (2004). Counselling in Audiologic practice: Helping patients and families adjust to hearing loss. Boston: Pearson Education, Inc.

[-Causes of Hearing Loss in Children, ASHA](#)

-Luterman, DM (1996). Counselling persons with communication disorders and their families (3rd edition). Austin, TX: Pro-Ed.

-Smith, J., Wolfe, J. (April 2015). Anticipate Families' Most Common Hearing Healthcare Questions, The Hearing Journal, 22-28.

Where Can I Find More Information?

Any of the above resources would be an excellent place to start (especially the CDC article).

The U.S. Department of Health and Human Services has a guide that explains genes and genetic testing at <http://www.hhs.gov/>.

The Genetic Science Learning Center has some information about basic genetics, genetic conditions and genetic counselling at <http://learn.genetics.utah.edu/>.

The Hereditary Hearing Loss Homepage gives an up-to-date overview of the genetics of hereditary hearing loss for researchers and clinicians working in the field. This site can be found at: <http://hereditaryhearingloss.org/>.

NCHAM E-book: A Resource Guide for Early Hearing Detection and Intervention: Chapter 6: The Etiologies of Childhood Hearing Impairment
http://www.infanthearing.org/ehdi-ebook/2015_ebook/6-Chapter6Etiologies2015.pdf.

Evaluating Hearing



A number of different tests are used to diagnose hearing loss, none of which tells the whole story. There are three main tests used that do not rely on a child's ability to demonstrate they can hear. These can also help to pinpoint the part of the auditory system that may be causing the hearing loss.

There are three main tests that do not rely on a child's ability to demonstrate they can hear.

Middle Ear Tests

The audiologist may also take measurements that will provide information about how the middle ear is functioning. These measurements include tympanometry, acoustic reflex measures, and static acoustic measures.

- **Tympanometry** assists in the detection of fluid in the middle ear, perforation (i.e., a hole or tear) of the eardrum, or wax blocking the ear canal. Tympanometry pushes air pressure into the ear canal, making the eardrum move back and forth. The test measures the mobility of the eardrum. Graphs are created, called tympanograms. These can reveal a stiff eardrum, a hole in the eardrum, or an eardrum that moves too much. Tympanometry is often used when middle ear infections are suspected.
- **Acoustic reflex measures** add information about the possible location of the hearing problem. A tiny muscle in the middle ear contracts reflexively when a loud sound occurs. The loudness level at which the acoustic reflex occurs - or the absence of the acoustic reflex - gives information to the audiologist about the type of hearing loss.
- **Static acoustic impedance** measures the physical volume of air in the ear canal. This test is useful in identifying a perforated eardrum or checking the openness of ventilation tubes.

Otoacoustic emissions (OAEs)

Otoacoustic emissions (OAEs) are sounds given off by the inner ear when the cochlea is stimulated by a sound. When sound stimulates the cochlea, the outer hair cells vibrate. The vibration produces a very soft sound that echoes back into the middle ear. The sound can be measured with a small probe inserted into the ear canal.

People with normal hearing produce emissions. People with hearing loss greater than 25–30 decibels (dB) do not produce these very soft sounds. The OAE test is often part of a newborn hearing screening program. Lack of OAEs may suggest blockage in the outer ear canal, the presence of middle ear fluid, and/or damage to the outer hair cells in the cochlea.

Auditory Brainstem Response

The **auditory brainstem response** (ABR) test gives information about the inner ear (cochlea) and brain pathways for hearing. This test is also sometimes referred to as auditory evoked potential (AEP). The test can be used with



OAEs and/or ABR tests are often part of newborn hearing screening programs.

children or others who have a difficult time with conventional methods of hearing screening. The ABR is also used when there are signs, symptoms, or complaints suggesting a type of hearing loss in the brain or a brain pathway.

The ABR is performed by pasting electrodes on the head - similar to electrodes placed around the heart when an electrocardiogram is run - and recording brain wave activity in response to sound. The person being tested rests quietly or sleeps while the test is performed. No response is necessary. ABR can also be used as a screening test in newborn hearing screening programs. When used as a screening test, only one intensity or loudness level is checked, and the baby either passes or fails the screen.

Pure-Tone Testing

An audiologist can also perform a pure-tone test (hearing test). There are several types of measurement methods. Your child's age and ability to cooperate will determine which methods the audiologist chooses to use. A hearing test, especially on smaller children, can take some time and your child's cooperation. Often other tests are required in order to define the degree of hearing loss.



The results of pure-tone testing are plotted on an audiogram.

The audiologist measures the sound level at which your child can or cannot hear different tones. The results are then plotted on a chart called an **audiogram**.

The audiogram shows whether your child actually has a hearing loss, and if so, what kind it is, and how severe it is. This helps the experts decide what treatment is best.

A **pure-tone air conduction hearing test** determines the faintest tones a person can hear at selected pitches (frequencies), from low to high. During this test, earphones are worn so that information can be obtained for each ear.

Sometimes, use of earphones for the test is not possible, such as when a child refuses to wear them. In these cases, sounds are presented through speakers inside a sound booth (called sound-field testing). Since sound-field testing does not give ear-specific information, a unilateral hearing loss (hearing loss in only one ear) may be missed.

The child taking the test may be asked to respond to the sounds in a variety of ways, such as by:

- raising a finger or hand
- pressing a button, pointing to the ear where the sound was received
- saying "yes" to indicate that the sound was heard

Sometimes, young children are given a more play-like activity to indicate response. The most common techniques involve **visual reinforcement audiometry (VRA)** and **conditioned play audiometry (CPA)**.

Visual reinforcement audiometry is the method of choice for screening children between six months and two years of age. The child is trained to look toward a sound source. When the child gives a correct response (e.g., looking to a source of sound when it is presented), the child is "rewarded" through a visual reinforcement. Example rewards include getting to watch a toy that moves or a flashing light.

Conditioned play audiometry can be used as the child matures and is commonly used with toddlers and preschoolers (ages 2–5). The child is trained to perform an activity each time a sound is heard. The activity may involve putting a block in a box, placing pegs in a hole, or putting a ring on a cone.

If there is a blockage, such as wax or fluid, in the outer or middle ears, a method called **pure-tone bone conduction testing** may be used. With this technique, the blockage is bypassed by sending a tone through a small vibrator placed behind the ear (or on the forehead). The signal reaches the inner ear (or cochlea) directly through gentle vibrations of the skull. This testing can measure response of the inner ear to sound independently of the outer and middle ears. In these cases, this test helps the audiologist determine the type of hearing loss being measured.

Speech Testing

The audiologist will also conduct tests of listening to speech. These results are also recorded on the audiogram. One such test is the **speech reception threshold (SRT)**. This is used with older children and adults, and helps to confirm the pure-tone test results. The SRT records the faintest speech that can be heard. The audiologist will also record word recognition or the ability to correctly repeat back words at a comfortable loudness level.



Speech testing may be done in a quiet or noisy environment. Difficulty understanding speech in background noise is a common complaint of people with hearing loss, and this information is helpful.

An annual hearing assessment is recommended for children who are Deaf or Hard of Hearing.

Since their hearing ability can change, children with hearing loss should have their hearing abilities retested on a regular basis: every 3-4 months for babies, every 6 months for 3-5 year olds and every year after that. An annual hearing assessment is recommended for children who are Deaf or Hard of Hearing because not all hearing losses are stable.

Adapted from:

- [Types of Tests used to Evaluate Hearing in Children and Adults, ASHA](#)
- [Parents' Guide: A Guide for Parents of Children with Hearing Loss, Oticon Paediatrics](#)
- [Things You Need to Know About Your Child's Hearing, Oticon Paediatrics](#)

Understanding the Audiogram

The audiogram is a graph that represents a child's responses to sound during a pure-tone hearing test. It is used to document the softest sound a person can detect at a variety of different frequencies (itches). Sound is measured in both intensity (loudness) and frequency (pitch). Intensity is measured in decibels (dB). Frequency is measured in hertz (Hz). Sounds can be described as loud or soft, and high-pitched or low-pitched.

Frequency (Pitch)

The frequency or pitch of sound is shown by the numbers across the top of the audiogram. Each vertical line from left to right represent a pitch, or frequency, in hertz (Hz) (see Figure 2). 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. Most sounds are made up of a range of different frequencies.



Speech is usually a mix of high, middle and low frequency sounds.

The frequencies included on an audiogram are chosen because they are important for understanding speech. The range of frequencies tested by the audiologist are 250 Hz, 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, and 8000 Hz.

Different speech sounds have different pitches, so it is important to know how well a person hears across the frequency range. Speech is usually a mix of high, middle, and low frequency sounds. 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 (Loudness)

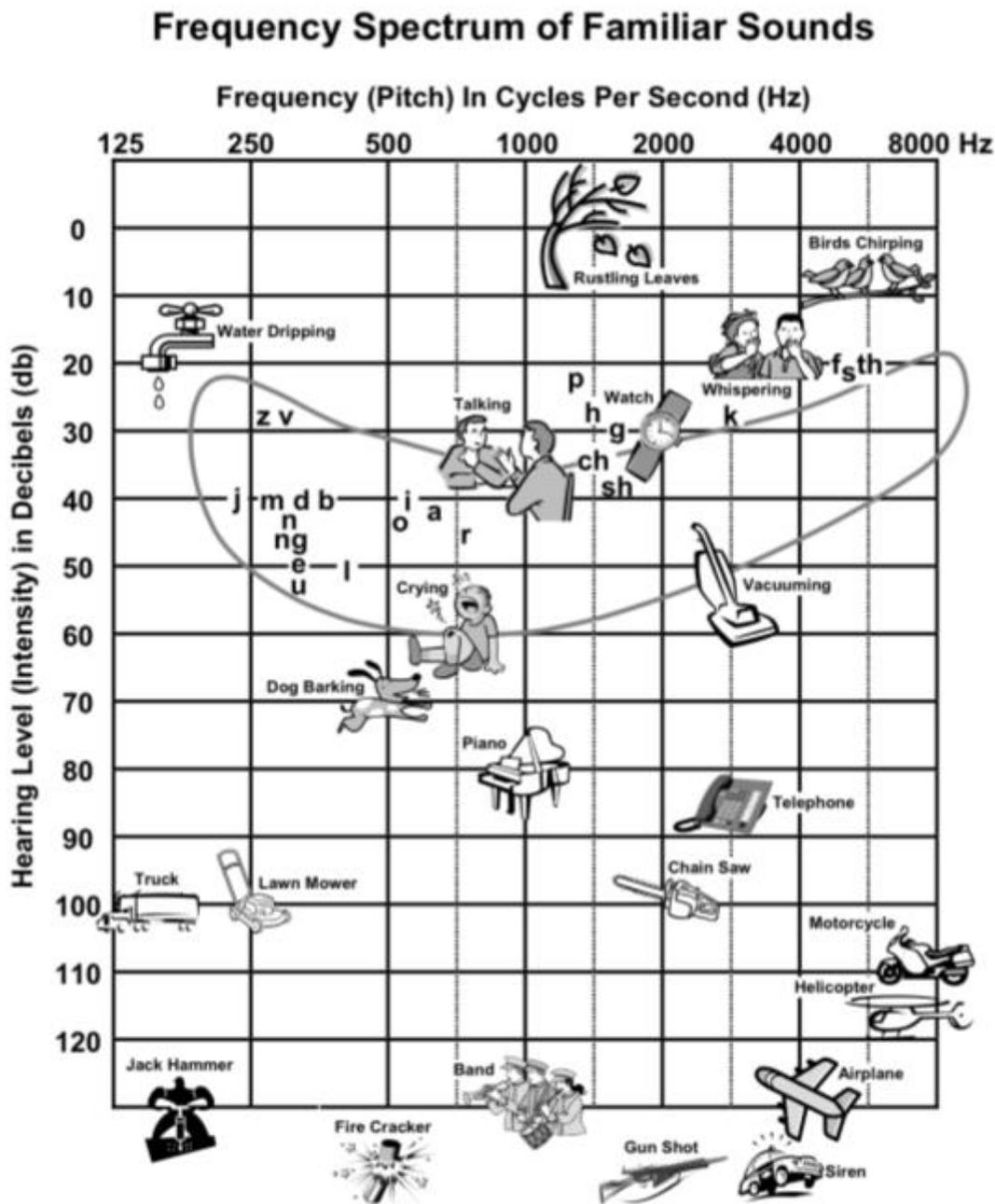


The intensity or loudness of sound is shown by the numbers down the side of the audiogram. Each horizontal line on the audiogram from top to bottom represents loudness or intensity in units of decibels (dB). The small numbers at the top are soft sounds (-10, 0, 10 decibels), and the large numbers at the bottom are loud sounds (90, 100, 110 decibels). Examples of sounds in everyday life that would be considered soft are a clock ticking, a voice whispering, and leaves rustling. Examples of sounds in everyday life that would be considered loud are a lawnmower, a car horn, and a rock concert.

The speech banana represents the area of pitch and loudness in which the majority of speech sounds will occur.

If we were to compare “normal conversational loudness level” (typically 60 dB) with whispering (typically 30 dB), we’d say that whispering is softer than conversation. In Figure 2, “Frequency Spectrum of Familiar Sounds,” the pitch and loudness of several environmental sounds and typical speech sounds are shown. The shape these 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.

With a complete audiogram, an audiologist can determine the type, degree, and configuration (or shape) of the hearing loss. The audiologist uses a red O to indicate the right ear and a blue X to record the left ear. The farther down the audiogram the Xs and Os appear, the louder the sound needs to be in order to hear it. Other symbols may also appear on the audiogram. The meaning of these symbols can be interpreted or explained by your audiologist.



* Source: Northern, Jerry L., and Marion P. Downs. *Hearing in Children*. 5th ed. Baltimore, MD: Williams & Wilkins, 2002. 18. Adapted with permission of Lippincott Williams & Wilkins. <<http://www.lww.com>>.

Figure 2. Frequency Spectrum of Familiar Sounds
(from the [Educators' Resource Guide, Manitoba Education, 2009](#))

Adapted from:

[-The Audiogram, ASHA](#)

[-Educators' Resource Guide, Manitoba Education, 2009](#)

[-Parents' Guide: A Guide for Parents of Children with Hearing Loss, Oticon
Paediatrics](#)

[-Things You Need to Know About Your Child's Hearing, Oticon Paediatrics](#)

Hearing Loss Configurations



The configuration of a hearing loss refers to its shape. The shape of the hearing loss depends on the degree and pattern of hearing loss across frequencies (pitches) on the audiogram. For example, a hearing loss that only affects the high pitches would be described as a high-frequency loss. Its configuration would show good hearing in the low pitches and poor hearing in the high pitches. In this case, you might hear speech, but it would sound muffled and unclear.

The configuration of a hearing loss refers to its shape.

On the other hand, if only the low frequencies are affected, the configuration would show poorer hearing for low pitches and better hearing for high pitches (low-frequency loss).

Some hearing loss configurations are flat, indicating the same amount of hearing loss for low and high pitches. If you have hearing loss at all pitches, you might have difficulty hearing any speech.

If both ears are affected, it is known as a **bilateral hearing loss**. If only one ear is affected, it is referred to as a **unilateral hearing loss**.

Symmetrical hearing loss means the degree and configuration are the same in each ear. **Asymmetrical hearing loss** means the degree and configuration are different in each ear.

Adapted from:
[-Configuration of Hearing Loss, ASHA](#)

What can my Child Hear?

Clinically, hearing loss is described:

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

It is not accurate to describe hearing loss as a percentage (i.e., 60 percent Deaf).



Residual hearing is the amount of usable hearing.

Most children will have some amount of **residual hearing**. Residual hearing is the amount of usable hearing. Your audiologist and support team will be able to give you more information about the degree of hearing loss and can explain the sounds that your child may hear, as well as the sounds that he would

not be expected to hear. The potential effects of a hearing loss, however, depends on many factors. These factors include degree, shape and type of loss, age at diagnosis, intervention services and parent involvement.

Adapted from:

[-Educators' Resource Guide, Manitoba Education, 2009](#)

To better understand what your child is hearing, your family may want to try a **hearing loss simulator**. Hearing loss is complex and often involves not only loss of volume, but also specific sounds. Blocking out sound or plugging your ears likely won't provide you with a comparable experience.

Hearing loss simulation programs allow you to experience not only different losses, but also different environments and sounds, such as a crowded restaurant, traffic noise or popular music. There are several free and paid programs available to stream or download online. A list of resources is provided below. This may be an important activity for immediate and extended family

members, siblings, friends, teachers and classmates to share in order to better understand what hearing loss sounds like.

Please note that some programs are more 'user friendly' than others. Some require the use of a PC, while some require a Mac or iPad. Please read the instructions or specifications clearly before use. The programs listed below were all free to use at the time of print.

Free Hearing Loss Simulators

Demonstrations: Simulated listening with hearing loss & devices from *Supporting Success for Children with Hearing Loss*. Provides links and information for several online simulation tools that involve hearing loss, FM systems, Cochlear Implants and Auditory Neuropathy Spectrum Disorder
<http://successforkidswithhearingloss.com/demonstrations>

Hearing loss simulators compiled by Bauman, N. at the *Centre for Hearing Loss Help*. Provides links to several simulation programs.
<http://hearinglosshelp.com/blog/hearing-loss-simulators/>