

Pure Tone Hearing Screening in Schools: Revised

Notes on Main Video

(Notes are also available for Video segments: Common Mistakes and FAQs)

IMPORTANT: A hearing screening does not diagnose a hearing loss.

- Instead, a hearing screening identifies children at risk for hearing who require further testing.
- In order to diagnose a hearing loss, a comprehensive audiologic assessment must be conducted by an audiologist.

Studies indicate:

- 2-4/1,000 babies are born with hearing loss in the United States.
- Hearing loss can also occur later in childhood.
- Hearing loss can affect speech, language, educational and psychosocial development.
- Early identification and treatment reduces the impact on a child's development.

Programs focused on finding/treating hearing loss consist of three parts:

Part 1: Screening

- Screening identifies children suspected of having hearing loss.

Part 2: Diagnosis

- Diagnosis involves either confirming or ruling out hearing loss.

Part 3: Treatment

- Treatment involves medical and/or audiologic treatment to meet the needs of a child with hearing loss.

Vocabulary:

Congenital: present at birth

Acquired: developed after child is born

Bilateral: present in both ears

Unilateral: present in one ear

Stable: does not change

Progressive: becomes worse over time

Fluctuating: varies- sometimes worse, sometimes better

The ear has three main parts:

- Outer Ear (the part you can see)
 - Includes pinna and ear canal.
 - Sound waves travel through the ear canal toward the eardrum.
- Middle Ear (air-filled cavity that begins at the eardrum)

- When a sound wave reaches the eardrum, the eardrum vibrates a chain of bones and the vibration is transmitted to the inner ear.
- Inner Ear (fluid-filled cochlea is lined with thousands of tiny hair cells)
 - Movement of middle ear bones creates a fluid wave which causes the hair cells to convert motion to electrical energy that travels to the brain and is interpreted as sound.

Three Categories of Hearing Loss

- **Conductive:** Hearing loss that occurs because of a problem with the outer or middle ear
 - Treatment:
 - Medical/Surgical
 - Causes:
 - Otitis media (middle ear infection)
 - Earwax impaction
 - Otitis externa (swimmer's ear)
 - Foreign body in the ear canal
- **Sensorineural:** Hearing loss caused by a problem with the inner ear or 8th nerve
 - Treatment
 - Hearing aids
 - Cochlear implants
 - Other technology
 - Causes:
 - Hereditary hearing loss
 - Complications during pregnancy/delivery
 - Childhood illness
 - Head injury
 - Noise exposure
- **Mixed:** includes both conductive and sensorineural hearing loss

Important Components of Sound (that need to be controlled by hearing screener)

- Frequency: what we perceive as pitch
- Intensity: what we perceive as loudness

Frequency

- Frequency range for normal ears: 20-20,000 Hz.
- Range of sounds for daily listening needs is smaller.
- Good hearing at 500, 1000, 2000 and 4000 Hz is critical for understanding speech sounds.
- Children with hearing loss may understand some sounds but not understand speech.

Intensity

- Intensity range for normal ears: 0 dB to 100+ dB.
- A child with a hearing loss loses the ability to hear soft, moderate and sometimes even loud sounds, depending on the degree of the loss.

An audiogram is a graphical representation of hearing ability

- Frequency (pitch) is indicated along the top of the graph.
- Intensity (loudness) is indicated along the side of the graph.
- Speech sounds fall within a certain speech envelope on the audiogram.
- Sounds that a child perceives will vary depending on the degree and type of hearing loss.

Important: Selecting a good screening room

- If possible, reserve a quiet screening room prior to the day of the screening.
- If the room is not quiet enough, the screening will have to be rescheduled.
- **It is NEVER acceptable to raise the intensity of the tone to compensate for a noisy environment.**
- Possible locations:
 - Vacant classrooms
 - Nurses office
 - Library/media center

Set up of the screening room will vary depending on size of room, number of children to be screened, and number of screeners.

- If possible, instruct children in groups to save time.
- If a 2nd person is available to assist, children can be lined up along a hallway or seated in a nearby room. The assistant can help keep the noise level down and control the flow of children into the screening room.
- Multiple hearing screeners can work at the same time if they coordinate actions so the screenings start and end at the same time.
- Do not allow talking during the screening process.

The Audiometer

- An **audiometer** is an electronic instrument designed to measure hearing.
- Avoid physical or temperature abuse of the audiometer (do not leave in a hot or cold car).
- Store cords without tangles.

Preparing for a hearing screening:

- Setting up the equipment:
 1. Plug audiometer into wall outlet. Be careful to not create a tripping hazard.
 2. Set chair for the children in a position facing away from the audiometer.
 3. Wash your hands or use hand sanitizer prior to listening check and between each screening.
 4. Clean the earphone cushions prior to each screening and between each child using an alcohol-free wipe designed to be used on rubber. Keep moisture away from the diaphragm of the earphone.
- Check the audiometer to see if it is working properly:
 1. Turn on power.
 2. Inspect cords for damage.
 3. Listen to tones at the frequency and intensity settings used for screening in positions the child will take. If you do not have normal hearing, ask someone with normal hearing to help with the listening check.
 4. 20 dB.
 5. 500, 1000, 2000, 4000 Hz.
 6. Check for unusual sounds.
 7. Be sure it has been calibrated in the past year by a professional testing facility.
- Repair the audiometer if:
 - Tone does not sound normal.
 - No sound is produced when tone switch is pressed.
 - Static is heard.
 - Earphones do not remain in proper position over ears.
 - Dial/switch does not function.
 - Indicator lights do not glow.
 - Cords are frayed/earphone cushions are ripped.

Important: Children should not be screened if they have hearing aids or cochlear implants.

Important: Refer to the school nurse if:

- Fluid is draining from the ear(s)
- Student complains of pain in ear(s)
- Student has head lice
- Student has red or swollen ear(s)
- Screener notices foreign object in ear canal.

Remove items that will interfere with the screening such as:

- Cotton balls (ask if the cotton balls are for a medical issue)

- Ear plugs (ask if it is part of amplification for hearing loss)
- Earphones
- Eyeglasses
- Large hair clips, headbands, or earrings that may interfere with the test.

Preparing students for screening:

1. "I am going to put earphone on your ears" (show them earphones).
2. "You are going to hear some beeps in your right ear and then in your left ear, raise your right hand every time you hear a beep, even if it is very, very soft. Put your hand down when the beep goes away."
3. Give the student frequent praise for listening carefully.
4. If student does not understand directions, remove headset and repeat instructions
5. If directions still not understood after repeat instruction, remove headset and allow child to return to class. Student should be referred for further testing.
6. For young children, practice the hand-raise before earphones are placed and consider responses other than a hand-raise if necessary.
7. For group instruction, demonstrate by putting the earphones on the table and presenting a loud tone. **Be sure to the intensity to 20 dB before screening.**
8. From in front of child, place red earphone on right ear and blue earphone on left ear.
9. Tighten earphones on ears by adjusting band on headset so there is a snug fit over the ears and earphones do not slide down off ears.
10. Do not permit students to place own earphones.
11. Diaphragm should be directly over ear canal (push hair behind ear if necessary).

Screening procedures:

1. Make sure child cannot see the examiner pressing the button either directly or via a mirror/reflective glass.
2. Always screen right ear first.
3. With the intensity dial set to 20 dB and frequency dial at 1000 Hz, present tone for 2-3 seconds and then release.
4. Turn frequency dial to 2000 Hz, present the tone for 2-3 seconds and then release.
5. Turn frequency dial to 4000 Hz, present the tone for 2-3 seconds and then release.
6. Change the selector to the left ear, with intensity still at 20 dB, present tones at 4000, 2000 and 1000 Hz in the left ear.

Frequency	Ear	Intensity
1000 Hz	Right	20 dB
2000 Hz	Right	20 dB
4000 Hz	Right	20 dB
Switch ears		
4000 Hz	Left	20 dB
2000 Hz	Left	20 dB
1000 Hz	Left	20 dB

Screening results:

- If student responds to all tones in BOTH ears= **PASS**.
- If student fails to respond to any of the tones= **FAIL** and mark **REFER**.
 - **even if the student only missed 1 tone, refer for further testing**

Paperwork: After each screening the screener should mark:

- Child's name
- Date
- Result of screening
- Any other information required by school system or health department