



## Introduction to Audiology

### Audiolab Assignment: Determining Type of Hearing Loss

#### Student Assignment: Pediatric ENT Clinic

##### Background

A full description of the type, severity, and configuration of a hearing impairment provides useful information about a patient's hearing status. People can experience different types of hearing loss, depending on which portion of the ear is affected. There are three types of hearing impairment: conductive, sensorineural, and mixed.

The severity of hearing loss tells you about its degree. For example, a mild impairment is much different than a profound impairment, with the former indicating the person may only have difficulty hearing soft sounds, and the latter implying the person may not hear even very loud sounds. However, note that severity may not always correspond to the patient's reported functional or subjective abilities. Calculating a person's pure-tone average (PTA) can also help you determine severity and corroborate speech-recognition threshold data. You can calculate PTA for each ear by averaging that ear's thresholds at 500, 1000, and 2000 Hz. A commonly used classification system to describe severity was described by Clark (1981) and can be viewed via the ASHA website.

The configuration of hearing loss is used to describe the pattern of hearing thresholds typically shown on an audiogram. For example, if thresholds for each test frequency occur within the same severity range, it's considered a "flat" configuration. Thresholds across test frequencies (low to high) that show a downward shift across severity ranges are often referred to as "sloping" (e.g., mild sloping to severe), while those showing an upward shift are a "rising" configuration (e.g., moderately-severe rising to mild).

A pure-tone hearing threshold is the lowest sound level someone can hear 50% of the time for a particular test frequency. Most forms of hearing impairment present with elevated thresholds. By obtaining hearing thresholds using both air- and bone-conduction, you can determine the type,

severity, and configuration of impairment. Air conduction allows you to test audiometric thresholds for the entire auditory system, starting from the outer ear to the cochlea. Bone conduction allows you to test the auditory system starting at the cochlea or inner ear (bypassing both the outer and middle ear space). By comparing air and bone-conduction thresholds, you can calculate an air-bone gap to determine the type of hearing loss. To do this, subtract the bone-conduction threshold from the air-conduction threshold.

**Conductive hearing loss** occurs when sound travel is impeded through the outer or middle ear. Conductive hearing loss can have several causes, including impacted earwax, otitis media, eustachian tube dysfunction, a perforated eardrum, an object blocking the ear canal, damage to the ossicles, and malformation of the outer ear (e.g., microtia or atresia). Conductive hearing loss can sometimes be corrected with surgery or medicine. Hearing aids and bone-conduction hearing aids can be used to treat conductive hearing loss. On an audiogram, conductive hearing loss presents by showing bone conduction thresholds within normal limits and elevated air conduction thresholds (positive air-bone-gap).

**Sensorineural hearing loss** occurs when the inner ear or higher levels of the auditory system are damaged. Sensorineural hearing loss (SNHL) can have several causes, including aging, ototoxic drug exposure, prolonged hazardous noise exposure, genetic causes, and idiopathic. Sensorineural hearing loss is not typically corrected with surgery or medicine. Hearing aids and/or cochlear implants are commonly used to treat SNHL. On an audiogram, SNHL presents by showing approximately equal and elevated thresholds for both air and bone conduction thresholds (no air-bone-gap).

**Mixed hearing loss** occurs when conductive and sensorineural hearing loss occur simultaneously. People can have damage to the outer or middle ear as well as the inner ear. On an audiogram, mixed hearing loss presents by showing elevated thresholds for both air and bone conduction, but air conduction thresholds are significantly worse than bone conduction (positive air-bone-gap).

For more information about hearing loss severity, configuration, and type, visit ASHA's website.



## Part Two: Active learning - Determining Type of Hearing Loss

Log into Audiolab, navigate to the Pure Tone Audiometry - Basic module, and join the Pediatric ENT clinic. Read the instructions. You will be introduced to one of five potential patients. Read the patient's case history and then answer these questions.

1. What information about your patient might be important?
  
2. Are there additional questions you would like to ask the patient or their parents/guardians?

Next, consider how you will instruct the patient. Let your patient know they will be listening for many different tones, that those tones will have different pitches, and some tones will sound very quiet. Explain that they should sit still, listen attentively, and press the response button when they hear the tone. If they are unsure whether they heard it, tell them it is okay to guess. Practice instructing your patient out loud.

**Prior to administering the hearing test, answer these questions.**

1. Which frequencies will you include in your test? Which ear will you start testing first?
  
2. How many ascending responses will you require to determine the threshold for each frequency?
  
3. Will you test both air- and bone-conduction thresholds?
  
4. How may your instructions vary depending on the patient's age?
  
5. How long will you present your stimulus for? How long will you wait before you present the next stimulus?

Administer the hearing test. Report thresholds for the right and left ear using the audiogram in Audiolab. Include bone conduction testing. Once you enter the audiometric data, select "Continue to Review." Review the patient's audiogram and interpret the results. You will be prompted to answer this question: **Which of the following best characterizes the patient's hearing?** Choose your response and enter a summary of your findings.

If you are completing this assignment in class, stop after you complete testing for your first patient. Be ready to talk about your patient's hearing status with the class.

If you are completing this assignment at home, test all five patients. In a separate document, write a brief report indicating your test results and recommendations for each patient (one page limit in total). If the patient does not have normal hearing, describe the severity, configuration, and type of hearing impairment.

### **Submitting Your Work**

After completion, submit this completed assignment and a copy of your Audiolab transcript(s) to your instructor. If you completed the assignment at home, you will also submit your reports to your instructor.

## Citation

Calandrucchio, L., & Ligon, E. (2024). Audiolab lesson plan: Pediatric ENT clinic (Student). [PDF]. Simucase LLC.

## References

American Speech-Language-Hearing Association. (n.d.). *Type, degree, and configuration of hearing loss*.

Gelfand, S. A. & Calandrucchio, L. (2023). *Essentials of Audiology*, 5th edition. New York, NY: Thieme.