

# Age-Related Hearing Loss for the Physical Therapist: Effects on Postural Control and Strategies to Promote Comprehensive Care in the PT Clinic

By: Carolyn Mistele, SPT

Background: Falls and Hearing Loss in Older Adults



Hearing and Hearing Loss (HL) 101

Current Concepts in Research

Screening for Hearing Loss in PT Evaluation

Tips for Success: Communicating with Patients with HL

## Content Outline



# Learning objectives:

1. Describe the impact of HL on balance, falls risk, and quality of life for older adults.
2. Incorporate a HL screen into comprehensive evaluation for older adults.
3. Identify appropriate referral sources for those with HL.
4. Implement strategies for communicating with older adults with hearing loss in clinical settings.

# Falls are a public health crisis for older adults<sup>1,2</sup>

- Leading cause of death and injuries for adults age 65+
- > 32,000 deaths/year
- 1 in 4 older adults falls each year in the U.S.
  - 36 million fallers/year
- 1 of 5 falls causes serious injury
  - Femoral neck fx, Colles fx, TBI
- Fear of future falls

# Risk factors for falling<sup>2,3</sup>

- Lower extremity weakness
- Impaired balance
- Comorbidities (DM, CVA, renal failure, depression, arthritis)
- Polypharmacy (dizziness, sedation, orthostatic hypotension)
- Environmental hazards (throw rugs, clutter, poor footwear)
- Sensory impairment

# Risk factors for falling

## Sensory Impairment

### Visual



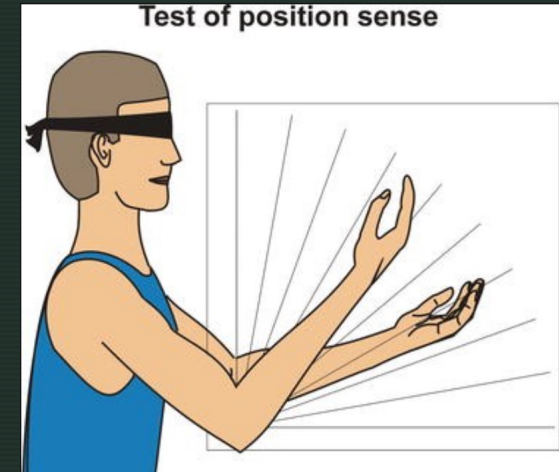
<https://www.assistedseniorliving.net/>

### Vestibular



<https://health.clevelandclinic.org/are-vertigo-and-dizziness-the-same-thing>

### Somatosensory



[https://link.springer.com/referenceworkentry/10.1007%2F978-1-4614-1997-6\\_31](https://link.springer.com/referenceworkentry/10.1007%2F978-1-4614-1997-6_31)

### Auditory??

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# Falls for older adults with HL vs without HL:

Increased odds of falling (Jiam et al., 2016)<sup>3</sup>

- Sensitivity analysis pooled odds ratio: **1.72**, (95% CI 1.07-2.37)
- Overall pooled odds ratio for all 13 studies: **2.39** (95% CI 2.11-2.68)

Greater probability of injuring themselves in a fall (Mahmoudi et al., 2019)<sup>4</sup>

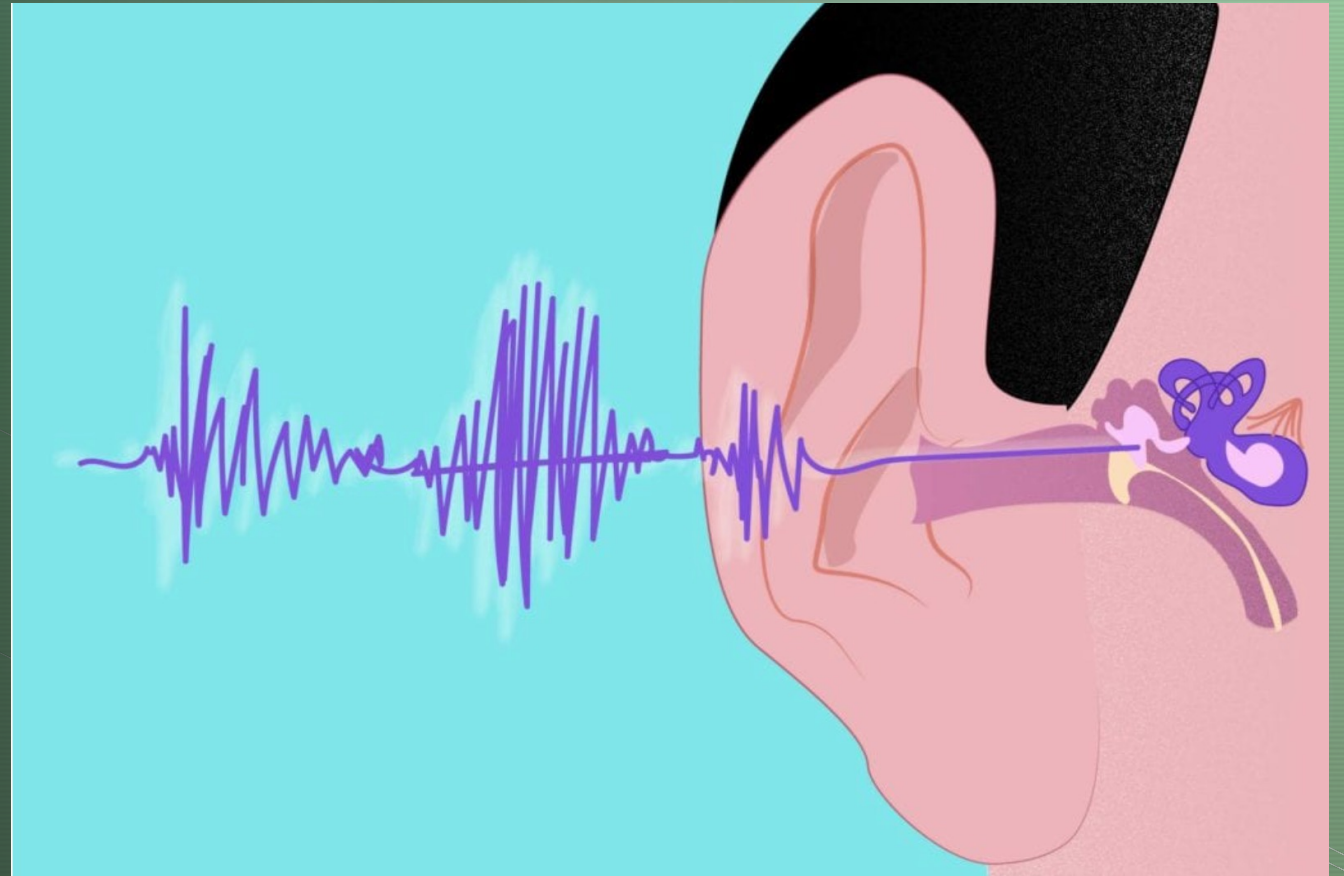
- Incidence of injurious falls in 2008-2016: 12.7% vs 7.5%

# Prevalence of HL in the U.S.<sup>5</sup>

- Approx. 30-35% of adults age 65-74
- Approx. 40-50% people age 75+
- Over 27 million Americans age 65+ with HL<sup>4</sup>
- Expected to increase with the aging population



# ▾ Hearing and Hearing Loss



<https://creakyjoints.org/comorbid-conditions/inflammatory-arthritis-hearing-loss/>

# How does hearing work?<sup>6</sup>

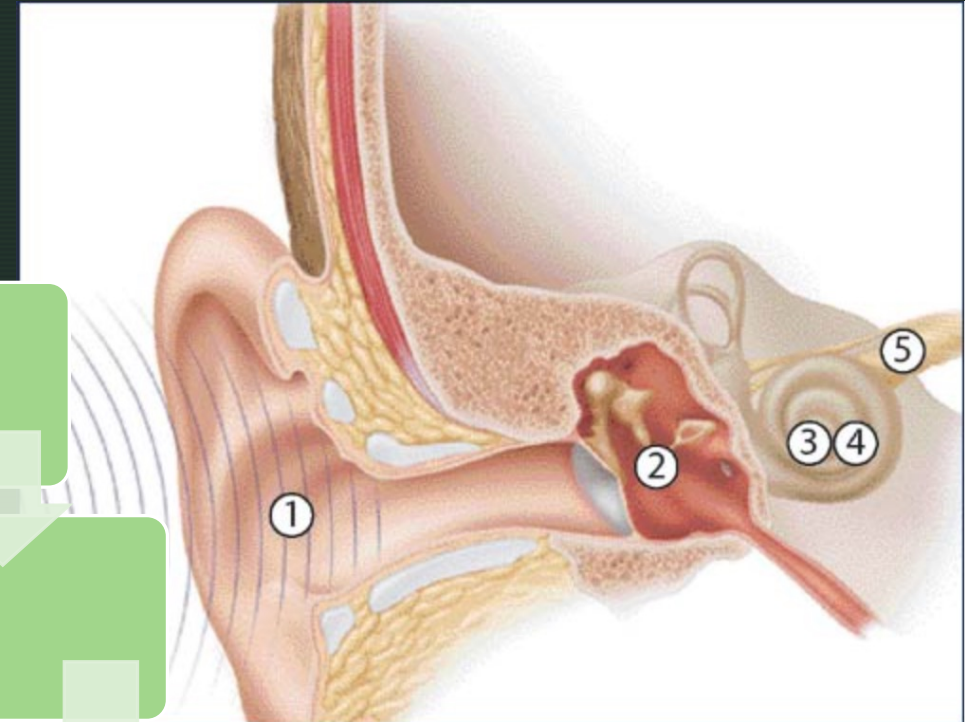
Outer ear: auricle gathers sound waves → external auditory meatus

Middle ear: tympanic membrane and ossicles vibrate

Inner ear: Fluid in cochlea moves → hair cells bend, convert to impulses

Electrical impulses through CN 8 → cochlear nucleus

Cortex: Electrical impulses interpreted as sound



<https://www.umms.org/ummc/health-services/hearing-balance/patient-information/how-ear-works>

# Hearing loss is the reduced ability to detect or interpret sound<sup>6,7</sup>

- Conductive
  - Damage to outer/middle ear
  - Ex: Tympanic membrane rupture, infection
- Sensorineural
  - Damage to inner ear or CN8
  - Most common
  - Ex: Age, loud noise exposure, hereditary, medications
- Mixed HL

# Age-related hearing loss = Presbycusis<sup>5</sup>

- Gradual
- Sensorineural
- Greater loss of high-pitched sounds
  - Deeper voices easier to hear/understand
  - “s” and “th” difficult to tell apart
- Background noise ↓ sound perception

# Hearing loss simulation-What's it like?



(Hearing Healthcare Centre, 2017)

<https://www.youtube.com/watch?v=PbBZjT7nuoA>

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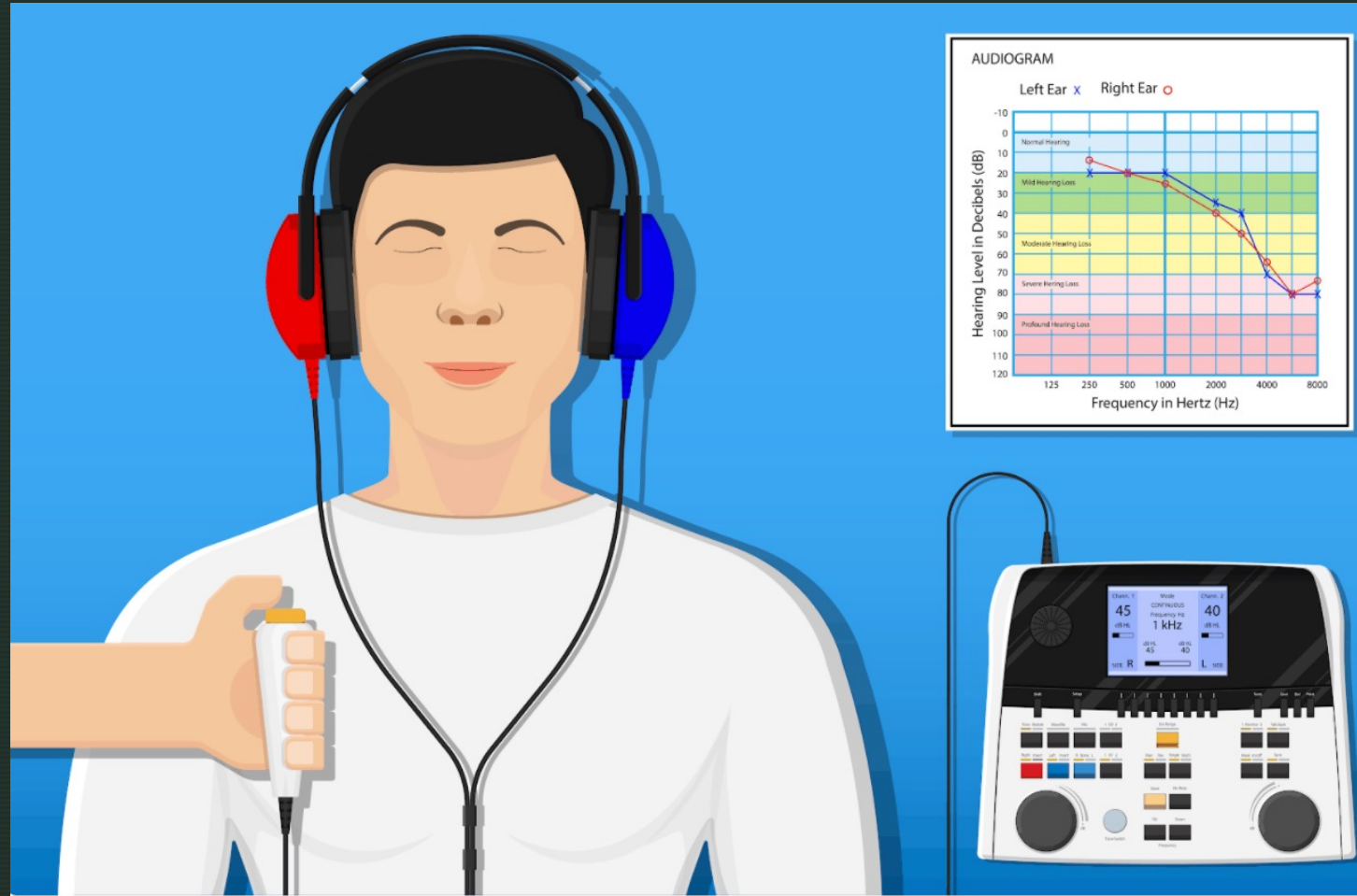
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# Hearing loss effects on communication

- Asking people to repeat themselves
- Misunderstandings
  - Vowels vs. consonants
  - Piecing together words/phrases/sentences
- Frustration
- Withdrawal from conversations & avoidance of some social situations

# Measuring hearing and hearing loss<sup>8</sup>

- Pure-Tone Audiometry Testing
- Detects quietest sound you can hear at different pitches (frequencies)
- Results recorded in an audiogram



<https://audiocardio.com/hearing-loss/the-different-types-of-audiometry-tests-for-your-hearing/>

BACKGROUND

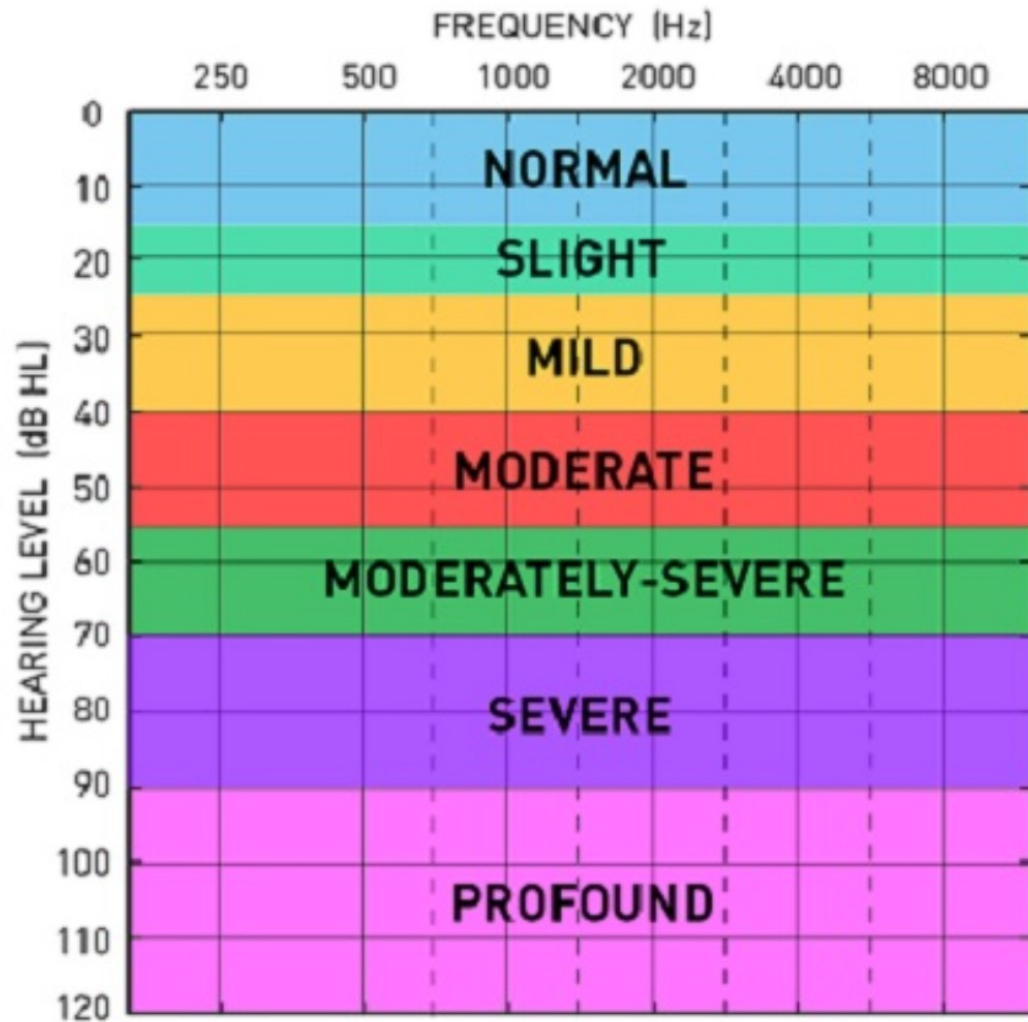
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# Audiogram Interpretation<sup>9</sup>

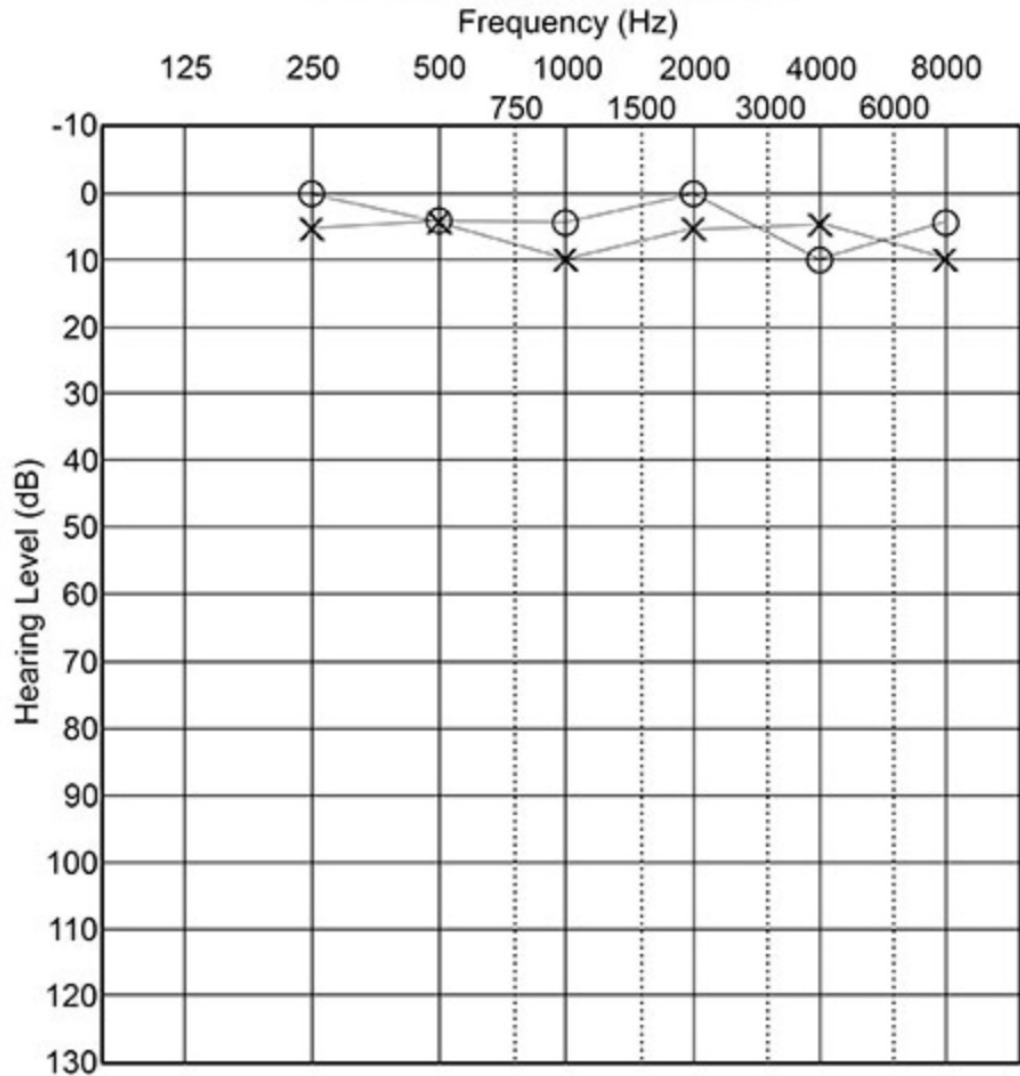


- Hearing threshold for each frequency
- Pure Tone Average (PTA)

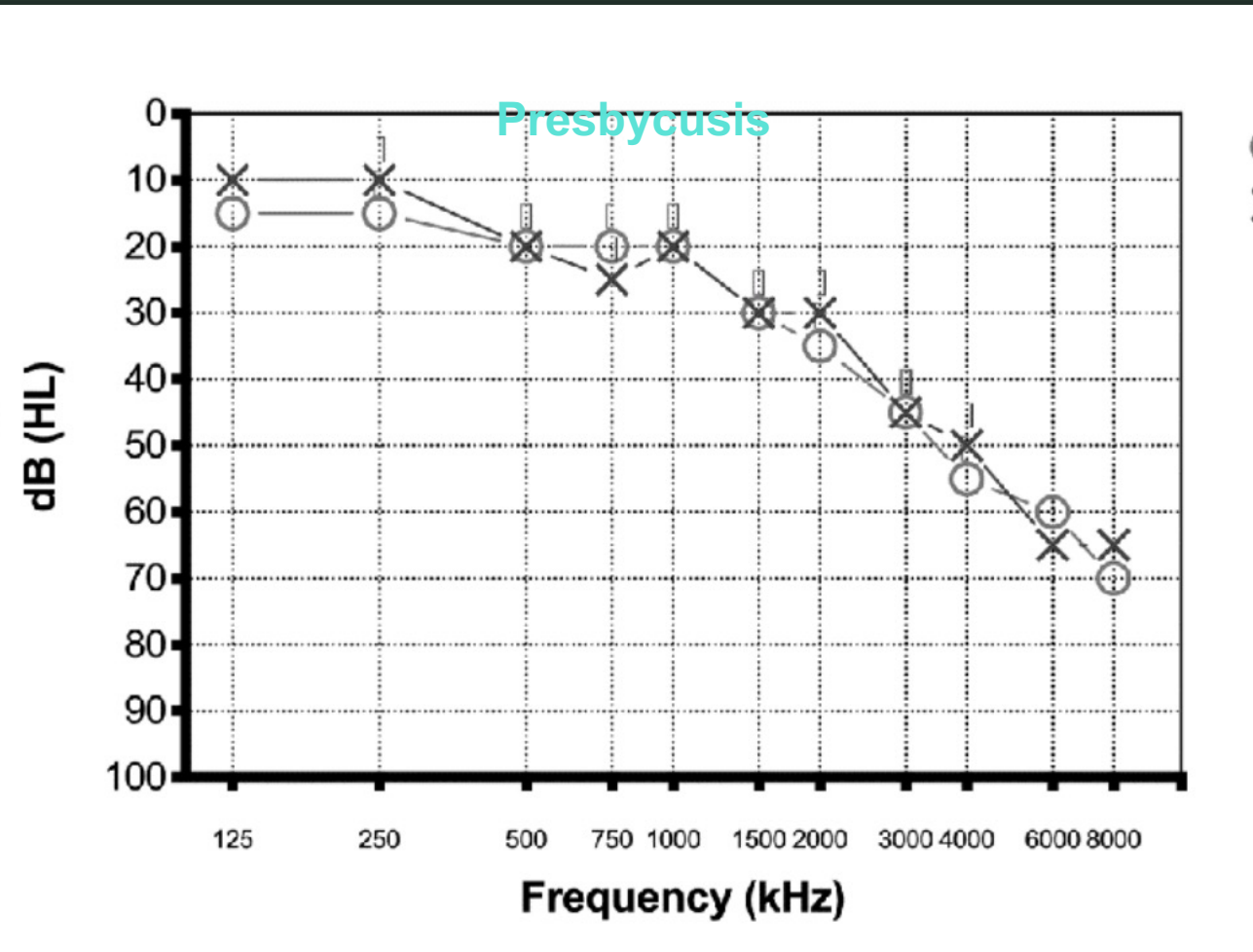


# Audiogram Interpretation

## Normal Hearing



<https://www.babyhearing.org/what-is-an-audiogram>



[https://www.researchgate.net/figure/Typical-audiogram-in-presbycusis-Pure-tone-audiometry-presents-a-sensorineural-hearing\\_fig1\\_335292560](https://www.researchgate.net/figure/Typical-audiogram-in-presbycusis-Pure-tone-audiometry-presents-a-sensorineural-hearing_fig1_335292560)

# Measuring hearing and hearing loss<sup>10</sup>

- Speech Testing= More functional!
- Speech reception threshold
- Word recognition



<https://hearinghealthmatters.org/betterhearingconsumer/2013/the-hearing-loss-whisper-game/>

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# HL terminology<sup>11</sup>

Grade of Impairment (WHO)	Lowest understandable volume of speech	PTA (dB) for 500, 1000, 2000, and 4000 Hz in better ear
No impairment	Whispers	≤ 25
Slight/mild	Regular voices	26-40
Moderate***	Raised voices	41-60
Severe	Shouting in ear	61-80
Profound/deafness	None	81+

← “normal”

← “disabling”/ “significant”

# Risk of developing frailty and falls vs normal-hearing older adults (Kamil et al., 2016)<sup>12</sup>

Increase in odds of a fall EACH YEAR

- Normal hearing: **+4.4%** (95%CI=2.6-6.2)
- Mild HL: **+6.3%** (95%CI=4.4-8.2)
- Mod-or-greater HL: **+9.7%** (95%CI=7.0-12.4)

Increased risk of developing frailty

- Mild HL adjusted Hazard Ratio (HR)=**1.12** (95% CI=0.90-1.39).
- Mod-or-greater HL Adjusted HR=**1.63** (95% CI=1.26-2.12)


# Check your learning!



Mrs. Jones is an 85 y.o. female who is having difficulty hearing your questions and instructions during her PT evaluation. She reports that she has had moderate hearing impairment for approximately 10 years.

What should you do to help determine Mrs. Jones' prior level of function?

- A. Raise the tone of your voice
- B. Lower the tone of your voice
- C. Speak into her better-hearing ear
- D. Speak with her husband instead



# Check your learning!

What should you do to help determine Mrs. Jones' prior level of function?

A. Raise the tone of your voice

**B. Lower the tone of your voice**

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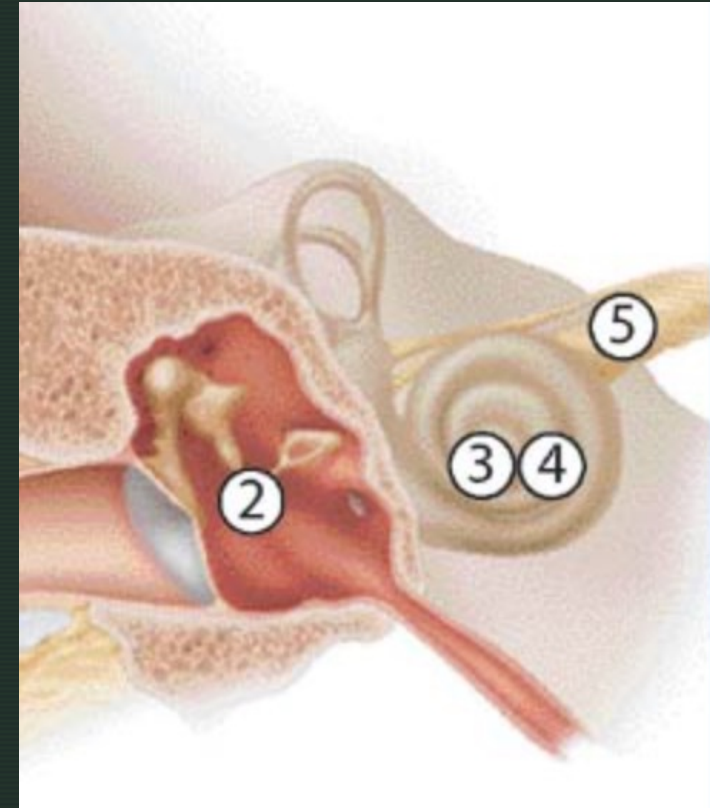
# WHY?

What is the mechanism for this association?

1. Vestibular comorbidity
2. Reduced capacity for dual-task
3. Isolation and reduced physical activity
4. Reduced auditory inputs for spatial awareness

# #1: Vestibular comorbidity<sup>3,13</sup>

- Anatomic proximity
- Exposures
  - Infections
  - Ototoxic medications
- Age-related neural degeneration



<https://www.umms.org/ummc/health-services/hearing-balance/patient-information/how-ear-works>

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## #2: Reduced capacity for dual-task with mobility<sup>3,13</sup>

- Typical aging:
  - gait/mobility less automatic, more executive control
  - decreased capacity for dividing/switching attention
- Hearing loss → increased attention required for processing sounds → less cognitive resources for balance
- Real-world situations → increased risk of falling

# #3: Social isolation and reduced physical activity

Hearing loss is associated with:

- ↑ risk of social isolation (Shukla et al., 2019)<sup>14</sup>
- ↑ odds of low physical activity levels
  - Mod-or-greater HL odds ratio: **1.70**, 95% CI=0.99-2.91. (Gispen et al., 2014)<sup>15</sup>
- ↑ odds of reporting major walking difficulties
  - Adjusted odds ratio: **2.09**, 95% CI=1.01–4.33. (Viljanen et al. 2009)<sup>16</sup>
- Slower gait speed (Kamil et al., 2017)<sup>12</sup> (Viljanen et al., 2009)<sup>16</sup>

Contributors  
to falls!

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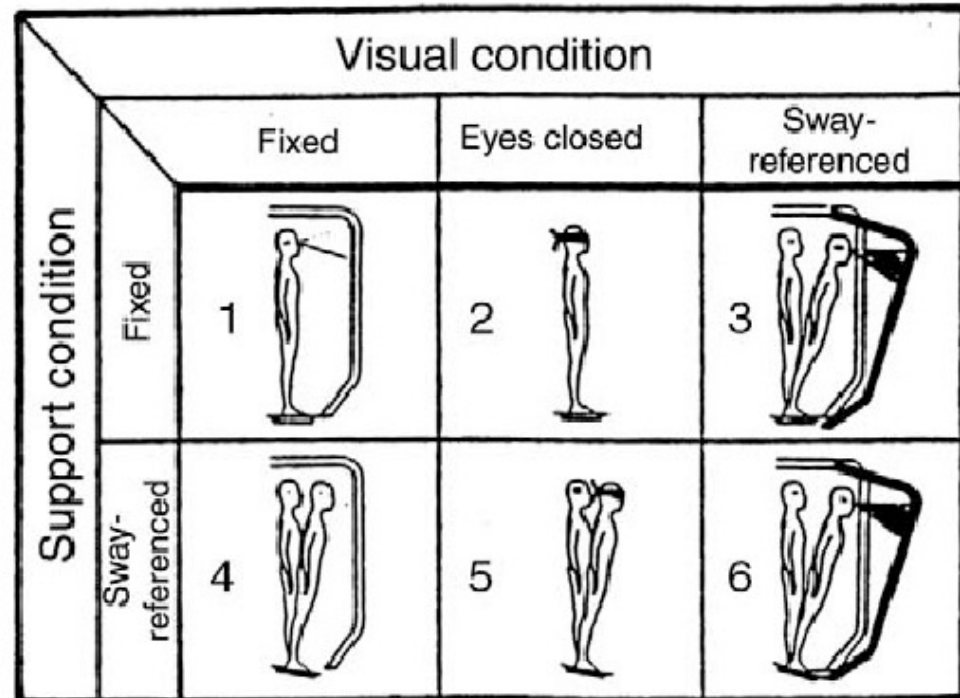
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# #4: Reduced auditory inputs for spatial orientation<sup>3,12,13</sup>

Sensory systems involved in balance:

- Visual
- Vestibular
- Somatosensory
- Auditory??

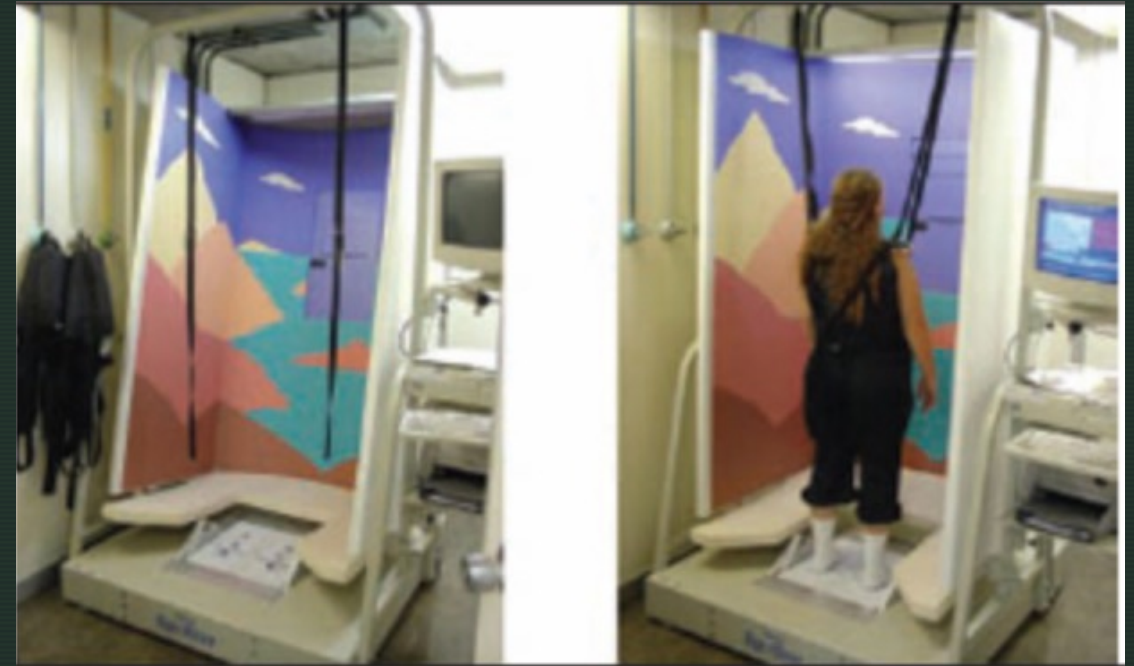


[https://www.researchgate.net/figure/The-6-Sensory-Organization-Test-SOT-testing-conditions-used-with-the-NeuroCom-Smart\\_fig2\\_23305019](https://www.researchgate.net/figure/The-6-Sensory-Organization-Test-SOT-testing-conditions-used-with-the-NeuroCom-Smart_fig2_23305019)

# Hearing loss and postural stability studies<sup>17-19</sup>

Study methods:

- Hearing conditions
- Modified SOT standing conditions
- Force platform posturography
- COP measures



[http://arquivosdeorl.org.br/additional/acervo\\_eng.asp?id=523](http://arquivosdeorl.org.br/additional/acervo_eng.asp?id=523)

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# Hearing loss and postural stability studies

↑ postural instability with hearing aids out vs. in (Rumalla et al., 2015)<sup>17</sup>  
Negahban et al., 2017)<sup>18</sup>

- Standardized effect size of hearing aid use on COP velocity:  
2.24-3.37 (Negahban et al, 2017)<sup>18</sup>

Consider hearing aids as treatment for poor balance and for falls prevention

# Hearing loss and postural stability studies<sup>17-19</sup>

Hearing aid use did not improve static balance during SOT for older adults with HL (McDaniel et al, 2018)<sup>19</sup>

## Limitations

- Non-experimental
- Cross-sectional
- Small sample size

HL is a modifiable risk factor for falls!

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# Other effects of hearing loss<sup>4</sup>

## Cascade Theory

- Depression (Mahmoudi 2019)
  - Incidence 35.6% HL vs 25.2% normal hearing
- Cognitive decline/dementia (Mahmoudi 2019)
  - Incidence 13.9% HL vs 12.2% normal hearing



# Check your learning!

Hearing loss is associated with:

- A. Frailty, depression, polypharmacy
- B. Falls, Parkinson Disease, dementia
- C. Mobility decline, advanced age, falls
- D. Social isolation, healthy aging

# Check Your Learning!

Hearing loss is associated with:

- A. Frailty, depression, polypharmacy
- B. Falls, Parkinson Disease, dementia
- C. Mobility decline, falls, advanced age**
- D. Social isolation, healthy aging

# Screening for HL in a PT evaluation

Importance

Methods

Patient referral

Role of PTs in health, wellness, & disability prevention:

Hearing screen in evaluation for ALL older adults

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# “Do you have any difficulty with your hearing?”

(Zazove et al., 2020)<sup>20</sup>

- Alert added to electronic medical record system
- Referral rate increased from 2.2% to 10.7%
  - 93.3% of referrals were appropriate
- 717 audiograms performed: 87% had HL, 58.7% were candidates for hearing aids

# “When was your last hearing test?”

- Follow-up question due to possible unawareness
- Refer if  $\geq 2$  years for age 65+

# Hearing Handicap Inventory for the Elderly (HHIE)

- 10-items
- Score 10+ indicates moderate HL (PTA >40dB)<sup>21</sup>

Adapted from: Ventry I, Weinstein B. Identification of elderly people with hearing problems. ASHA. 1983; 25:37-42.  
<https://www.uspreventiveservicestaskforce.org/Home/GetFileByID/231>

## Hearing Handicap Inventory – Screening Version (HHIE-S)

### Instructions:

Please circle YES, SOMETIMES, or NO to each of the following items. Do not skip a question if you avoid a situation because of a hearing problem. If you use a hearing aid, please answer the way you hear without the aid.

E-1. Does a hearing problem cause you to feel embarrassed when meeting new people?	YES	SOMETIMES	NO
E-2. Does a hearing problem cause you to feel frustrated when talking to members of your family?	YES	SOMETIMES	NO
S-3. Do you have difficulty hearing when someone speaks in a whisper?	YES	SOMETIMES	NO
E-4. Do you feel handicapped by a hearing problem?	YES	SOMETIMES	NO
S-5. Does a hearing problem cause you difficulty when visiting friends, relatives or neighbors?	YES	SOMETIMES	NO
S-6. Does a hearing problem cause you to attend religious services less often than you would like?	YES	SOMETIMES	NO
E-7. Does a hearing problem cause you to have arguments with family members?	YES	SOMETIMES	NO
S-8. Does a hearing problem cause you difficulty when listening to TV or radio?	YES	SOMETIMES	NO
E-9. Do you feel that any difficulty with your hearing limits or hampers your personal or social life?	YES	SOMETIMES	NO
S-10. Does a hearing problem cause you difficulty when in a restaurant with relatives or friends?	YES	SOMETIMES	NO

Scoring: No = 0; Sometimes = 2; Yes = 4.

Interpretation of Total Score:

0-8 = no handicap; 10-24 = mild to moderate handicap; 26-40 = severe handicap.

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# Smartphone-based audiometric testing

(Li et al., 2020)<sup>21</sup>

- Validated screening tool compared to gold-standard tool for hearing loss: PTA
- Sensitivity: 0.92 (95% CI=0.60-0.99)
- Specificity: 0.76 (95% CI=0.56-0.89)
- **+ LR: 3.80**



<https://www.beltonedfw.com/tips-to-prevent-hearing-loss-when-using-headphones/>

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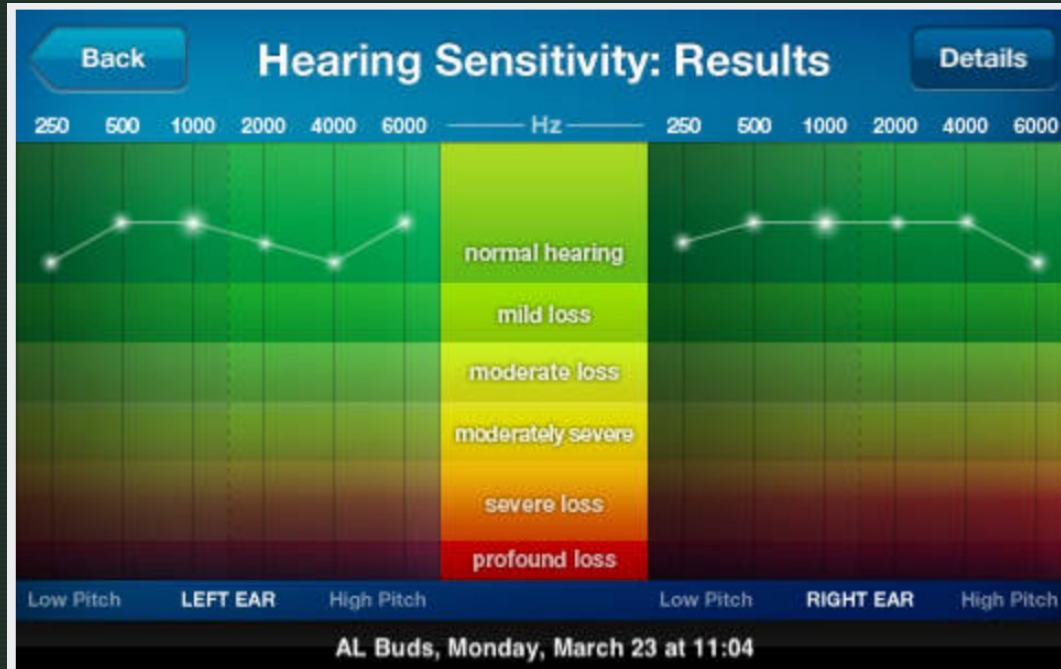
CONCEPTS

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# uHear vs HearScreen



<https://www.appicker.com/reviews/10149/uhear-app-review-assess-your-hearing-with-three-different-auditory-tests>



<https://americanhearingtulsa.us/check-your-hearing/>

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# Referrals: hearing professionals<sup>5,22,23</sup>

- Audiologist (Au.D.)
- Otolaryngologist (MD). Ear, Nose, & Throat Specialist
- Hearing Instrument Specialist

# Hearing aids: how they work<sup>24,25</sup>

- For sensorineural (inner ear) HL
- Magnifies sound vibrations entering the ear



<https://www.oticon.com/your-hearing/hearing-health/how-do-hearing-aids-work>

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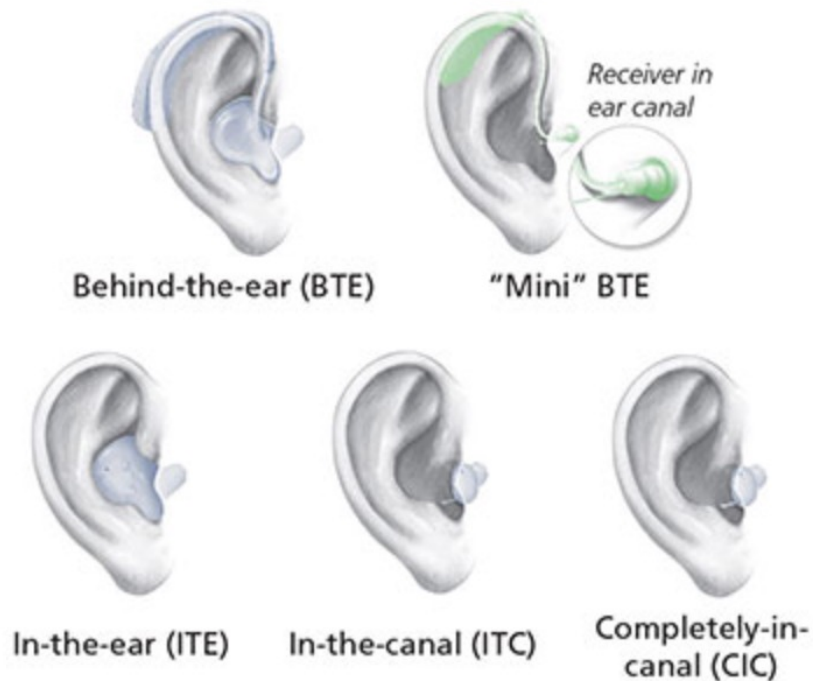
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# Hearing aids: types

## Styles of hearing aids



<https://www.nidcd.nih.gov/health/hearing-aids>

## Type of Hearing Aids



<https://www.ausyresolutions.com/hearing-aid-services/>

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# Hearing Aids: Barriers (Mahmoudi et al., 2019)<sup>4</sup>

- 14% of those with HL use hearing aids
- COST
  - Avg \$2,000-7,000 for pair
  - No/low insurance coverage
- Stigma
- Frustration
- Batteries cost and management
- Racial/ethnic disparities of hearing aid use

# Check Your Learning!

Question:

What question can you ask older adults to efficiently screen for hearing loss?



# Check Your Learning!

Answer:

***“Do you have any difficulty with your hearing?”***



# ▶ Communicating with patients with HL





# Communication Tips: General<sup>5,26,27</sup>

- Ask patient the best way to communicate
- Don't give up on discussing important topics
- Talk to the patient, not family member

# Communication Tips: Background Noise & Lighting<sup>5,26,27</sup>

- Turn down music, television playing in the clinic
- Move to empty area of the gym or move to private treatment room
- Adequate lighting for observing facial expressions, lip reading, body language, gestures

# Communication Tips: Your Location<sup>5,26,27</sup>

- 3-6 feet away to maximize audibility
- Face patient directly, eye level
- Position yourself slightly towards better ear. Do not speak directly in their ear
- Don't turn your head while speaking
  - Multi-tasking

# Communication Tips: When you speak<sup>5,26,27</sup>

- Get attention and secure eye contact before speaking (ie: Say their name, wave, light tap)
- Give topic of conversation
- Add facial expressions and gestures
- Speak slightly louder with lower pitch/frequency of voice
  - Do not shout
  - Presbycusis- higher frequencies affected

# Communication Tips: When you speak<sup>5,26,27</sup>

- Speak slowly and use short, simple sentences
- Be concise! Don't mumble/talk to yourself
- Avoid speaking while chewing food or covering your mouth with your hands
- If a patient didn't understand you, rephrasing > repeating

# Communication Tips: Patient Education

- Demonstrate exercises and activities; avoid complex, multistep verbal instructions
- HEP: write it down!
- Check for understanding **OFTEN**
  - Patients' facial expressions, nonverbal cues
- Teach back method!

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# Communication Tips: COVID Considerations<sup>28</sup>

- Virtual meetings and telehealth sessions
  - Video ON
  - Real time speech-to-text captioning
  - Google Meet and Microsoft Teams
- Social distancing + face masks = communication barrier

# Communication Tips: COVID Considerations<sup>28</sup>





# Communication Tips: COVID Considerations



[www.theclearmask.com](http://www.theclearmask.com)



[Safenclear.com](http://Safenclear.com)


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# Check Your Learning!

What practices should you avoid while working with patients with hearing loss?

- A. Shouting
- B. Speaking directly into patient's ear
- C. Turning your head away while speaking
- D. Giving imprecise, wordy cues
- E. All of the above

# Check Your Learning!

What practices should you avoid while working with patients with hearing loss?

- A. Shouting
- B. Speaking directly into patient's ear
- C. Turning your head away while speaking
- D. Giving imprecise, wordy cues
- E. All of the above**



## Role of PTs in health, wellness, & disability prevention:

1. Hearing screen in evaluation for ALL older adults
2. Encourage patients to wear their hearing aids
3. Establish effective communication to build therapeutic relationship



<https://www.shutterstock.com/search/old+people+cartoon>

# Questions?


Contact:

[Carolyn\\_mistele@med.unc.edu](mailto:Carolyn_mistele@med.unc.edu)

<https://www.shutterstock.com/search/old+people+cartoon>



Link to evaluation:  
<https://forms.gle/U9PsfgrKwAavnQ878>



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for your assistance with this project!

Link to evaluation:

<https://forms.gle/U9PsfgrKwAavnQ878>



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