

Musicians and Hearing Loss

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UT Health San Antonio

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THE UNIVERSITY OF TEXAS

**MD Anderson
Cancer Center**

Making Cancer History



**University
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Physicians

Famous Musicians with HL



Chris Martin of Cold Play

Started noticing HL and tinnitus at 25 y.o.
“Looking after your ears is unfortunately something you don’t think about until there’s a problem. I wish I’d thought about it earlier.”

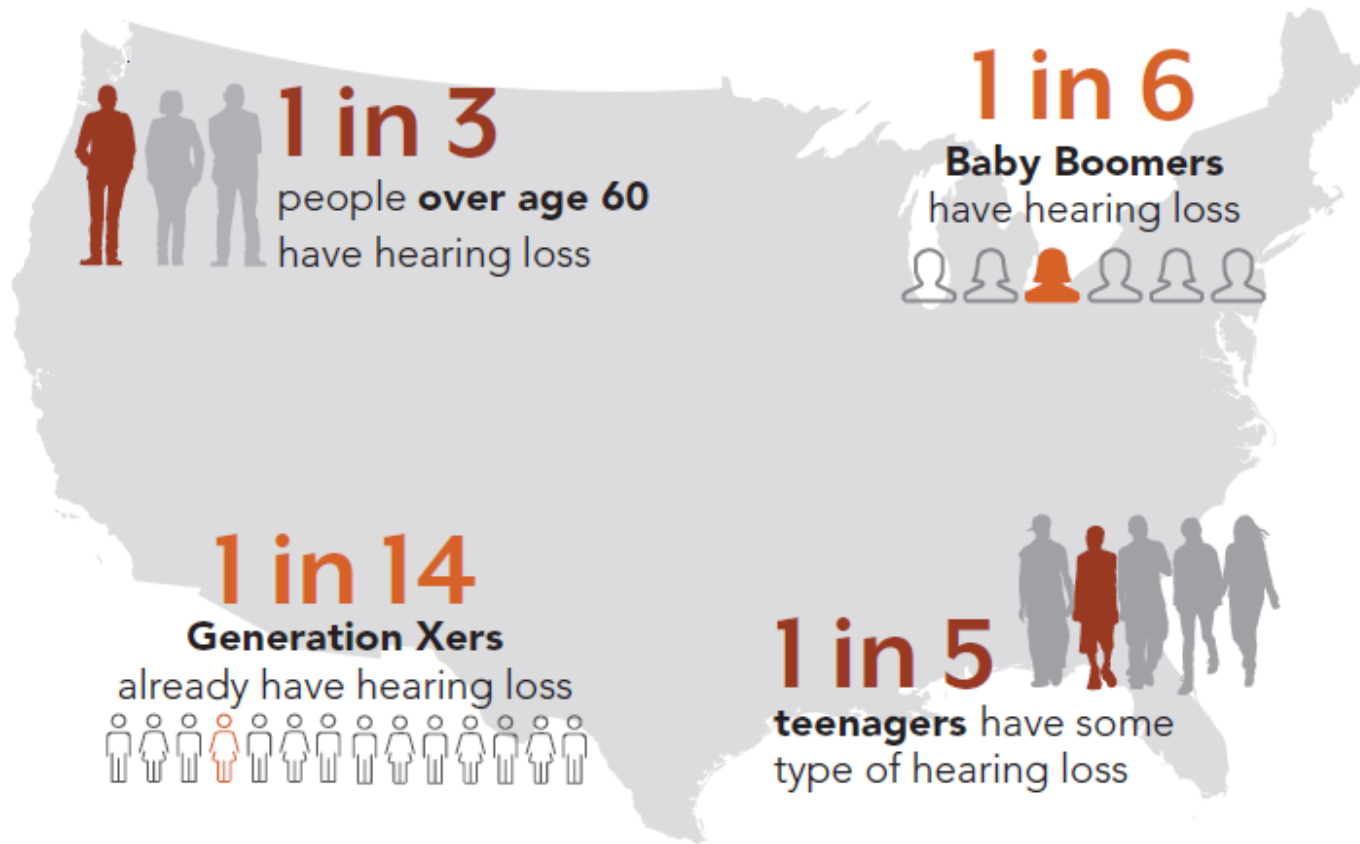


Roger Daltrey of the Who

“All you rock ‘n’ roll fans” to “take your f---ing earplugs to the gigs. If only we had known when we were young.”

OVER 18 MILLION AMERICANS
WHO SUFFER FROM HEARING
LOSS ARE **YOUNGER THAN 65.**

HEARING LOSS IN AMERICA*



Hearing Loss is the **third most prevalent chronic condition in older Americans**, after hypertension and arthritis.

Noise-Induced Hearing Loss
or NIHL is on the rise in America.
Our ears are exposed to higher levels of
noise more today than ever before.

THIS HEARING LOSS IS:
PERMANENT
100% PREVENTABLE
CAN OCCUR AT ANY
AGE!

Why should you
care!?

Student Musicians

2010 Study:

- 18-25 y.o.
- 45% NIHL
 - 78% at 6000 Hz
 - 11.5% hearing loss in both ears
- Significant increase in students practicing +2 hours per day
- **No significant** associations for instrument group or other noise exposure



Practice Rooms

- Sound levels in the practice rooms for all instrument groups exceeded **85 dB**
- Averages for some students were above 94 dB, **which would be a safe level for less than 1 hour per day**
- Some students received approximately 36% of allowable exposure in 50 minutes;
 - This does not include normal daily practice of two hours per day or ensemble rehearsal time



But how loud is
too loud?

It depends on
who you ask!

-
- World Health Organization (WHO)
 - Safe sound: 80 dB and below
 - National Institute for Occupational Safety and Health (NIOSH)
 - Safe sound: 85 dB and below
 - Occupational Safety and Health Administration (OSHA)
 - Safe sound: 90 dB and below

Though their recommendations vary, they can all agree, prolong noise exposure causes damage

Interpret with caution! Based off Industrial Noise!**

How loud for how
long is
dangerous?


Levels of Noise & Duration




How long until exposure to a sound level is dangerous?




Hand saw
 85 dB 8 hours


Tractor
 88 dB 4 hours


Motorcycle
 91 dB 2 hours


Drill
 94 dB 30 min.

Combine
 100 dB 15 min.

Football Game
 103 dB 7.5 min.

Chainsaw
 112 dB <1 min.

Pig Squeal
 115 dB <30 sec.

Gunshot
 130 dB <1 sec.



Just because a noise is not painful to listen to, does not mean it is not harmful.

Noise levels of Musical Instruments and Environments

Musical Instrument or Environment	Decibel Level
Normal Piano Practice	60-70
Fortissimo Singer – 3 feet away	70
Chamber Music in a small auditorium	75-85
Regular sustained exposure capable of damage	90-95
Piano – fortissimo	92-95
Violin	84-103
Cello	82-92
Oboe	90-94
Flute	85-111
Piccolo	95-112
Clarinet	92-103
French Horn	90-106
Trombone	85-114
Tympani and bass drum rolls	106
Average Walkman on 5/10 setting	94
Symphonic music peak	120-137
Amplified rock music peak	120
Rock music peak	150

	LAeq (dB)	LCpeak (dB)	Duration (minutes)
Choir master	84.9	114.0	37
Male singer (tenor)	87.0	117.0	19
Female singer (Mezzo)	77.4	113.8	19

Measurements were taken during a rehearsal and Evensong performance at St. Pauls Cathedral and consisted of 24 choristers and 12 adult members of the choir.

Sound Level In dB(A)	Sound Source	Permissible Exposure Time	Effect On Humans
10	Rustling Leaves	24 Hours	None
60	Conversation	12 Hours	Irritating
85	Tractor Cab	8 Hours	Risk
88	Power Drill	4 Hours	Risk
91	Arc Welding	2 Hours	Risk
94	Nightclub Bar	1 Hour	Risk
97	Power Mower	30 Minutes	Risk
100	Metal Workshop	15 Minutes	Injurious
106	Road Drill	7.5 Minutes	Injurious
109	Chainsaw	<2 Minutes	Injurious
112	Punch Presses	<1 Minutes	Injurious
130	Rivet Hammer	Zero	Dangerous
140	Jet Engine	Zero	Dangerous



Noise Exposure Limits
As Per NIOSH standards 1998-2016

Daily Caloric Intake



Accumulates through out the day

We have a daily noise dose **85 dBA** for a maximum limit of eight hours per day, followed by at least ten hours of recovery time at 70 dBA or lower



Daily Noise Dose Example



Blender	Subway to work	Rehearsal	Bar/Club	Subway home
90 dB for 1 min.	90 dB for 30 min.	92 dB for 1.5 hr.	92 dB for 2 hr.	90 dB for 30 min.
0.7%	19.8%	94.5%	126%	19.8%

DAILY NOISE TOTAL: 260.8%

(Kahari et al., 2003)

In General:

It's probably causing damage if.....

- You have to shout over background noise to make yourself heard
- The noise makes your ears ring
- You have decreased or “muffled” hearing several hours after exposure
- The noise is painful to your ears

Who is is exposed to more “noise?”



Typically practice for longer periods of time!!



High School Marching Band Camp

- 16 subjects (100 member band)
- Wore personal noise dosimeters (doseBadges)
- Five days from 8 a.m. to 6 p.m. for indoor and outdoor rehearsals



High School Marching Band Camp

Day 1:

- 15 of 16 subjects experienced noise doses in excess of 500% (100% is the maximum allowable dosage)

Day 2:

- 15 of 16 subjects experienced noise doses in excess of 300%
 - A student playing the snare drum experienced the highest levels of noise on both days at **3,925%** on day one and **1,866%** on day two
 - A color guard member experienced the lowest levels of noise on both days at 27% on day one and 23% on day two
 - Data from the other 14 subjects ranged from **504-2302%** exposure during day one and **316-1341%** exposure during day two

What about the band
instructors???



Teachers/Instructors

- 19 music teachers (elementary, middle, and high school)
- Teachers wore a personal sound dosimeter (doseBadge) for two days



Teachers/Instructors

Daily sound doses ranged from 6% to 261%

- Elementary: Doses from 6% to 26%
- Middle school choral/general teachers: doses from 16% to 133%
- High school choral teacher: 18% to 134% (not a typical day)
- Middle school instrumental teachers: doses from 31% to 207% (average of 143%)
- High school instrumental teachers: doses from 101% to 261%

Use of over the counter earplugs would have resulted in in less than 100% dose for all participants in this study

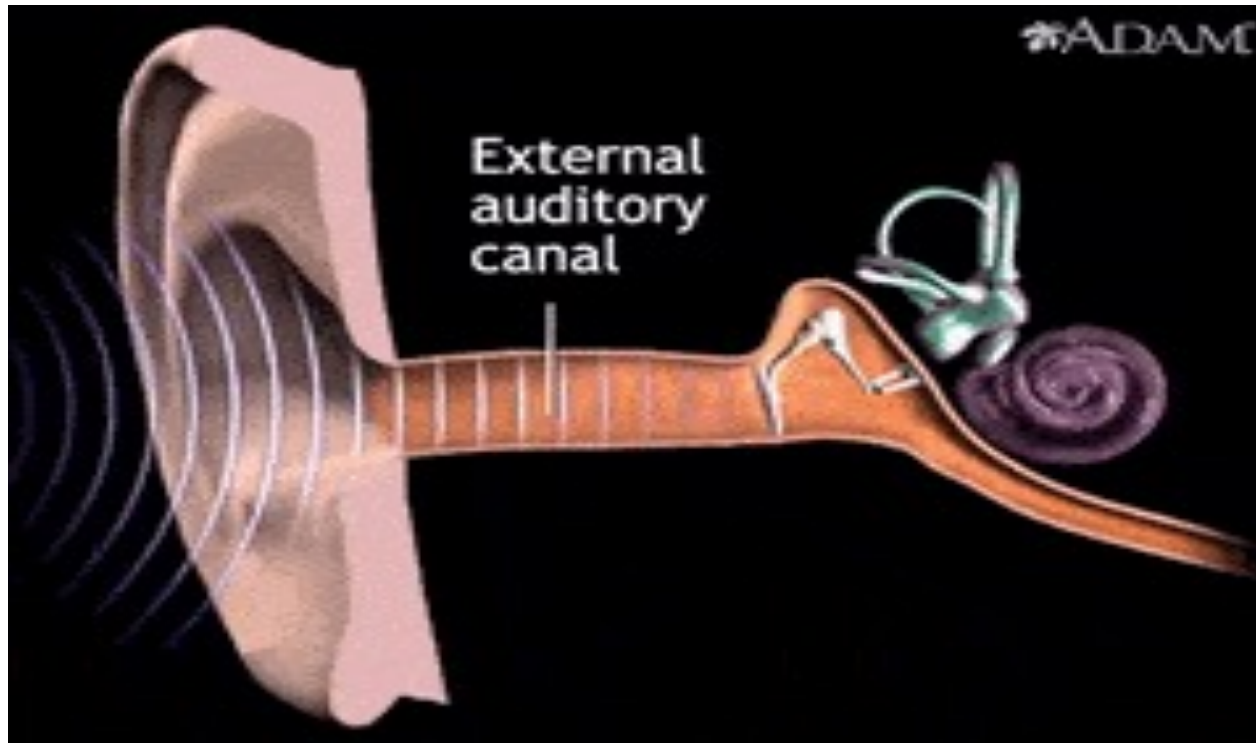
What Do I suggest?



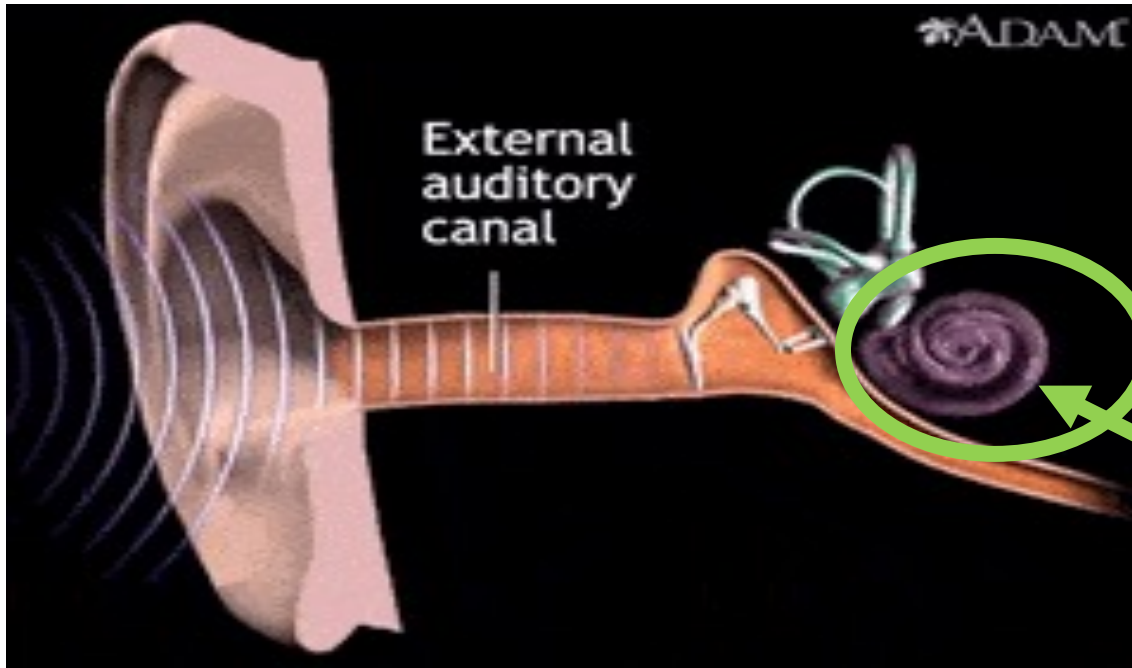
What Do I suggest?

- Understand the cause of NIHL
- Learn prevention techniques!

How We Hear:



Types of Hearing Loss:

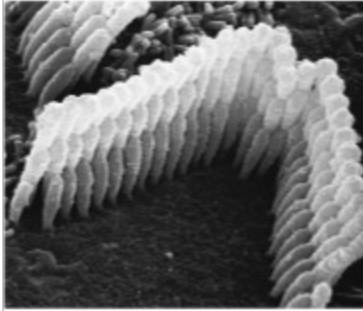


Sensorineural Hearing Loss

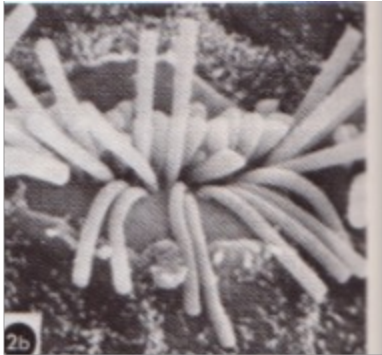
- o Hearing loss that is congenital or caused by aging, illness, ototoxic antibiotics and chemotherapy, and excessive exposure to noise (**noise-induced hearing loss**)

NIHL (Noise-Induced Hearing Loss)

Hearing loss as a result of prolonged or sudden exposure to loud noise.

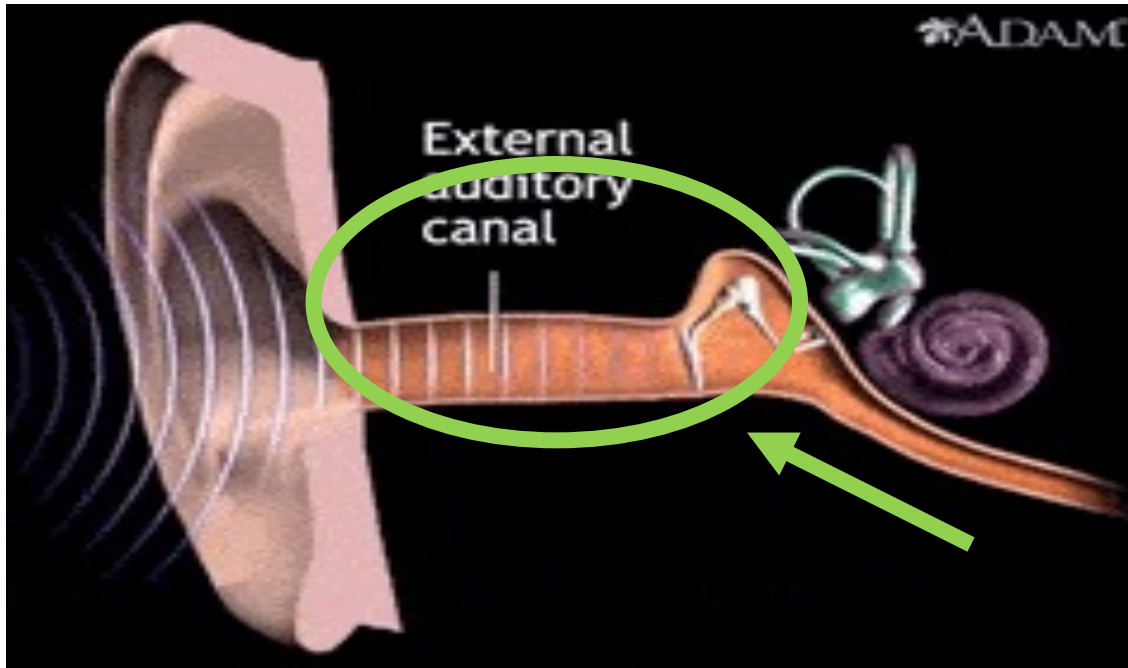


When our ears are exposed to levels of noise over **85 dB**, the tiny hair cells in our cochlea can become disorganized and damaged from too much and too harsh of vibrations.



Once the hair cells break, they will **NEVER** grow back, this causes hearing loss.

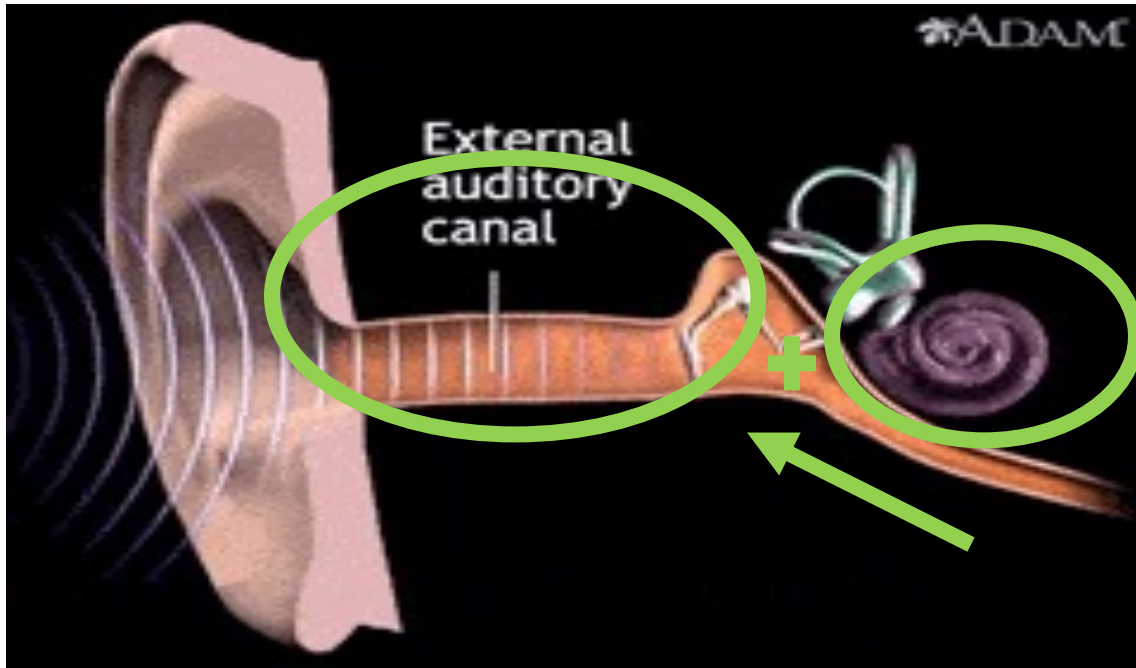
Other Types of Hearing Loss:



Conductive Hearing Loss

- o Hearing loss occurs when sound waves are prevented from reaching the inner ear (ear infection, hole in ear drum, wax in canal)

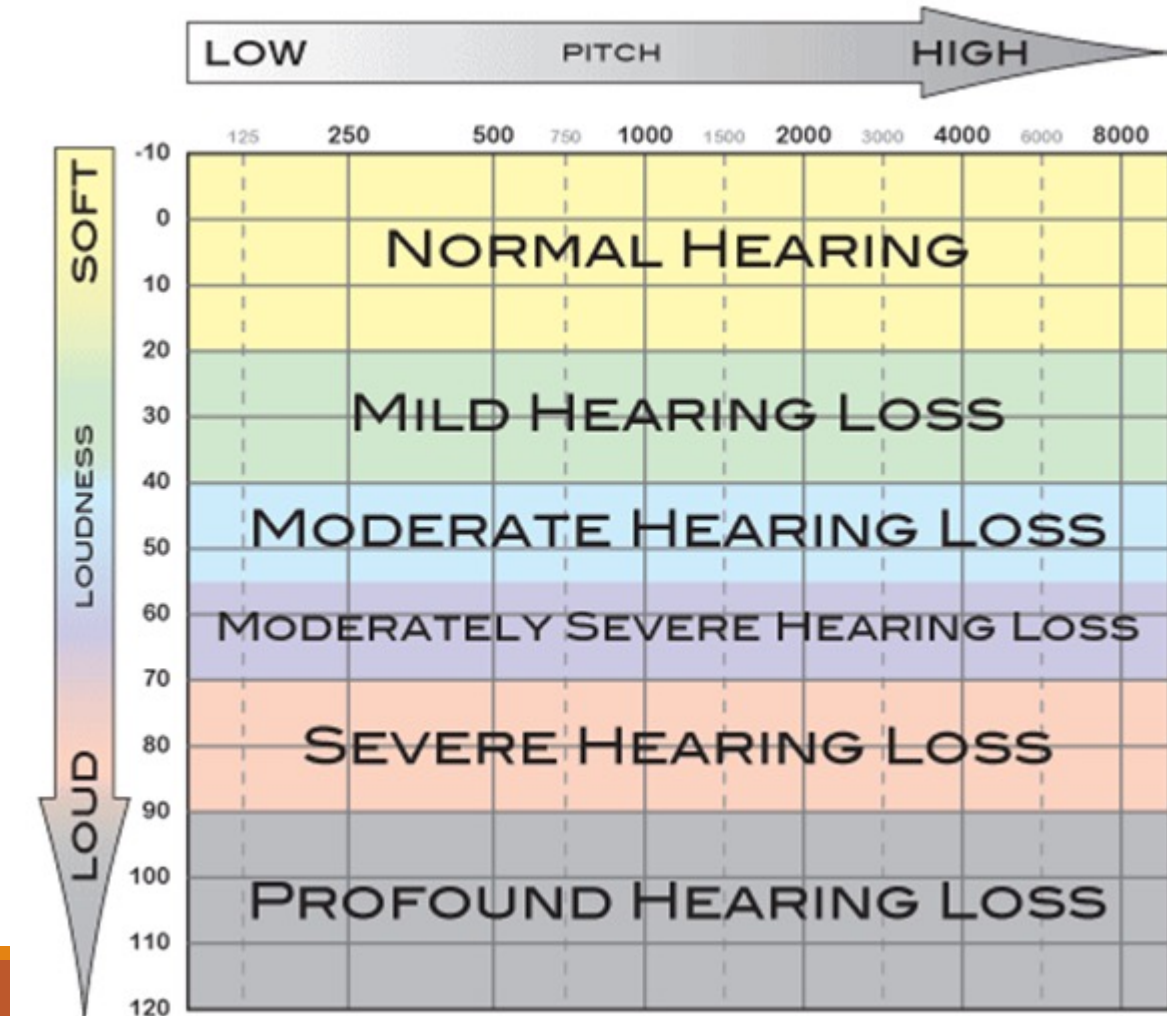
Other Types of Hearing Loss:



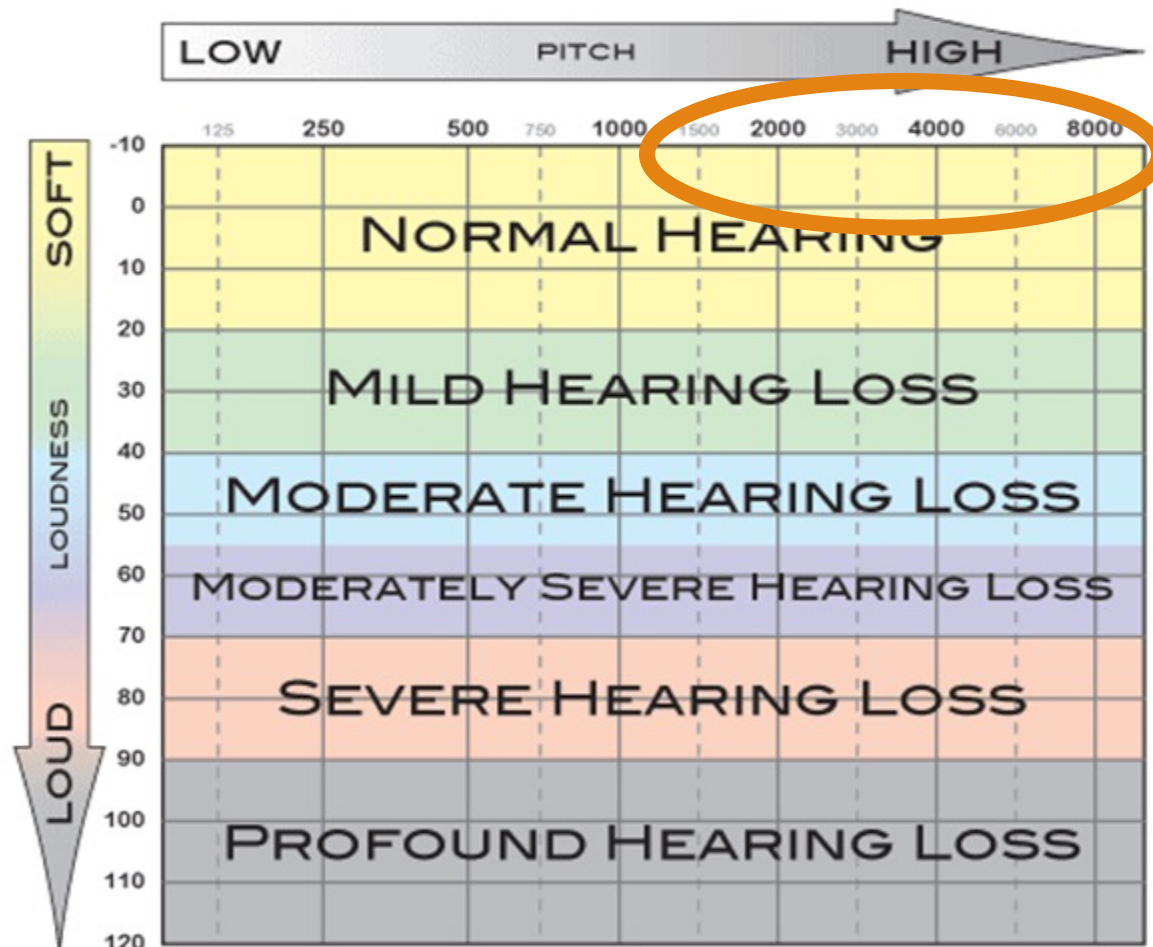
Mixed Hearing Loss

- o Hearing loss caused by a combination of both sensorineural and conductive hearing losses

Degrees of Hearing Loss



Degrees of Hearing Loss



Signs of NIHL

- Muffled hearing or ringing in the ears after you leave a noisy environment.
 - This is temporary noise-induced hearing loss and is a sign that some damage has been caused to the hair cells in your ears.
- Distorted sounds. Trouble hearing certain consonants such as “s,” “sh,” and “t.”
- Difficulty hearing when background noise is present, such as in a restaurant.
- A constant or intermittent ringing, buzzing, or hissing in your ear.
 - This is called tinnitus.
 - Often a symptom accompanying hearing loss.

Its not just hearing loss

- Tinnitus

- Perception of sound in the absence of it (ringing, buzzing, humming, crickets chirping))

- Hyperacusis

- Decreased sound tolerance

Diplacusis

- Distortion of pitch
- One pitch may sound like different pitches to each ear or as different pitches in the same ear
 - Makes matching pitches difficult, one note being heard as two

(Kahari et al., 2003)

What Can You DO?





3 General Ways to Protect Your Hearing



**WALK AWAY
FROM THE NOISE**



**TURN DOWN
THE VOLUME**



**WEAR EAR
PROTECTION**

Walk Away



- If the noise is too loud, you don't have to be near it, avoid it walk away
- Moving back 10 to 15 feet from the noise can reduce the intensity that is going into your ears
- Be aware of how long you have been in a noisy environment, exposure time also plays a role in NIHL

What sounds throughout the day can you control?



Turn It Down



When listening to anything with ear buds or ear phones: if someone next to you can hear what you are hearing, **it is probably too loud.**

Listening with Earbuds



Volume Level	Maximum Listening Time per Day
50% or below	No limit
60%	18 hours
70%	4.6 hours
80%	1.2 hours
90%	18 minutes
100%	5 minutes



Headphones: Adjust the above volume levels by adding 10%:

- 1.2 hours at 90% volume instead of 80% volume (It won't sound any louder to you)



Wear Ear Protection



Foam Ear
Plugs



Etymotic
ETY-PLUGS



Ear Muffs



Custom Ear Plugs



Custom Musician Plugs

Look for the NRR rating to know the approximate decibel reduction the ear protection provides.

Wear Ear Protection



Foam Ear
Plugs



Etymotic
ETY-PLUGS
"ER-20s"



Ear Muffs



Custom Ear Plugs



Custom Musician Plugs

Look for the NRR rating to know the approximate decibel reduction the ear protection provides.

Fire-arms:



Non-Custom Ear Plugs



Ear Muffs



Improper Fit

Poor Fit

**Best Fit For Best
Protection**

STEP 1



Roll: For roll-down foam earplugs, start rolling the foam gently to avoid creases. Then roll firmly to make the cylinder as small and stiff as possible. **Move quickly** to next step so that the earplug doesn't expand before insertion.

STEP 2



Pull: Reach over the head to pull OUT (or for some people, pull UP or BACK) on the outer ear. Have someone observe and give you feedback about which pull-direction is most effective in opening the ear canal for a better fit.

STEP 3



Insert: Insert the earplug far enough so that it goes around the bend in the ear canal. This often feels sensitive (not painful), or may trigger a cough reflex. This is normal. Let go of the ear after the earplug is fully inserted.



Hearing Protection Tips for Musicians

Wall treatments:

- Heavy curtains in the studios, practice rooms and rehearsal spaces
- Sound-**absorbing** panels made of thick fabric and batting, heavy velvet drapes, or even tapestries to absorb excess sound

Panels and drapery should be free from debris (e.g., photographs, papers, diplomas) to be effective*

Hearing Protection Tips for Musicians

- Instructors should increase distance from student source as much as possible! 
- Rest periods for musicians and instructors!
- **You don't have to practice at full volume!** 

Hearing Protection Tips for Musicians

- Be mindful of your total daily noise exposure levels...where can you limit or decrease noise?
- **Destigmatize hearing protection and hearing aids!!**
- Educate and set good examples future musicians!

Hearing Protection Tips for Musicians

- Be aware of OSHA regulations!

<https://www.osha.gov/laws-regs/standardinterpretations/1983-05-01>

Your decisions today impact your quality of life in the future!



Communication Strategies



**5 things people with
hearing loss wish you
understood.....**



You need to look at me!



You need to check for comprehension!



<https://youtu.be/9JxhTnWrKYs>

You need to provide context!



You need to eliminate background noise!



You need to allow for extra processing time

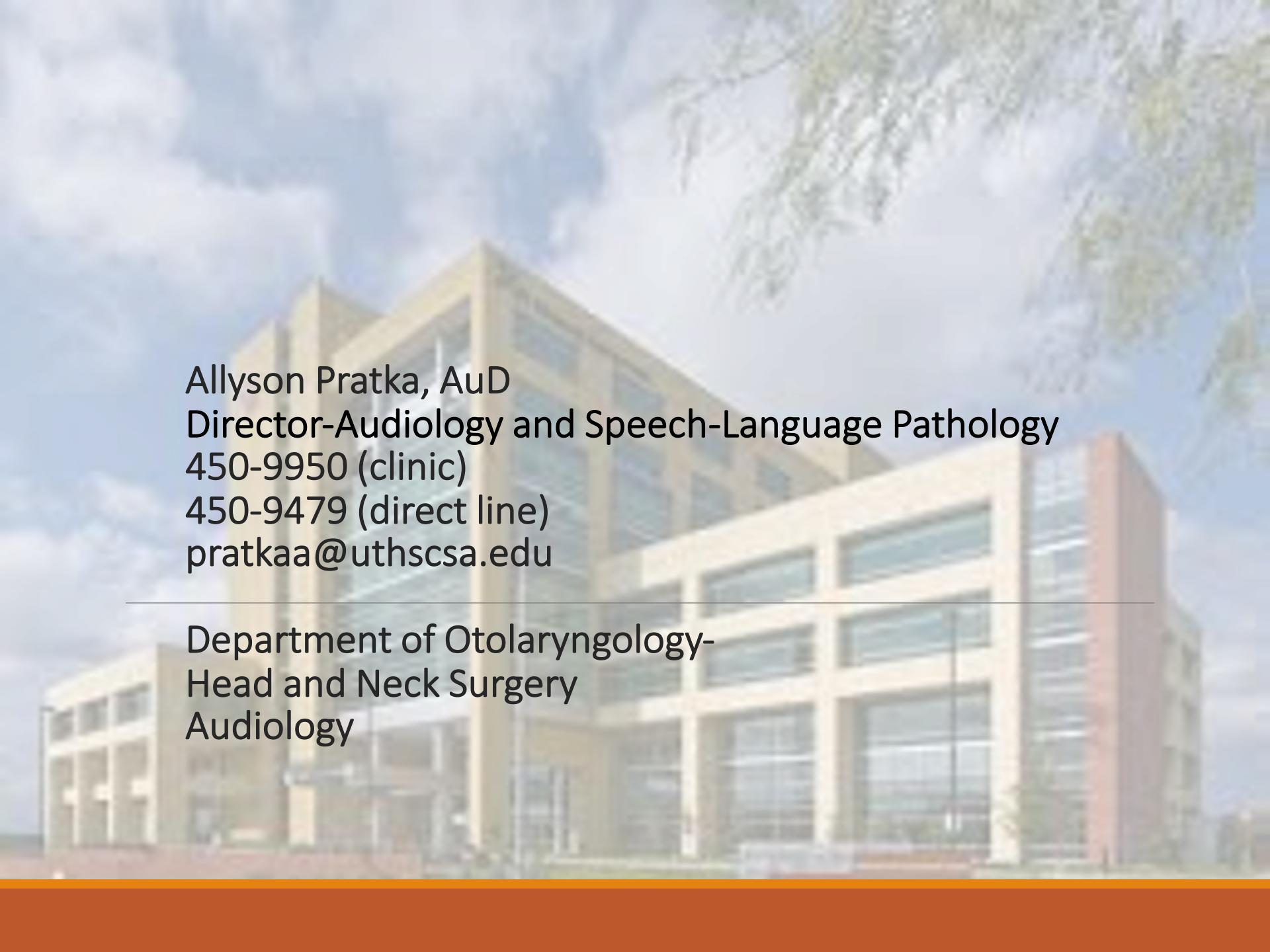
Most importantly.....



You need to be patient!!



Facemask, though vital, create serious barriers for the hearing impaired!



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