Musicians and Hearing Loss

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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 Daltry 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*

1 in 3 people over age 60 have hearing loss

1 in 6 Baby Boomers have hearing loss

1 in 14 Generation Xers already have hearing loss

1 in 5 teenagers have some type of hearing loss

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

<table>
<thead>
<tr>
<th>Source</th>
<th>Sound Level</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand saw</td>
<td>85 dB</td>
<td>8 hours</td>
</tr>
<tr>
<td>Tractor</td>
<td>88 dB</td>
<td>4 hours</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>91 dB</td>
<td>2 hours</td>
</tr>
<tr>
<td>Drill</td>
<td>94 dB</td>
<td>30 min</td>
</tr>
<tr>
<td>Combine</td>
<td>100 dB</td>
<td>15 min</td>
</tr>
<tr>
<td>Football Game</td>
<td>103 dB</td>
<td>7.5 min</td>
</tr>
<tr>
<td>Chainsaw</td>
<td>112 dB</td>
<td>&lt;1 min</td>
</tr>
<tr>
<td>Pig Squeal</td>
<td>115 dB</td>
<td>&lt;30 sec</td>
</tr>
<tr>
<td>Gunshot</td>
<td>130 dB</td>
<td>&lt;1 sec</td>
</tr>
</tbody>
</table>

Just because a noise is not painful to listen to, does not mean it is not harmful.
### Noise levels of Musical Instruments and Environments

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

<table>
<thead>
<tr>
<th>Role</th>
<th>LAeq (dB)</th>
<th>LCpeak (dB)</th>
<th>Duration (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Choir master</td>
<td>84.9</td>
<td>114.0</td>
<td>37</td>
</tr>
<tr>
<td>Male singer (tenor)</td>
<td>87.0</td>
<td>117.0</td>
<td>19</td>
</tr>
<tr>
<td>Female singer (Mezzo)</td>
<td>77.4</td>
<td>113.8</td>
<td>19</td>
</tr>
<tr>
<td>Sound Level In dB(A)</td>
<td>Sound Source</td>
<td>Permissible Exposure Time</td>
<td>Effect On Humans</td>
</tr>
<tr>
<td>----------------------</td>
<td>-------------------</td>
<td>---------------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>10</td>
<td>Rustling Leaves</td>
<td>24 Hours</td>
<td>None</td>
</tr>
<tr>
<td>60</td>
<td>Conversation</td>
<td>12 Hours</td>
<td>Irritating</td>
</tr>
<tr>
<td>85</td>
<td>Tractor Cab</td>
<td>8 Hours</td>
<td>Risk</td>
</tr>
<tr>
<td>88</td>
<td>Power Drill</td>
<td>4 Hours</td>
<td>Risk</td>
</tr>
<tr>
<td>91</td>
<td>Arc Welding</td>
<td>2 Hours</td>
<td>Risk</td>
</tr>
<tr>
<td>94</td>
<td>Nightclub Bar</td>
<td>1 Hour</td>
<td>Risk</td>
</tr>
<tr>
<td>97</td>
<td>Power Mower</td>
<td>30 Minutes</td>
<td>Risk</td>
</tr>
<tr>
<td>100</td>
<td>Metal Workshop</td>
<td>15 Minutes</td>
<td>Injurious</td>
</tr>
<tr>
<td>106</td>
<td>Road Drill</td>
<td>7.5 Minutes</td>
<td>Injurious</td>
</tr>
<tr>
<td>109</td>
<td>Chainsaw</td>
<td>&lt;2 Minutes</td>
<td>Injurious</td>
</tr>
<tr>
<td>112</td>
<td>Punch Presses</td>
<td>&lt;1 Minutes</td>
<td>Injurious</td>
</tr>
<tr>
<td>130</td>
<td>Rivet Hammer</td>
<td>Zero</td>
<td>Dangerous</td>
</tr>
<tr>
<td>140</td>
<td>Jet Engine</td>
<td>Zero</td>
<td>Dangerous</td>
</tr>
</tbody>
</table>

**Noise Exposure Limits**
As Per NIOSH standards 1998-2016
Daily Caloric Intake

Accumulates throughout 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

(Kahari et al., 2003)

<table>
<thead>
<tr>
<th></th>
<th>Blender</th>
<th>Subway to work</th>
<th>Rehearsal</th>
<th>Bar/Club</th>
<th>Subway home</th>
</tr>
</thead>
<tbody>
<tr>
<td>noise</td>
<td>90 dB for 1 min.</td>
<td>90 dB for 30 min.</td>
<td>92 dB for 1.5 hr.</td>
<td>92 dB for 2 hr.</td>
<td>90 dB for 30 min.</td>
</tr>
<tr>
<td>%</td>
<td>0.7%</td>
<td>19.8%</td>
<td>94.5%</td>
<td>126%</td>
<td>19.8%</td>
</tr>
</tbody>
</table>

**DAILY NOISE TOTAL:** 260.8%
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 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
- 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
- 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**: Hearing loss caused by a combination of both sensorineural and conductive hearing losses.
Degrees of Hearing Loss

- Normal Hearing
- Mild Hearing Loss
- Moderate Hearing Loss
- Moderately Severe Hearing Loss
- Severe Hearing Loss
- Profound Hearing Loss
Degrees of Hearing Loss

- Normal Hearing
- Mild Hearing Loss
- Moderate Hearing Loss
- Moderately Severe Hearing Loss
- Severe Hearing Loss
- Profound Hearing Loss

Pitch:
- Low
- High

Loudness:
- Soft
- Loud
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.
It's 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

<table>
<thead>
<tr>
<th>Volume Level</th>
<th>Maximum Listening Time per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td>50% or below</td>
<td>No limit</td>
</tr>
<tr>
<td>60%</td>
<td>18 hours</td>
</tr>
<tr>
<td>70%</td>
<td>4.6 hours</td>
</tr>
<tr>
<td>80%</td>
<td>1.2 hours</td>
</tr>
<tr>
<td>90%</td>
<td>18 minutes</td>
</tr>
<tr>
<td>100%</td>
<td>5 minutes</td>
</tr>
</tbody>
</table>

**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
<table>
<thead>
<tr>
<th>STEP 1</th>
<th>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. <strong>Move quickly</strong> to next step so that the earplug doesn’t expand before insertion.</th>
</tr>
</thead>
<tbody>
<tr>
<td>STEP 2</td>
<td>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.</td>
</tr>
<tr>
<td>STEP 3</td>
<td>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.</td>
</tr>
</tbody>
</table>
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!

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!
You need to provide context!

https://youtu.be/9JxhTnWrKYs
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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