

Earthquakes and Hearing Loss

(and possibly crazy)



A unique, unconventional idea of educating others on hearing loss prevention.

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Disclaimer

The views expressed in this presentation are solely my own and are not representative of the Lyster Army Health Clinic, the US Army, or the US Government.

Background

- When?
- Where?
- Have I lost my mind?!?!?

Similar Terminology

- Acceleration
 - Amplitude
 - Amplification
 - Attenuation
 - Compressional (or P-) Wave
 - Damping
 - Frequency
 - Hazard
 - Hertz
 - Intensity
 - Magnitude
 - Oscillator
- * Peak Acceleration
 - * Residual
 - * Resonance
 - * Response
 - * S-Wave (shearing)
 - * Spectrum
 - * Time (history)
 - * Velocity
 - * Wavelength

Definitions

- An **earthquake** (also known as a **quake**, **tremor** or **temblor**) is the result of a **sudden release of energy** in the Earth's crust that creates seismic waves. The **seismicity** or **seismic activity** of an area refers to the frequency, type and size of earthquakes experienced over a period of time.
- Noise-induced hearing loss: A sensorineural hearing loss caused by **repeated or sudden exposure to high-intensity sound levels**. Noise-induced hearing loss is characterized by irreversible damage to the sensory hair cells located within the inner ear. Usually occurs over a period of time.
- Sound Waves: longitudinal pressure waves in any material medium regardless of whether they constitute audible sound (earthquake waves and ultrasonic waves are sometimes called *sound waves*)

Sound Wave Propagation (what we know)

- Sound is a form of vibration (coming from a sound source)
- Condensation (pressure increase) and rarefaction (pressure decrease)
- There must be a medium
 - Elastic, compressible
 - Medium must have mass

Same as with Earthquakes!!!

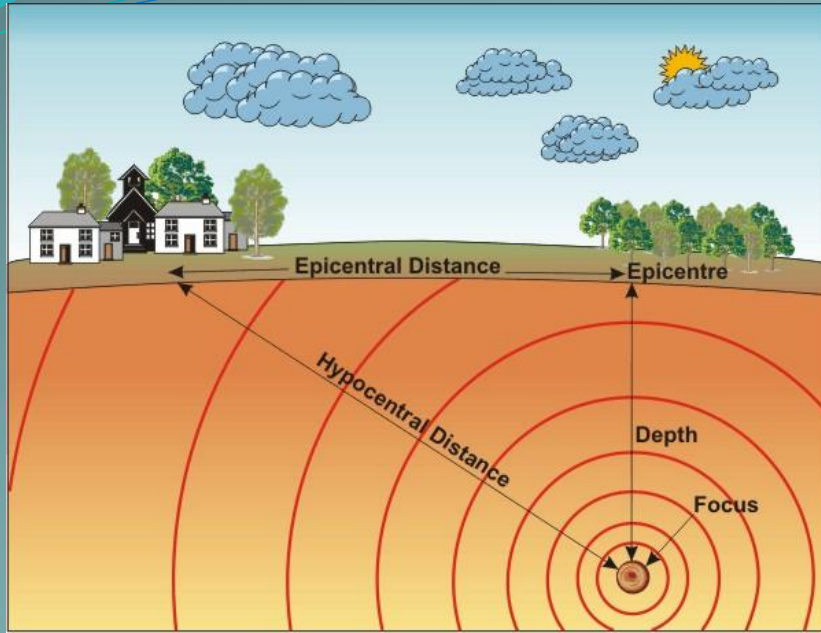
Methodology

- Modified Standard HCON PP briefing
- Included similar audiology/earthquake terms, images and references
- Presented briefing to 3 HCON classes on Ft. Rucker (mostly aviation population)
- Handed out surveys after briefing to get feedback on the briefing

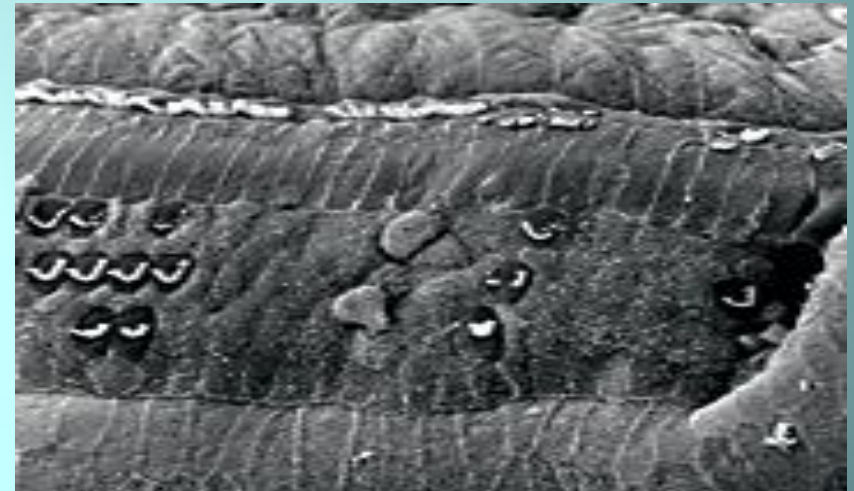
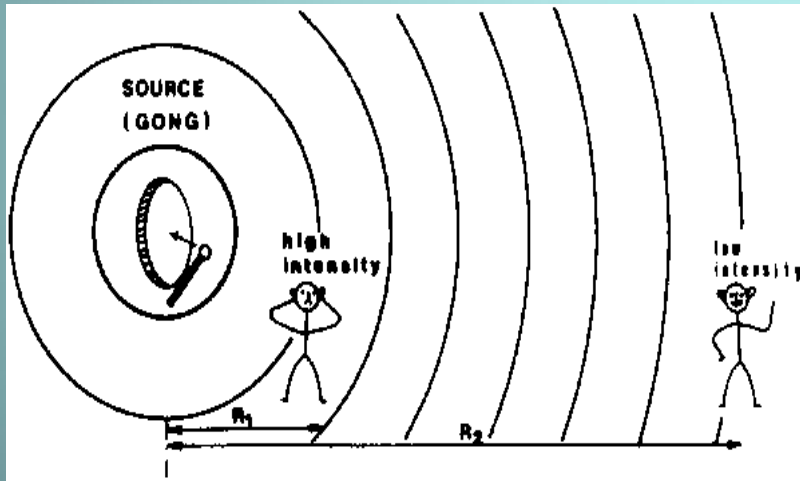
Some slide examples
used for
teaching points

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The closer you are to the earthquake the more damage can occur;

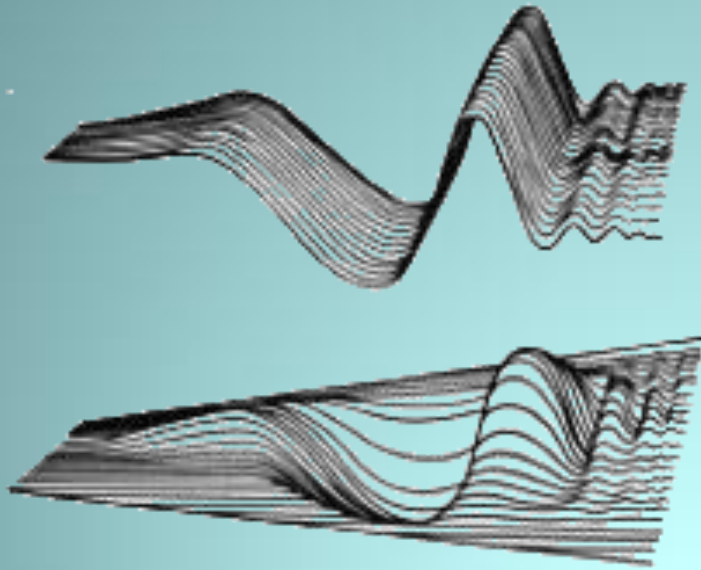


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..likewise, the closer you are to a loud noise source; the more damage can occur!

Basilar Membrane Movement



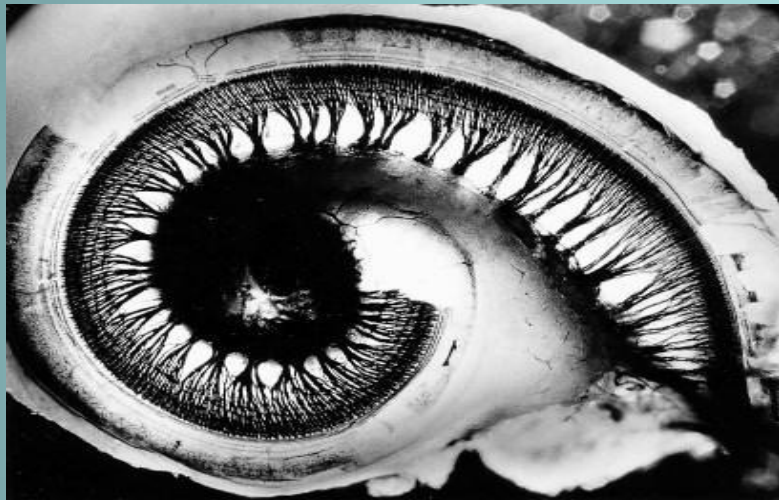
Damage from earthquake movement



Similar patterns exist between basilar membrane movement and earthquake movement

How does excessive noise exposure affect the Cochlea?

Before



After



Before/After Earthquake (Haiti)

Before



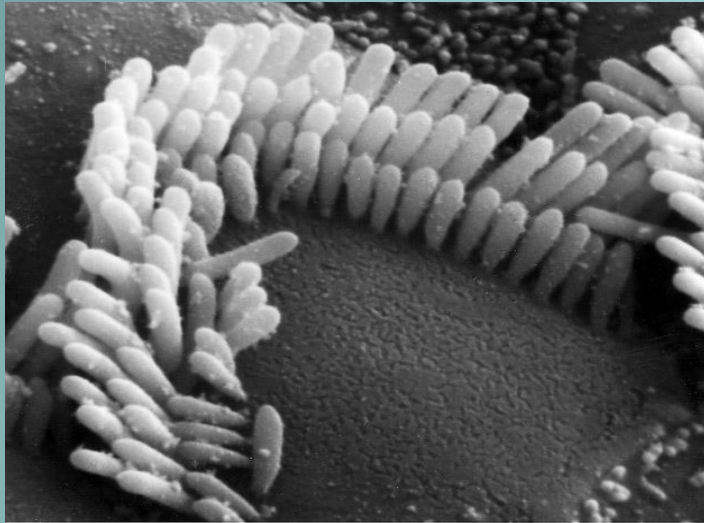
After



Helps get the point across

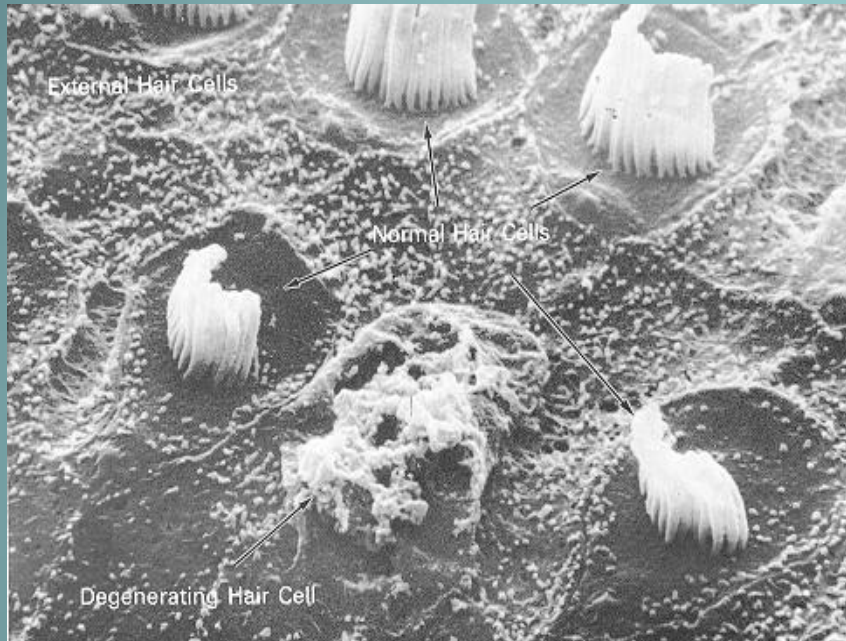
Is there really much difference?

Between this...



...and this?

Or this...

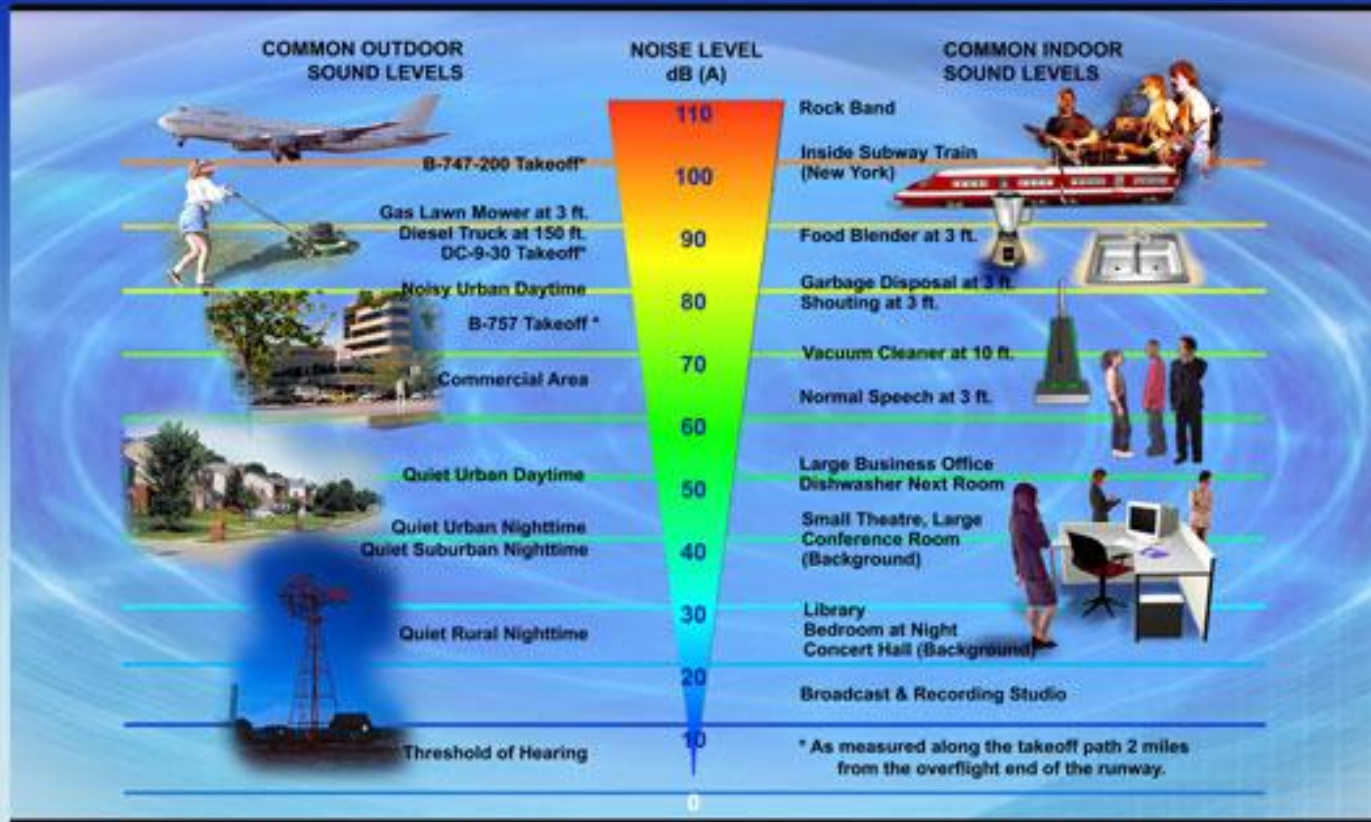


....and this?

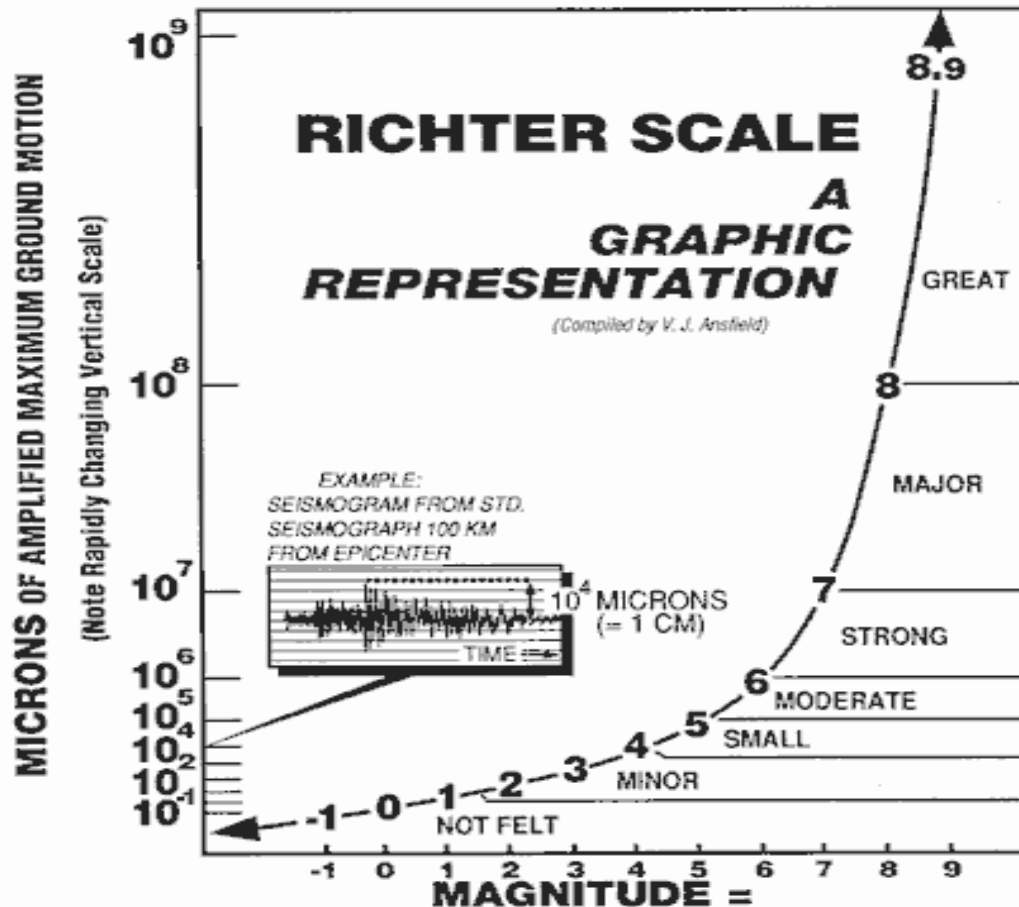


Intensity/Magnitude of Sound

COMPARISON OF NOISE LEVELS



Intensity/Magnitude of Earthquake



Largest Recorded ***
(Offshore Chile, 1960)

Alaska, 1964

New Madrid, MO, 1812

San Francisco, 1906

Great Devastation
and Many
Fatalities Possible *

Loma Prieta, CA, 1989

Damage Begins *
Fatalities Rare

LOGARITHM (BASE 10) OF MAXIMUM AMPLITUDE MEASURED IN MICRONS **

* EFFECTS MAY VARY GREATLY DUE TO CONSTRUCTION PRACTICES, POPULATION DENSITY, SOIL DEPTH, FOCAL DEPTH, ETC.

** MICRON = A MILLIONTH OF A METER

*** EQUIVALENT TO A MOMENT MAGNITUDE OF 9.5

Both scales are logarithmic in nature!

Remember....



When you are exposed to loud noise without hearing protection, this is what is happening inside your ear!

Results of Survey

- 94 surveys returned
- Q1: Did you feel that using the pictorial representations of the earthquakes ...gave you a more realistic understanding of how noise can actually damage the ear?
 - 80 of the 94 said yes (85%)
- Q2: Were you more interested in the presentation... by using the earthquake analogy?
 - 71 out of 94 (75%)

Results

- Q3: (abridged) Any suggestions/info that would be useful to help you understand how noise exposure affects ears?
 - Varying answers: Mostly aviation population who are well versed in effects of noise on the ears
- Q4: Overall, how would you rate this HC presentation compared with other HC pres you've had in the past? (Excellent, Good, Fair, Poor, N/A)
 - Excellent (71/94-75⁰%);
 - Good (19/94-20⁰%);
 - Fair (4/94-4%),
 - No Poor or N/A responses

Discussion

- Excellent comments: thought briefing was unique and interesting way of presenting material they have heard many times before.
- Good/Fair comments: stated they were well-versed in excessive noise exposure effects (mostly aviators) so overall not new to them.
- Presentation should be geared to new recruits or young Soldiers/students. Hopefully would leave bigger visual impact they would remember when exposed to noise.

It's okay to think outside of the box!!

Presentation Copy

If you would like a copy of the Earthquake HCON presentation, email:

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Shoot,
Move,
Communicate!

Questions?

Your
Sense of Hearing
is Essential



USE
HEARING
PROTECTION!