

The Jolene Travel Guide



The Jolene Travel Guide

...a companion resource for the Jolene Cookbook

Version 1.0

University of Northern Colorado

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NORTHERN COLORADO

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Contents

Preface	5
About the Authors	6-7
Creating Your Perfect Travel Companion	8
Celebrating Jolene's Creation	9
Special Build Events	10
Travel Destinations for all Seasons	11-12
Making Reservations for Your Trip	13
Travel Guides	14
What to Pack	15
Earphone and Headphone Types	16
Earphone/Headphone Style Guide	17
Traveler's Tips	18
Sound Level Measurements	19
How Loud is Too Loud?	20
Communicating Hearing Health Messages	21-26
Jolene Exposure Flyer	27
Sound Level Measurement Tips	28
Communicating Hearing Health Messages continued	29-31
Frequently Asked Questions	32
Myth Busters	33
What Jolene is NOT Designed To Do	34
Special Calibration Note	35
Keeping in Touch While Traveling	36
Where Jolene Has Been	37-38
Research With Jolene	39
References	40

Preface

This [Travel Guide](#) has been created to provide the Jolene handler with details that are designed to facilitate a positive change in knowledge, attitudes, and behaviors related to healthy music listening habits. It is directed towards those who interact with the Jolene educational mannequin during educational outreach events.

The [Travel Guide](#) includes instructions, sample narratives, and tips that incorporate the necessary topics required to engage a person who listens to music through earphones regarding safe music-listening habits. Health Behavior Science, the study of enabling a person to take control of and improve their health, has been incorporated into the [Travel Guide](#) to increase the success of the intervention. Ideally, encouraging music-listeners to make hearing-healthy choices when listening to their music players.

In addition, practical suggestions for traveling with Jolene are provided to facilitate travel ease and enjoyment.

Music-induced hearing loss is hearing loss caused by repeated exposure to excessively high music levels over time.



About the Authors

Christina Phillips is currently a graduate student at the University of Northern Colorado studying Audiology. She became interested in hearing loss prevention when she was introduced to the Jolene mannequin during her first semester of graduate school. Since then she has helped build several mannequins and has participated in numerous local community outreach events.



Deanna Meinke is a Professor of Audiology and Speech-Language Sciences at the University of Northern Colorado and Co-Director of the Dangerous Decibels Program. Presently, she serves as a special consultant to the National Institute for Occupational Safety and Health (NIOSH) and chairs the “Safe-in-Sound Expert Committee”. Her research interests are focused upon the early detection and prevention of noise-induced hearing loss.

About the Authors

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Creating Your Perfect Travel Companion

Fabricating the Jolene mannequin is a fun activity for everyone. After downloading the Jolene cookbook, the handler is able to custom design

their Jolene. The handler is able to choose the gender, the color, the clothing, and the accessories that their Jolene will wear. Remember you are creating a look that will generate natural curiosity amongst those who encounter her.



After your Jolene has been created, a picture can be sent to Dangerous Decibels (at dd@unco.edu) to be entered into the Jolene Family Album for inclusion on the website at <http://www.dangerousdecibels.org/jolene/jolene-family-album/>.

Once created, your Jolene is ready to travel to a variety of venues. Jolene's colorful appearance and flashy attire grabs attention everywhere she goes. Once a person's attention is caught, the opportunity for education regarding the prevention of music-induced hearing loss and safe music listening has been created. This [Travel Guide](#) has been created to formally incorporate health behavior science within the Jolene interaction and to provide recommendations for successful Jolene interactions with personal audio systems.

Celebrating Jolene's Creation

- **Born:** August 1, 2006
- **Place:** Portland, Oregon
- **Jolene's Creator:** [Genna Martin](#) from Oregon Health & Science University (OHSU) in consultation with Dr. William Hal Martin (OHSU); sponsored by Dr. William Lambert through a CROET (Center for Research in Occupational and Environmental Toxicology) summer grant at OHSU.



Special Build Events



Jolenes created during the “Jolene Family Reunion and Build”, Minneapolis, MN in 2013.

Special events can be hosted in order to engage prior Jolene-handlers as well as to introduce new handlers.

- For instance, a large-scale mannequin build can be held in order to fabricate multiple Jolenes at once to increase the opportunities for education on safe music-listening. Invite the local teachers, youth group leaders, and students to team up to build a Jolene. Or plan one for your worksite with employees and their children.

Once mannequins have been fabricated, a Jolene Family Reunion can be held to allow an opportunity for handlers to meet and network. Youth who create their own Jolenes are in the best position to educate their peers.



Travel Destinations for All Seasons



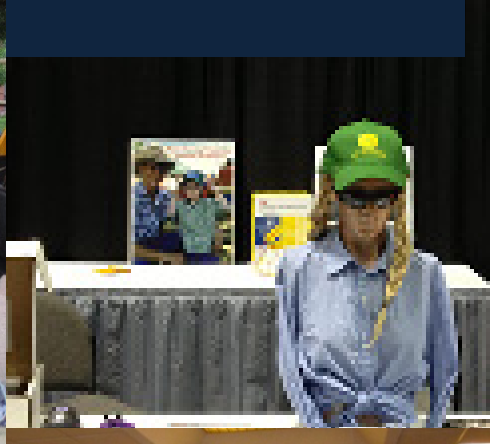
Jolene loves to get out in the world. She travels to any public or private venue or event throughout the entire year. Whether rain, snow, or sunshine, Jolene can engage people to learn about safe music listening. During the **summer** season, Jolene can be brought to an indoor or outdoor festival, sporting event, exercise gym, farmers market, flea market, picnic, barbeque in the park, train or bus station, or concert. Throughout the **fall** season, Jolene can be seen at harvest or autumn festivals, corn mazes, haunted houses and other seasonal or holiday events. Throughout the **winter** Jolene can attend winter sporting events such as skiing, winter festivals, holiday events, debut at grocery stores, hangout at museums, capture attention at a casino, engage holiday shoppers at shopping centers, or even make impressions at local coffee shops. During **spring** time Jolene can be brought to flower festivals, local zoos, team sporting events such as softball, farm or agriculture events, playgrounds, or school-based spring break events. Jolene and her colorful persona can be brought to any event and will be sure to be a learning activity for the public. *Jolene is an excuse to go somewhere!*





Suggested Places to Visit

- Bring your child to work days
- Classrooms
- Community Fests
- Farm Shows
- Girl Scout/Boy Scout events
- Health Fairs
- Mini Maker Faire
- Museums
- Parks
- Retail stores and malls
- Science Fairs
- Senior Center
- Work places



Making Reservations for Your Trip

Once you have identified the venue that Jolene is traveling to, you need to reserve your date and table location.



Ideally you will request the following information and consider the following when making your reservation:

- Best dates to attract a crowd
- A somewhat quiet location (if possible)
- A highly visible location frequented by the public
- A 4-8 foot table (if not bringing your own)
- Electrical outlet for computer (optional)
- Internet connection for computer (optional)

It is important for the handler to know the date of the event as well as check-in and check-out times if applicable to the venue. Arriving early will allow for proper Jolene table set-up. If there is prior advertisement for the event, it can be helpful to encourage and instruct attendees to bring their own personal music players with them.

Tip:

A quiet location allows for easier communication with music listeners, and prevents them from turning their music higher than the surrounding ambient sound level. However, this may be appropriate if educating in a subway, airport etc. where listening to music in the presence of background noise is common.

Travel Guides “Jolene Handlers”

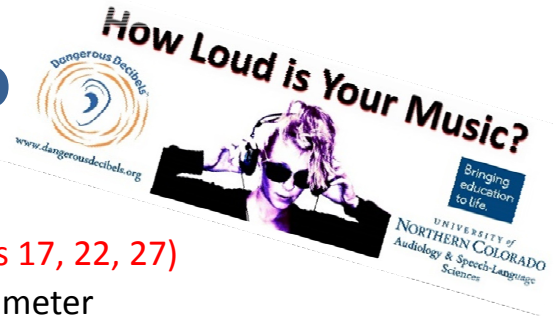


Depending on the number of individuals expected to attend an event, it may be extremely helpful to have multiple Jolene-handlers as well as multiple Jolene mannequins. At least two Jolene handlers per mannequin allows the interaction to flow smoothly. One handler can interact with the listener and the mannequin, while the other engages the other attendees and prepares them for their listening level measurement. Often the visitors will have several questions about hearing and hearing loss, so having multiple informed handlers is useful when possible. The following are some ideas to keep in mind:

- Training of handlers is critical to ensure that the proper information is disseminated and the correct sound level measurements are taken.
- A basic understanding of hearing and the risk of music-induced hearing loss is helpful.
- Handlers with friendly personalities who invite the audience to participate is critical.



What to Pack?



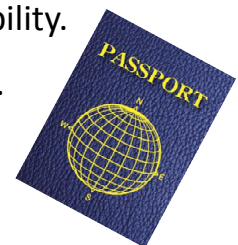
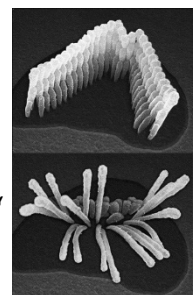
- Jolene mannequin(s)
- Safe listening level handouts (see pages 17, 22, 27)
- 9V battery (+spare) for the sound level meter
- Personal Audio System (e.g. MP3 player or smartphone to use for demonstrations)
- Earphones (or disposable earphones) for those without a music player
- Alcohol swabs to clean off earphones between listeners who do not have their own earphones

Tip:

It is important to have multiple songs on the personal audio system that are appropriate for all ages

Optional:

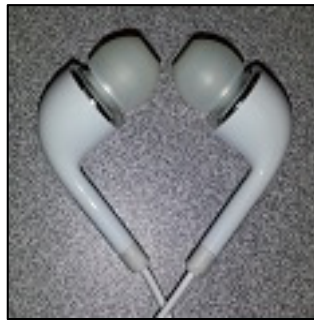
- Laminated noise thermometer with dry erase markers to chart and compare chosen listening levels amongst participants (see page 27)
- How Loud is Your Music? Banner or signs to attract interest.
- Laptop connected to <http://www.dangerousdecibels.org/virtualexhibit/> where the attendees can explore the virtual exhibit and can even take part in games that reinforce the lesson on prevention of music-induced hearing loss. Best if headphones are attached to the computer to make listening in crowds easier.
- Laminated graphics of healthy and damaged hair bundles from Dangerous Decibels website <http://www.dangerousdecibels.org/about-us/the-issues/> please indicate “adapted from www.dangerousdecibels.org” on any reprints.
- Artificial “play” passport or travel log to track the locations that Jolene visits over time. A travel log app is also a possibility.
- Raffle tickets and a prize drawing for those who participate.
- Different types of earphones for educational purposes.



Earphone and Headphone Types



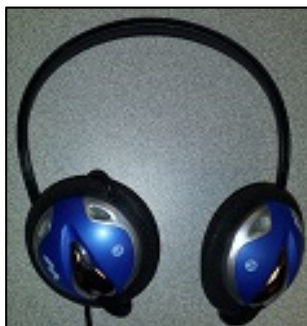
Earbud Earphones
sit lightly in the ear



Insert Earphones
sit deeper in the ear canal



Noise-Canceling Earphones
partially seal the ear



Supra-aural Earphones
rest on the outer ear



Circumaural Earphones
surround the outer ear



Bone-Conduction Earphones
are placed in front of the ear

Earphone / Headphone Style Guide

EARPHONE STYLE	ADVANTAGES	DISADVANTAGES
Earbud Earphones	<ul style="list-style-type: none"> • Come standard with some music player products 	<ul style="list-style-type: none"> • Higher chosen listening levels • Can hear background noise • Does not always fit all sizes of ears comfortably
Insert or Isolating Earphones	<ul style="list-style-type: none"> • Blocks out unwanted background noise • Lower chosen listening levels • High fidelity in some 	<ul style="list-style-type: none"> • Must be sealed properly • May be uncomfortable • Loss of environmental awareness and audibility
Supra-aural Headphones	<ul style="list-style-type: none"> • Ease of use 	<ul style="list-style-type: none"> • Higher chosen listening levels • Can hear background noise
Circumaural Headphones	<ul style="list-style-type: none"> • Partially blocks out unwanted background noise • Lower chosen listening levels • High fidelity in some 	<ul style="list-style-type: none"> • Higher output capabilities than earbuds
Noise-Canceling Headphones or Earphones	<ul style="list-style-type: none"> • Cancels out low frequency background noise. • Ideal for transportation environments • Average of 4 dB lower chosen listening level 	<ul style="list-style-type: none"> • Does not cancel out all frequencies of background noise • Cannot be considered “safe” because it cancels only low frequency sounds
Bone Conduction Headphones	<ul style="list-style-type: none"> • Allows the ear to remain open for environmental awareness when listening at low levels • Comfortable for some who prefer not to have a device in their ear canal 	<ul style="list-style-type: none"> • Does not work well in noisy listening environments because the ear canal remains open. • May shift position with talking or chewing. • Poorer sound fidelity
Output Limiting	<ul style="list-style-type: none"> • Sound level is limited to an output of 82-85 dBA regardless of volume setting 	<ul style="list-style-type: none"> • May not provide sufficient audibility in some listening environments

Traveler's Tips



The Jolene mannequin can be easily shipped for travel. It is important to pack her properly so that she is not damaged. Local shipping stores can assist the Jolene handler with this process if desired. Newspaper, bubble wrap, or even packing blankets or paper can be used to wrap her body. Be sure to protect the head and sound level meter well.

- During car travel, buckle her into the seat with the seat belt so that Jolene does not rattle around and become damaged.
- It is good to keep some matching paint on-hand to touch up scuffs and scratches after a trip.



Tips

- It is important to place extra packing material around her head and the sound level meter since these are the most delicate parts.
- Buckling Jolene into the front seat next to you is a sure way of generating some attention, especially when going through the drive-through for a milkshake or passing cars on the highway.

Sound Level Measurements



Setting up the Sound Level Meter: (consult your sound level meter user guide)

- Turn the sound level meter “ON”.
- Filter Setting:
The sound level meter may have the option of A or C weighting
 - **Select “A” weighting scale.** This filter setting is used for measuring hazardous sound exposures because this filter best represents the hearing sensitivity of a human ear. Always use the “A-weighting” filter setting for music measurements.
- Fast or Slow Response:
Select slow response if applicable for measuring music levels.

Reading the Sound Level Meter:

- Have the listener select their music and “typical” listening level while listening with both ears (unless they only listen with one earphone routinely).
- Take one earphone and place it securely in the Jolene’s silicone ear.
- Allow the sound level meter to sample the sound. Sound levels will fluctuate as a function of the music. This is normal. The Jolene handler should simply make an estimate of the level that is most common.
- **Subtract 5 dB** from the listening level that is presented on the sound level meter screen to account for the Transfer Function of the Outer Ear (TFOE). See page 35 for further information on TFOE.

NOTE: Jolene has only been calibrated for use with earbud style earphones at this time.



How Loud is Too Loud?

NIOSH: Recommended Exposure Limits (REL)

Continuous Sound Pressure Level	Duration of Exposure
85 dBA	8 hours
88 dBA	4 hours
91 dBA	2 hours
94 dBA	1 hour
97 dBA	30 min
100 dBA	15 min
103 dBA	7.5 min
106 dBA	<4 min
109 dBA	<2 min
112 dBA	~1 min
115 dBA	~30sec

Accepted guidelines for recommended permissible exposure time for continuous time A-weighted average noise, according to NIOSH and CDC, 1998.

NOTE: It may be advisable to reduce your listening time by 50% or reduce your volume level by an additional 3 dB if you are exposed to other hazardous sounds during the course of a day.

Safe or dangerous sound exposure is a function of BOTH sound level and sound duration. Repeated exposures over extended periods of time (40 years) are hazardous to your hearing.

This is a chart of recommended maximum daily noise exposure limits from the National Institute of Occupational Safety and Health (NIOSH). The first column lists the sound pressure levels in decibels and the second column designates the length of time you can listen to sound at that level before it begins to damage your hearing. For example, a person can listen to 94 dBA sound for 1 hour during a 24-hour day before it is considered dangerous. All values are equal to 100% noise dose. Reducing the level by 3 dB, doubles the allowable time of exposure or listening.

Communicating Hearing Health Messages

Engaging Interest

- Promote the “How Loud is Your Music” event in newsletters, organizational announcements, social media, e-mail, posters, and fliers in advance of the event.
- At the event, when a person expresses curiosity in the exhibit you might say:
 - “Would you like to meet Jolene? She can tell you what level you listen to your music at, and whether your listening level is safe or dangerous for your hearing.”
- For the disinterested passerby: approach them in a friendly manner and engage them in conversation. Phrasing for doing this are offered below;
 - “Do you listen to music through headphones? If so, I would like to introduce you to Jolene. She can tell you what level you listen to your music at, and if that listening level is safe.”
 - “I would like to measure your music listening level if you have a couple of minutes.”
 - “I’ve noticed you are listening through earphones/headphones, would you like to know what level the sound is that you are listening to and whether it is safe for your hearing?”
- If extra motivation is needed to get the public to engage, consider having a drawing for output limiting headphones. Persons who participate by having their listening level measured are eligible to enter. Usually once the measurements start taking place, those who pass by will become curious and join in easily.
- Parents and grandparents will frequently encourage children to participate if they are informed of the opportunity.
- Offer a photo opportunity with Jolene for those who interact with the mannequin.

Tips

- Be close to your audience. Avoid standing behind a tabletop.
- Wear engaging dress such as hats, wigs, t-shirts
- Smile and show enthusiasm and excitement about your message



Communicating Hearing Health Messages

For those interested in ways to reduce their risk of music-induced hearing loss you might provide printed safety tips:

Safe Listening Tips

- The higher the volume setting and the longer the listening time, the greater the risk of hearing loss. Listen at or below 50- 60% of the maximum music player volume for unlimited listening time.
- Use output limiting earphones that are designed to keep the volume at safe levels (usually below 82-85 dBA).
- Set the volume safety limit on your music player's control settings to less than 82-85 decibels.
- Use the lowest comfortable volume level whenever possible.
- Take listening breaks.
- Do not sleep when wearing earphones.
- If possible, listen in quieter places rather than in high noise environments such as on subways, buses etc. Noise-canceling or insert earphones may be a better choice for use in these environments.
- Use insert earphones which allow the listener to enjoy music at lower volumes in the presence of background noise. However, it is important to maintain environmental awareness at all times.
- If you can't hear a person speaking to you at an arms length away without taking an earphone out of one ear, turn the player down.
- Noise-cancellation earphones reduce the risk of over-exposure by 3-4 dB, but do not assure a safe overall listening level.
- Do not use music earphones as earplugs to protect your hearing when working or listening in high levels of noise.

Communicating Hearing Health Messages



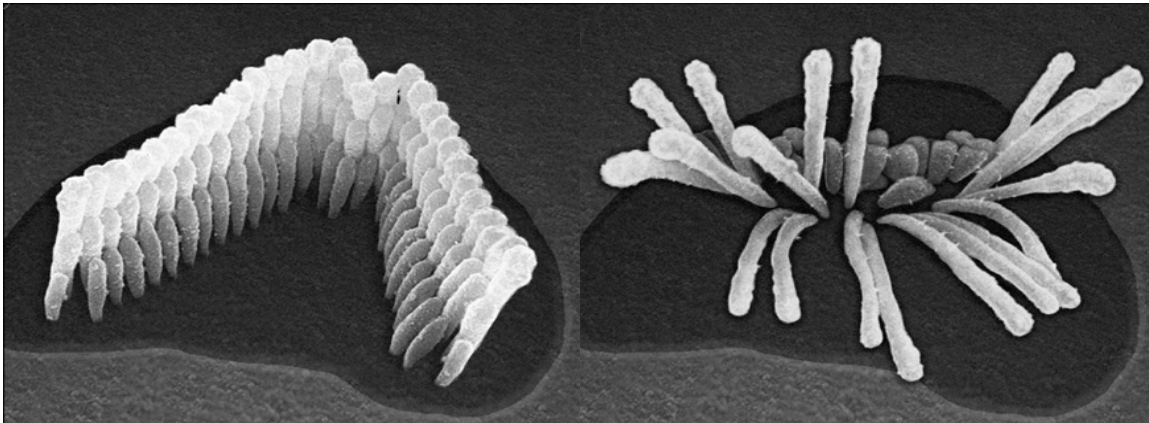
Describe the listener's potential susceptibility:

- “This is “Jolene”, a specially designed mannequin. She/he has a sound level meter built into the ear that will allow us to measure how high you set your music volume level.”
- Music-induced hearing loss: “The reason we want to do this is because nearly 17% or 1 out of 5 adolescents between the ages of 12 to 19 years have noise-induced hearing loss that may be related to listening to music at high levels for extended periods of time that may be hazardous to hearing.” (Henderson, Testa, & Hartnick 2011).
- Tinnitus: “Also an estimated 35 to 50 million people in the U.S. experience a ringing or buzzing sound called tinnitus. More than 75% or 3 out of 4 children and young adults between the ages of 9 and 31 years claim that they have experienced tinnitus in their life.” (Quintanilla-Dieck, Artunduaga, & Eavey, 2009).
- Tinnitus is one of the early warning signs of potential hearing damage from loud sounds. “Experiencing ringing or buzzing in your ears after music player listening may be a sign that the player is damaging your hearing.”

Health Behavior Construct

- Perceived susceptibility is a construct from the Health Belief Model that can be addressed by educating music lovers that even young people are affected by music-induced hearing loss and tinnitus.
- Knowledge of the health risk in the Social Cognitive Theory can be incorporated by describing the above hearing health risks .

Communicating Hearing Health Messages



Healthy and Damaged Hair Cell Bundles www.dangerousdecibels.org

Describe the damage to the ear with unsafe listening habits

- “Your inner ear has tiny fragile hair bundles that move in response to sound. When you listen at or above 85 dBA for longer than 8 hours a day, over extended periods of time (i.e. years), these hair bundles can become damaged. The damage results in hearing loss, and the hair bundles cannot be repaired or regrown. It is important to listen safely now to protect your ears from becoming damaged. We have no guarantees that medicine will be able to help in the future.”

Health Behavior Constructs

- Perceived Severity from the Health Belief Model can be addressed by providing hearing loss simulators and online testimonials from professional musicians while a person waits to test their music player.
- Cues to Action from the Health Belief Model can be recognized when periods of tinnitus, muffled hearing, or aural fullness follow an episode of loud music listening.
- Precontemplation from the Stages of Change Model can be addressed by initially educating a person on the long term effects of MIHL who did not previously know the damage that could occur.
- Knowledge of the Health Risk from the Social Cognitive Theory can be applied by describing the damage that occurs in the inner ear when exposed to music at excessive volumes for extended durations.

Communicating Hearing Health Messages



Describe the benefits of healthy listening

It is important for the listener to understand the benefits of choosing to listen to music through earphones safely.

- “Listening safely protects you from developing hearing loss and tinnitus. If you listen at safe levels, you will be able to enjoy music for a lifetime. Having excellent hearing is important for doing well in school, hearing your friends and even qualifying for some jobs (like flying an airplane). ”
- In addition, you want to be safe when walking across the street when cars are present or be able to hear a bicycle or skateboard come up behind you when walking outdoors. This may require that you have your music turned down, keep one ear open, or use an environmental awareness switch or app on your device. These switches or apps turn on a microphone, so that you can hear the important sounds around you.”

Health Behavior Construct

- Perceived Benefits of the Health Belief Model can be realized by understanding the benefit of enjoying music naturally for a lifetime free of the damaging effects of tinnitus and/or hearing loss. Also being eligible for future jobs and avoiding potential accidents.
- Expectations for Changing Unhealthy Behaviors from the Social Cognitive Theory can be addressed by describing the benefits of healthy hearing habits.

Communicating Hearing Health Messages

Test music player and describe the sound level measurement

Once the listener has set his or her music player to their typical listening level, place one earphone in Jolene's silicone ear for measuring the sound level.

- "I am placing your earphone into the mannequin's ear and the sound level meter will display the sound level of your music. I am going to **subtract 5 dB** to account for differences in measuring inside the ear versus outside the ear. You listen at _____ dB which means that you can listen for _____ minutes/hours a day before you are at risk for damaging your hearing." The Jolene Handler can provide a copy of the listening level/duration chart on the next page . Note: if a child is young, the Jolene handler does not need to explain the -5 dB correction.
- Scenario 1: Dangerous Level: Measurements indicate that the music player is set at a dangerous Level (>85 dBA): Ask the listener to turn the music player down to a safe level (<85 dBA) so that they can learn where the volume level indicator for safe listening level is found. "Approximately 17% of music player listeners listen to music dangerously. At the level we measured, you can only listen to music safely for _____ minutes/hours. If you turn the music down just 3 dB you can listen for twice as long."
- Scenario 2: Safe Level: (<85 dBA) "Most music listeners choose to listen at a safe level and it's great that you are in that group. You can listen safely for over 8 hours a day. Now, let me show you what an 85 dBA level sounds like so that you avoid going above the safe level when you set your music player volume in noisy listening environments such as when traveling on buses, airplanes or subways." Ask the listener to turn up volume setting to show 85 dBA.

Health Behavior Constructs

- Perceived Barriers of the Health Belief Model -It is important for the listener to know where on the volume indicator a safe listening level is located.
- Self Efficacy of the Health Belief Model and Social Cognitive Theory - Knowing how to self-adjust the music player to safe versus unsafe music levels will help a person make healthy listening choices..
- Social Cognitive Theory - 80-83% of music listeners actually choose to listen to music players at a safer level (under 85 dBA for 8 hours).

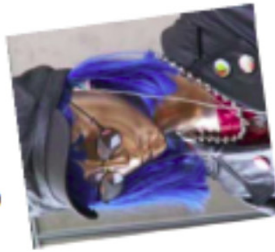
What Sounds Cause Noise-Induced Hearing Loss?

Noise-induced Hearing Loss (NIHL) can be caused by a one-time exposure to extremely high levels of sound as well as by repeated exposure to hazardous sounds at various levels over extended periods of time.

The intensity (volume level) of sound is measured in units called decibels.

Exposure to harmful sounds causes permanent damage to the sensitive hair cells of the inner ear. These structures can be injured by noise in two different ways: from an intense brief impulse, such as an explosion or from continuous exposure to noise, such as that in a woodworking shop.

Listening to a music player, smartphone, CD, or other personal stereo devices can be dangerous if the volume is set too high and



you listen for too long. How do you know that it is too high? If you have to turn it down or off to understand a person speaking to you an arm's length away, it is too loud.

Remember: The louder the sound, the less time you can safely listen to it.

For every 3 decibels (dBA) over 85, the permissible exposure time is cut in half.

For example;

-At 85 dBA, it takes **8 hours** before possible damage can occur.

-At 88 dBA, it takes **4 hours** before possible damage can occur.

The louder the sound, the less time you can safely listen to it.

Continuous Sound Pressure	Permissible Exposure Time
85 dBA	8 hours
88 dBA	4 hours
91 dBA	2 hours
94 dBA	1 hour
97 dBA	30 min
100 dBA	15 min
103 dBA	7.5 min
106 dBA	<4 min
109 dBA	<2 min
112 dBA	~1 min
115 dBA	~30 sec

Accepted guidelines for recommended permissible exposure time for continuous time A-weighted average noise, according to NIOSH and CDC, 1998.

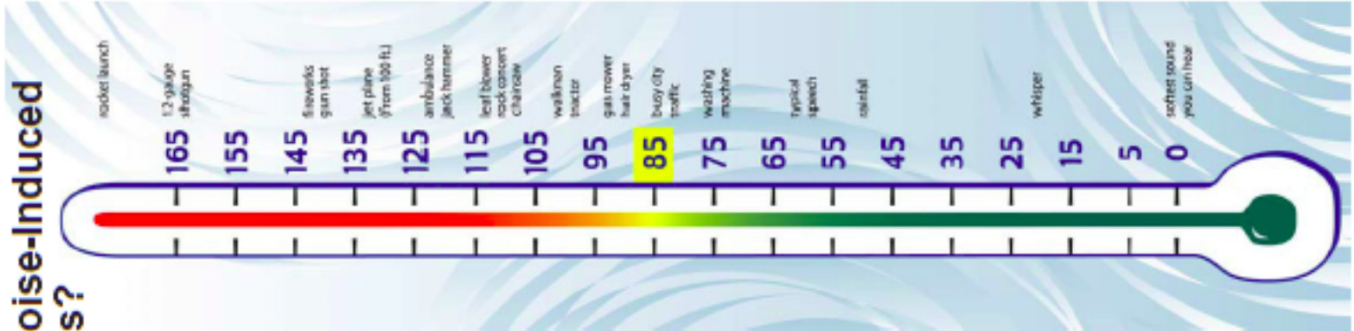
NOTE: It may be advisable to reduce your listening time by 50% or reduce your volume level by an additional 3 dB if you are exposed to other hazardous sounds during the course of a day.

dd@unco.edu www.dangerousdecibels.org

Dangerous Decibels® is a collaborative public health partnership for the prevention of noise-induced hearing loss and tinnitus.



Partners: Oregon Health & Science University-Prevention Research Center, Oregon Museum of Science and Industry, University of Northern Colorado, Portland State University, University of Auckland, National University of Singapore
 Funders: NIH – National Institutes of Health, Centers for Disease Control and Prevention and Private Foundation Grants.



Measurement Tips

- Have the listener set the listening volume with both earphones in their own ears. Chosen listening levels will be higher for single ear listening than when listening with both earphones inserted. (Unless, a person only listens with one ear routinely).
- Make sure the earbud is fit snugly into Jolene's silicone ear.
- Start listening measurements early in a song to allow enough time for complete measurement.
- An earphone splitter is a useful way to allow the handler to monitor the music so that Jolene does not measure the music during a pause or break in the music.
- Jolene is not currently designed to measure music listening levels for insert earphones. Bring earbud earphones and ask the listener if they are willing to use the stock earphones to choose their typical volume. If not, insert earphones can be measured, but the measurement will be somewhat inaccurate.



Communicating Hearing Health Messages



How to minimize risk of hearing loss

- “Here are some important things for you to remember in order to keep your hearing strong and healthy;”
 - “Turn it down.”
 - “Take listening breaks.”
 - “If you participate in other noisy activities such as motor sports or attend concerts, you may want to think about cutting your listening time in half or lowering your music volume by 3 dB.”
 - “Another option is to think about is purchasing output limiting earphones, then you will not exceed 82-85 dBA and can listen for longer periods of time.”
 - “We also know that people listen typically listen at lower volume settings with insert or isolating earphones.”
 - “Avoid sleeping with earphones in your ears while music is playing.”

Health Behavior Construct

- Stages of Change Model (Contemplation, Preparation, and Action) - Listener anticipates making healthy listening decision, prepares to take action, and finally changes unhealthy listening habits.
- Self Efficacy of the Health Belief Model and Social Cognitive Theory - Knowing how and becoming capable of turning the volume down on the music player and developing the self control to maintain the music player at a safe volume level and/or to shorten listening time at higher volume settings. The listener practices safe listening habits.

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Listening in noisy environments

- “Do not use your music player earphones as hearing protection when mowing your lawn or when doing other noise hazardous activities that are above 85 dBA, unless the earphones are output limited.”
- “If you find yourself frequently listening to music through earphones when traveling or while in moderate levels of background noise, proper earphone choice can help reduce your risk of music-induced hearing loss. The use of insert or circumaural earphones can make background sounds quieter and may allow you to listen at lower volume levels. However, you may increase your risk of accidents if you do not maintain environmental awareness. Specialized earphone switches or apps are available to solve this problem.”

Note: There are also specialized earmuffs and hearing protectors designed to protect hearing and allow the enjoyment of music listening while working in high noise environments.



Communicating Hearing Health Messages



These are optional activities to engage the public while they may be waiting to test the level of their music players:

- Computer with audio headphones set up to play and interact with computerized simulations of noise-induced hearing loss;
 - Dangerous Decibels virtual exhibit “What’s that Sound”
<http://www.dangerousdecibels.org/virtualexhibit/1whatsthatssound.html>
 - NIOSH hearing loss simulator using music as the input
<http://www.cdc.gov/niosh/mining/works/cover-sheet1820.html>
 - Starkey Hearing loss simulator with multiple inputs
<http://www.starkey.com/hearing-loss-simulator>

Optional testimonials from well-known musicians :

- Tinnitus: For example; Chris Martin from Coldplay: “Looking after your ears is unfortunately something you don’t think about until there’s a problem. I’ve had tinnitus for about ten years, and since I started protecting my ears it hasn’t got any worse. But I wish I’d thought about it earlier.” <http://www.dailymail.co.uk/tvshowbiz/article-2139352/Chris-Martin-tinnitus-Coldplay-star-reveals-suffering-ear-torment-years.html>
- Pete Townshend from The Who discusses the effects of hearing loss on his music career <https://www.youtube.com/watch?v=nPHJe5LqMpA>

Health Behavior Construct

- Perceived Susceptibility – The music player listener may recognize their own vulnerability if others who enjoy and perform music are experiencing tinnitus and/or hearing loss.
- Cues to Action of the Health Belief Model can be realized by understanding the early warning signs of music-induced hearing loss.

Frequently Asked Questions (FAQs)

Which earphone type is best?

There is no single “best” earphone style. Review the earphone comparison on page 17 regarding the advantages and disadvantages for various music earphone styles.

Is there a way to cure music-induced hearing loss?

Damage to your ear from exposure to hazardous sound levels causes permanent hearing loss. Once the delicate structures of the inner ear are damaged, they cannot be repaired with medicine or surgery. Hearing aids will help you cope with the hearing loss, but will not restore normal hearing.

Do noise-canceling headphones make listening safe?

Contrary to the name, these headphones do not eliminate “noise” and make listening safe. The real story is that they cancel low-to-mid frequency background noise, but they do not reduce all of the energy in sound. Therefore, sound levels can still be dangerous even when using this type of headphone depending on the listener’s volume setting. Research demonstrates approximately a 4 dB reduction in chosen listening level when measured in the presence of background noise. Listening with this type of headphone, might allow a listener to double their listening time” (Liang, Zhao, & French, 2012).

What should I do if I think I have hearing loss or tinnitus?

If someone indicates they may have hearing loss and/or tinnitus it is important that a referral to an audiologist and/or physician is made in order to evaluate the symptoms. This is especially important because there are other causes of hearing loss and tinnitus besides high volume music listening. It is important that care be provided promptly when you have any type of hearing disorder. You can find an audiologist at <http://webportal.audiology.org/Custom/FindAnAudiologist.aspx> or <http://www.asha.org/proserv/>

Myth Busters

“If I can hear your music coming from your earphones, it’s too loud.”

This statement is one that young people have probably heard from adults. In reality, this has been proven to be an inaccurate way to judge safe listening. In fact, music set to safe levels may merely be leaking out of the earphone due to a poor seal or reflect an intentional earphone design rather than an unsafe listening level.

“The risk of music-induced hearing loss is eliminated by locking the volume setting on a personal music player”

The locked volume setting on a personal music player does not eliminate the risk of music-induced hearing loss since the volume could be locked at an unsafe level. Listening safely is dependent on the level at which the volume limiter is set and the amount of time a person spends listening. The listener will need a Jolene measurement to know where to set it.

“A music listener should never play their personal music player at a hazardous level”

It may be acceptable for a music listener to increase the music player volume for a short period of time. Most everyone likes to turn up their favorite song. This may be done without risking permanent hearing damage if it is for only one song. It is important that the listener have the knowledge and ability to turn the music back down following his or her favorite song.

What Jolene is NOT Designed To Do

Occasionally handlers may be tempted or asked to use Jolene for purposes other than what she was originally designed to do.

Jolene has not been validated to be used in the following ways:

- Sound level measurements in Military Vehicles, Construction or Farming Equipment.
- Measurements performed without using the Transfer Function of the Outer Ear correction: Handlers must subtract 5 dB from the reading on the sound level meter when reporting the listening level measured in the ear (see next page).
- Measuring ambient sound levels outside of the silicone ear.
- Demonstrating the effectiveness of hearing protector devices.
- Formal measurements of sound levels for medical or legal purposes. These should be performed by an audiologist in a clinical setting. Jolene is for educational purposes.

It may be possible to validate some of these uses in the future once they are formally evaluated.

Tip
Be familiar with the range of the sound level meter (SLM) to ensure accurate measurements. **Range** refers to the upper and lower limits of measurement.



Special Calibration Note

(Source: Jolene Cookbook)

The shape of the human ear canal changes the sound waves as they enter the ear. This results in resonance peaks of energy in the spectrum of those sounds. As a result, the total energy reaching the eardrum may be different than that recorded outside of the head. Several health safety organizations like NIOSH (National Institute of Occupational Safety and Health) have developed their own recommended exposure limits for sound (<http://www.cdc.gov/niosh/docs/98-126/pdfs/98-126.pdf>). These guidelines were developed using sound measured in an open area or a diffuse-field, not in an ear canal.

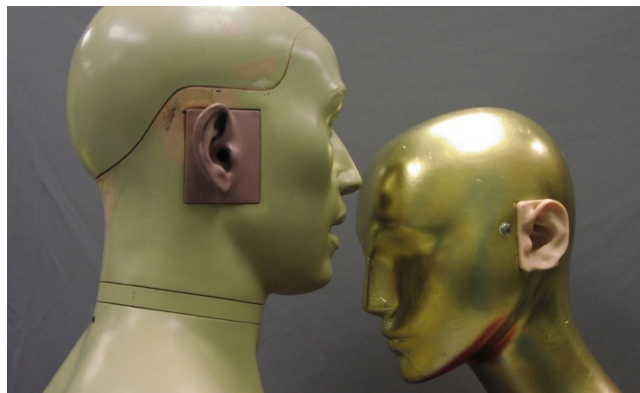
These occupational noise exposure standards are measured from a microphone at the shoulder rather than from inside the ear canal. We have to account for this difference in our measurement techniques in order to use the preset noise exposure recommendations set up by NIOSH and other groups. To do this we needed to figure out how different Jolene's in-the-ear sound level measurements are from the NIOSH measurements so that we can accurately correct for the difference. This is called finding the "**transfer function for the outer ear**" or the "TFOE." The TFOE for Jolene is approximately +5 dB for all headphone and ear bud types except ones that fit tightly inside the ear canal (also known as "insert earphones"). This means that the reading you get from the sound level meter on your Jolene will be **5 dB higher** than its corresponding measurement on the NIOSH chart. In order to use NIOSH recommended exposure limits (e.g. 85 dBA for 8 hours), just **subtract 5 from the SLM reading on your Jolene**. For example, if your Jolene SLM gives you a reading of 96 dB, you should subtract 5 dB and reference 91 dB on the NIOSH recommended daily exposure chart (page 27).

This is **only an approximation**, but it gives a reasonable estimate of how much sound energy is actually getting into the ear when someone uses headphones. Remember, the risk of noise-induced hearing loss is determined by sound level AND duration of repeated exposures over extended periods of time.

The TFOE that we measured for Jolene was validated by Elliott Berger, Division Scientist at 3M.

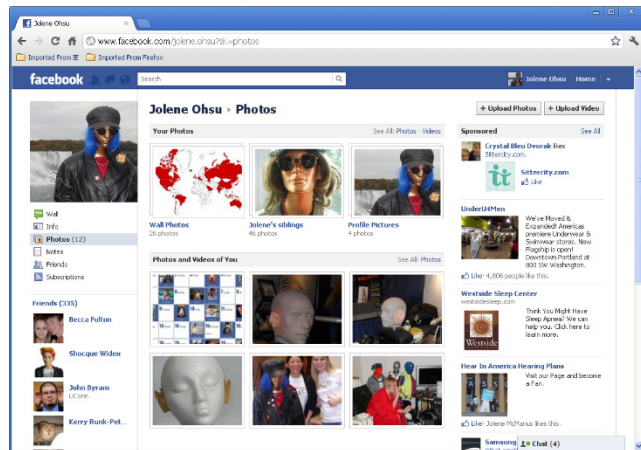
(Berger, E.H., Mergerson, S.C., Stergar, M.E., Personal music players: Are we measuring the sound levels correctly? ASHA Leader 14(10), p. 14-17, 2009.)
For a great explanation of TFOE see:

<http://www.asha.org/Publications/leader/2009/090811/f090811b.htm>



Keeping in Touch While Traveling

- <http://www.dangerousdecibels.org/>
- <http://www.dangerousdecibels.org/jolene/>
- <http://www.dangerousdecibels.org/jolene/jolene-family-album/>



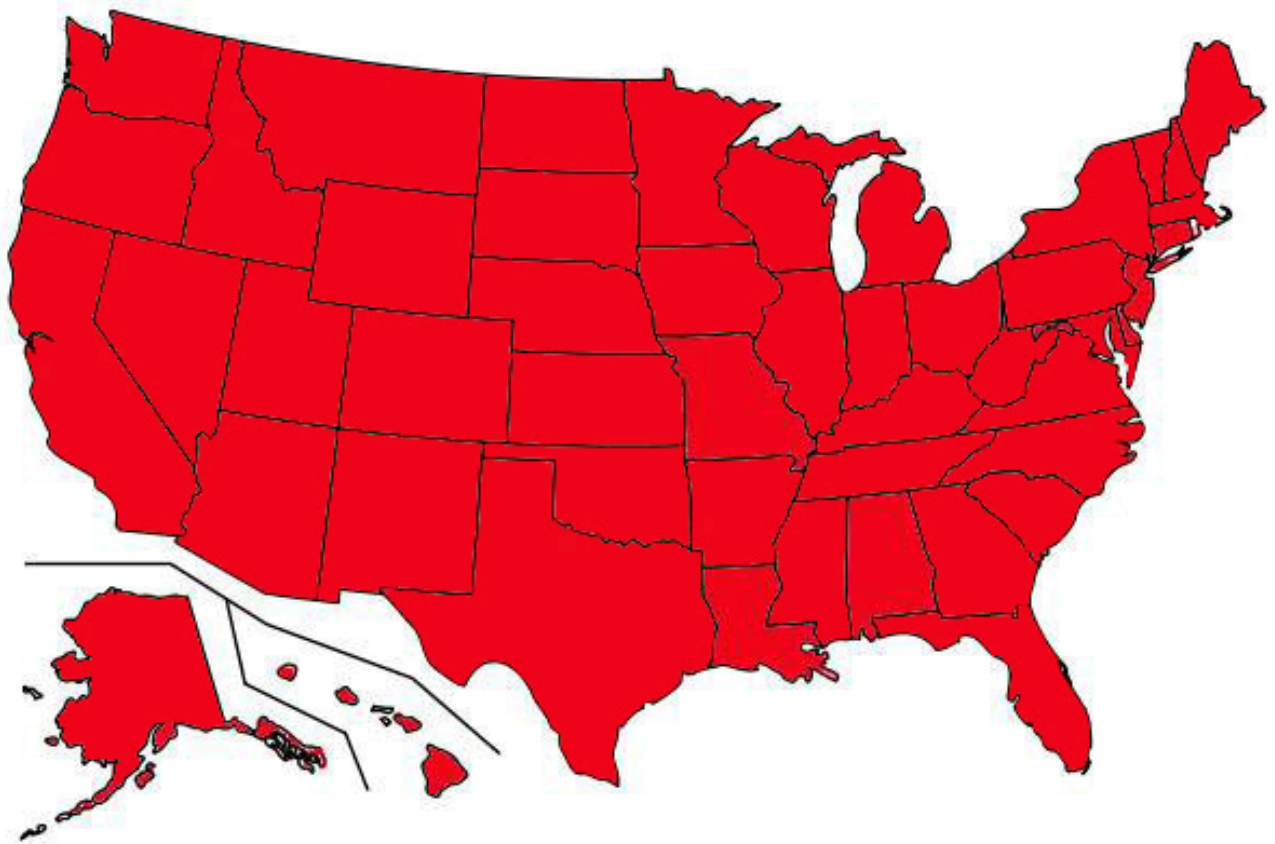
- <https://www.facebook.com/jolene.ohsu>
- <https://www.facebook.com/gunter.unc>
- <https://www.facebook.com/saasha.unc>

Tips

- Submit a photo of your Jolene mannequin along with its name to dd@unco.edu to become a part of the Jolene Family Album.
- You may also create a Facebook profile page for your mannequin to post about your travels.
- Be sure to send a friend request to other mannequin friends such as Jolene Ohsu, Gunter Unco, and Saasha!

Where Jolene Has Been

50 states and Washington D.C.



Where Jolene Has Been

37 countries



Research with Jolene



There are two types of research: formal and informal, and Jolene has been used for both.

- A proposal for **formal research** must undergo a mandated review process by a research institution's review board and participants sign a consent form prior to collecting and publishing any data from listeners.
 - Levey, Levey, & Fligor (2011) utilized a Jolene mannequin in a formal research project to measure the sound level of 189 urban college student's music players.
 - Another example of a formal research project involving Jolene is Martin, Martin, Griest, & Lambert (2008). These researchers measured the typical listening levels of 221 science museum visitors.
- **Informal research** is not going to be published. It is conducted for personal use, e.g. science fairs or classroom learning projects.
 - Jolene can be used informally in a classroom by writing all student listening levels down on a white board to compare peer listening levels.

Health Behavior Construct

- Social Cognitive Theory - Making group listening habits known will influence peer groups. This activity generates and reinforces the understanding that most of their peers listen at safe levels and will help individuals to recognize that safe listening levels and times are acceptable and common. This encourages the listener to make healthier listening choices for themselves.

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