

Basic Information on Hearing Health

Information and Recommendations for Administrators and Faculty in Schools of Music

**National Association of Schools of Music
Performing Arts Medicine Association**

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Basic Information on Hearing Health Information and Recommendations for Administrators and Faculty in Schools of Music

Introduction

The National Association of Schools of Music (NASM) and the Performing Arts Medicine Association (PAMA) have developed a comprehensive overview of hearing health issues for postsecondary schools and departments of music.

This document provides a comprehensive overview for administrators and faculty.

It is oriented toward decision-making about hearing health in the context of a school or department of music.

Information of a medical nature is provided by PAMA; information regarding contextual issues in music programs, by NASM.

Please note: Information in this Web resource is subject to change at any time without prior notice.

Use the hyperlinks in the fast tracks below or in the [table of contents](#) to go to specific sections.

Fast Tracks

- [The Basic Issue](#)
- [Noise Levels and Risk](#)
- [Exposure Times and Risk](#)
- [Developing Hearing Health Objectives in Schools of Music](#)

1. Organizations

NASM, founded in 1924, is an organization of schools, conservatories, colleges and universities with approximately 630 accredited institutional members. It establishes national standards for undergraduate and graduate degrees and other credentials and is the national music accrediting agency. NASM also provides information to potential students and parents, consultations, statistical information, professional development; and policy analysis.

PAMA, founded in 1989, is an organization comprised of dedicated medical professionals, artists, educators, and administrators with the common goal of improving the health care of the performing artist. Members of PAMA are professionals in fields that include research, education, and clinical practice who hail from all corners of the globe.

2. Disclaimers

- a. NASM and PAMA are providing this web resource for institutions that teach music to assist local consideration and action about hearing health.
- b. The information:
 - is generic, presentational, and advisory in character.
 - is oriented far more to musicians and lay persons than to medical, scientific, or research professionals concerned with hearing health.
 - does not substitute for the professional judgments of medical and other professionals working in their areas of documented expertise.
 - is not to be considered as professional advice or to be used as a basis for the medical treatment of specific individuals.
 - does not supersede present and future empirical research that may confirm, contradict, expand, or change the medical or other information provided here at any point in time.
 - in no way serves as the basis for the accreditation function of NASM or as an addition to the accreditation standards and procedures of NASM. (A *Handbook* containing standards and a set of *Membership Procedures* are published separately by NASM.)
 - is not an endorsement of the reference materials listed or cited; nor does it represent an endorsement of other opinions, methods, or approaches described in the text.
- c. Health and safety depend in large part on the personal decisions of informed individuals. Institutions have health and safety responsibilities, but fulfillment of these responsibilities can and will not ensure any specific individual's health and safety. Too many factors beyond any institution's control are involved. Individuals have a critically important role and each is personally responsible for avoiding risk and preventing injuries to themselves before, during, and after study or employment at any institution. This set of advisory information on hearing health and institutional actions taken under their influence or independently do not alter or cancel any individual's personal responsibility, or in any way shift personal responsibility for the results of any individual's personal decisions in any instance or over time to any institution, or to NASM, or to PAMA.

3. Acknowledgements

NASM and PAMA acknowledge with gratitude the efforts of the many past and present professionals in various medical, research, and music-related fields who developed the scientific and practical information summarized in this set of resources. They express appreciation to the members of PAMA, NASM, and the American Academy of Audiology who made comments and suggestions on drafts of this and other documents in this Web resource.

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Part I. Hearing Health Facts and Concepts

Hearing Health: The Basic Issue

Hearing health is important for everyone. It is critical for music professionals.

Certain types of hearing loss, such as those caused by genetic factors, infections, or head trauma are often unavoidable and sometimes only temporary.

One particular type of hearing loss is often permanent: hearing loss due to noise exposure.

Scientifically, this is referred to as noise-induced hearing loss or NIHL.

NIHL is largely preventable.

The hearing system can be injured not only by a loud blast or explosion but also by prolonged exposure to high decibel levels of sound.

Music of any type and source at high volume that exceeds daily exposure levels and time periods is dangerous. Over time, NIHL can be the result.

Preventative measures need to be taken by individual musicians and by institutions where musicians study and work.

Preventative measures include but are not limited to information, applications of information in decision-making and culture building, and acoustically appropriate performance and rehearsal spaces.

The issue is serious. NIHL is widespread. Statistics vary, but 50 percent of musicians may have problems with hearing loss to some degree.

The danger of noise-induced hearing loss is calculated on the basis of scientific evidence expressed mathematically and in other scientific languages. Individual perceptions about loudness may provide useful indications; however, such perceptions are not a substitute for assessments based on scientific measurement and evidence-based data.

Purpose of this Web Resource

This web resource is focused on hearing health and hearing loss, preventative measures, and how schools and departments of music can work appropriately and comprehensively with associated medical, educational, operational, facilities, public information, legal, and other issues.

This information is to be used in service of a goal in individual institutions to provide conditions that support hearing health.

The first essential is information about hearing health, hearing loss, and preventative action.

Without knowledge of what can happen and how to minimize risk, music students and professionals have little basis for making informed decisions to care for their hearing and that of other musicians with whom they work.

For each school or department of music, hearing health is addressed in a multi-faceted context.

Charting an effective course to promote and provide the best environment for hearing health means working with many issues and forces beyond providing information for students, faculty, and administrators.

To be successful, a comprehensive hearing health program needs to be sustained from year to year.

This resource provides the basis for instructional efforts to provide information and develop a plan for supporting hearing health with a particular focus on minimizing conditions that could contribute to noise-induced hearing loss.

Basic Facts

Music, Noise, and Loudness Levels

Music is not noise, at least not to musicians.

So why are we talking about **Noise-Induced Hearing Loss** in a music setting?

How are music, noise, and hearing health connected?

Authoritative information about hearing health comes from medical research and practice. Both are based in science where “noise” is a general term for sound.

Music is one kind of sound among thousands of others.

Do not be confused or offended by terms. Remember the fundamental point.

A sound that is too loud, or too loud for too long, is dangerous to hearing health, no matter what kind of sound it is or whether the sound is called noise, music, or something else.

Sounds below threshold danger levels produce no risk, no matter how long the exposure time.

Music itself is not the issue. Loudness and its duration are the issues, for music and for all other sound sources.

Decisions about music play an important part in hearing health, but hearing health can be affected by far more sound sources than music. Loud sounds from all sources contribute 24/7 to the daily exposure level.

Musicians are responsible for their art form, and for supporting the well-being of other musicians.

Cultivating the most positive personal and professional relationship between music and hearing health is part of that responsibility.

Like so many issues in music itself, optimum effectiveness depends on balanced applications of knowledge and skill in varying circumstances by thousands of individual student, professional, and amateur musicians day after day.

Noise-Induced Permanent Hearing Loss

The Path of Hearing

Sound enters the outer ear in the form of sound waves. These waves travel through the bones of the middle ear. When they arrive in the inner ear, they are converted into electrical signals which travel via neural passages to the brain. It is then that sound is “heard.”

Middle Ear Damage

Occasionally, the intensity of a very loud impulse noise, like an explosion, can perforate the eardrum or dislodge the miniature bones of the middle ear, causing a conductive hearing loss. In many cases, this damage can be repaired with microsurgery. But such loud noise levels are also likely to send excessive sound levels into the inner ear, where permanent sensorineural hearing damage occurs.

Inner Ear Damage

After a sound passes through the middle ear, it enters the inner ear, also known as the cochlea. Inside the cochlea are tiny hair cells that help transmit sound waves to the brain. Loud noises cause damage to the hair cells, impairing their ability to send neural impulses to the brain.

Severity of Loss

The severity of an individual’s noise-induced hearing loss depends on the severity of this damage to the hair cells of the inner ear.

Severity of damage to these hair cells is normally related to the length and frequency of exposure to loud sounds over long periods of time.

It is important to understand that hair cells do not regenerate and that once hair cells are damaged, they cannot be repaired.

Noise-induced hearing loss is permanent and painless and initially reduces hearing sensitivity for high frequency sounds. If additional noise exposures continue, the damage progresses to greater hearing loss for sounds that are important for speech understanding, as well as music perception.

Noise-Induced Temporary Hearing Loss

Sometimes, after continuous, prolonged exposure to loud noise, an individual may experience temporary hearing loss. During temporary hearing loss, known as Temporary Threshold Shift (TTS), a person’s hearing ability is reduced. Outside noises may sound fuzzy or muted. Normally, this reduction lasts no more than 16 to 18 hours, after which normal hearing levels are restored.

Often during TTS, individuals will experience tinnitus, a medical condition characterized by a ringing, buzzing, or roaring in the ears. Tinnitus may last only a few minutes, but it can also span several hours, or, in extreme instances, last indefinitely.

A series of temporary hearing losses may be a precursor to permanent damage.

Temporary noise-induced hearing loss is reversible with adequate rest and recovery.

Noise Levels and Risk

Prolonged exposure to any noise or sound over 85 decibels can cause hearing loss. A decibel, defined by Merriam-Webster as “a unit for expressing the relative intensity of sounds on a scale from 0 for the average least perceptible sound to about 130 for the average pain level” is abbreviated “dB.”

The longer one’s exposure to a loud noise, the greater the potential for hearing loss.

The closer a person is to the source of a loud noise, the greater the risk for damage to the hearing mechanisms.

Consider these common sounds and their corresponding decibel levels:

30 dB – A Whisper

50 dB – Moderate Rain

60 dB – The Average Conversation

70 dB – Passing Freeway Traffic

80 dB – Alarm Clock

90 dB – Blender, Food Processor, Blow-Dryer; The Subway

100 dB – MP3 Players at Full Volume; Lawnmower, Snowblower

110 dB – Rock Concerts and Sporting Events; Power Tools

120 dB – Jet Planes at Take Off

130 dB – Sirens; Race Cars; Jackhammers

140 dB – Gun Shots; Fireworks

As a general rule, for every 3 dB above the 85 dB threshold, the intensity of a noise rises exponentially. For example, a 100 dB noise or sound has 32 times the destructive power of an 85dB sound or noise.

“Safe” exposure time is reduced by $\frac{1}{2}$ for every 3 dB increase, a time/intensity relationship often referred to as the “exchange rate.” The 3 dB exchange rate is widely accepted as a means for developing scientific, evidence-based assessment of the potential for hearing impairment as a function of noise level and duration. The NIOSH chart in the next section shows the 3 dB exchange rate progression clearly.

Exposure Times and Risk

Two U.S. federal agencies that institute policies and enforce regulations related to on-the-job hearing health are the Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH), a branch of the Centers for Disease Control and Prevention (CDC). By and large, the NIOSH standards are stricter, and they recommend shorter exposure times to sound environments with elevated decibel levels.

Recommended Maximum Daily Exposure Times to Instances of Continuous Noise at Various Decibel Levels*

| <u>Decibel Level</u> | <u>NIOSH</u> | <u>OSHA</u> |
|------------------------------------|--------------------------------|--------------------------------|
| 85 dB | 8 hours | 16 hours |
| 88 dB | 4 hours | 10.6 hours |
| 91 dB | 2 hours | 7 hours |
| 94 dB | 1 hour | 4.6 hours |
| 97 dB | 30 minutes | 3 hours |
| 100 dB | 15 minutes | 2 hours |
| 110 dB | 2 minutes | 30 minutes |
| <u>120 dB (close-range)</u> | <u>almost immediate</u> | <u>almost immediate</u> |

***NIOSH and OSHA maintain that the risk for hearing loss is increased when continuous exposure time exceeds these recommended maximums.**

While both OSHA and NIOSH standards are normally applied to industrial facilities where workers face constant and continuous exposure to high sound levels, these recommendations may be applied more broadly to settings beyond the industrial workplace, such as the rehearsal room or the concert hall.

Note 1: OSHA regulations apply to many, many aspects of health and safety at work places of all kinds, including academic institutions.

Note 2: For an application of the above chart to MP3 players, see [Basic Protection for Musicians](#).

Note 3: For more detail regarding the time/intensity relationship or the 3 dB exchange rate, see <http://www.cdc.gov/niosh/docs/98-126/chap3.html>.

Musicians and Risk of Noise-Induced Hearing Loss

Two facts are clear:

- Acute hearing and aural perception are essential for musicians.
- Noise-induced hearing loss is preventable.

Two conclusions are obvious:

- Musicians have basic hearing health responsibilities.
- Sound-level management is a critically important addition to the musician's portfolio of essential disciplines.

Constant attention is necessary because in most instances hearing loss is a gradual process that initially affects a person's ability to hear very high pitched sounds.

Problems with pitch perception and tinnitus may accompany such initial-stage hearing loss, and these may be career-ending for a musician.

Even if debilitating problems do not occur initially, career activity becomes increasingly difficult, and finally impossible as hearing loss proceeds to more advanced stages.

What do these facts and conclusions mean for musicians and for schools and departments of music?

In many cases, musicians are exposed to elevated levels of sound when they rehearse and perform. But such exposure alone does not equal automatic risk of hearing loss. There are many factors involved in benchmarking and determining the risk of exposure.

For musicians, managing hearing health starts with understanding basic facts and avoiding the most obvious problematic situations.

An environment is risky when it is so loud that one must shout to be heard, especially if such loudness is sustained. A list of basics is provided on Noise Levels and Risk.

There is more, however. Like most other decisions in advanced music making, thoughtful judgments about what to do and what not to do for yourself and for others involve gaining in-depth knowledge and applying it with sophisticated understanding.

Research-derived metrics are a good example. Metrics are valuable. The NIOSH and OSHA standards provide an authoritative basis for comparisons and further calculations. Analytical studies and lists of findings about decibel levels by noise source, instrument, ensemble, or genre are important and useful. But such data deserves interpretation and contextualization as it is factored into specific decision-making. Remember that NIOSH and OSHA level and duration calculations refer to non-stop exposure to a constant intensity of sound, not to varying intensities over the same period.

Any metric needs to be used with the understanding that in any rehearsal or performance, a number of variables are interacting at the same time and that these interactions are unique to specific settings and situations.

Four major variables are:

Sound-level variation. In some musical situations, decibel levels are essentially constant. However, in most, decibel levels rise and fall. A rock concert may constantly expose performers and audiences to dangerously high noise levels. A classical string quartet performance is usually characterized by fluctuations between soft and loud, with relatively few moments at peak volume.

Settings. Rehearsals and performances may take place in spaces that are right-sized and shaped for the size and volume levels of the individual performer or ensemble. Such spaces have adequate cubic volume. Other spaces may be too small, thus concentrating noise levels. Such spaces do not have adequate cubic volume. Some have proper acoustical treatment for their musical purposes. Others may not. Some settings feature electronic amplification; others do not. Placement of individual musicians in ensembles is also a factor in sound-level exposure. Settings have a significant effect on sound levels.

Distance. The distances between individual musicians and between performers and audience members influence a person's sound-level exposure. Generally, the closer a person is to the source of music or source of amplification, the greater the sound level. This obvious point has applications in many decisions about hearing health.

Length of Exposure. The amount of loud sound varies by type of music, by composition, style, and setting, and by artistic and personal choice. Length of exposure is critical in calculating whether over exposure is occurring and hearing loss is a consideration.

Measurements can be regarding each of these variables, and calculations can determine the composite effect in any specific setting.

Issues associated with the four variables above are active in terms of sound exposure in Solo and Ensemble experiences.

Solo and Ensemble

Both single instruments and ensembles can produce a range of sound levels. However, unless there are high levels of amplification, ensembles normally produce more sound than single instruments.

For example, a typical piano practice session may average between 60 and 70 decibels, similar to the intensity of average conversation. At these levels there is no danger no matter how long the practice session lasts.

In ensembles, sound levels for musicians involved can easily go beyond the 85 decibel level where risk begins to grow exponentially. For these musicians, danger increases if high volume levels are prolonged, or the space is too small or acoustically inappropriate for the size of the ensemble, or if electronic amplification is involved.

Sound-level meter readings confirm the obvious. In an overall sense, groups of strings produce less sound than groups of woodwinds, brass, or percussion. Normal or average sound levels from various ensemble configurations vary according to their distribution of instruments and the length of time various instrumental combinations normally play.

In both solo and ensemble settings, choices associated with sound levels clearly matter. A one-hour ensemble experience with several minutes of high volume may carry less risk than continuous high volume exposure in hours of solo practice or listening to an MP3 player for extended periods. Days spent with continuous exposure to high levels of sound are risk-filled days indeed.

In music schools, music students normally participate several times each week in conducted or coached ensembles. This fact places an important item into ensemble rehearsal and performance planning: the cumulative effect of sound exposure when it reaches higher than safe dB levels. Planning choices include but are not limited to repertory, rehearsal sequences, repetition frequencies, durations of loudness, use of sound-level meters, dosimeters, or other scientific instruments for monitoring cumulative exposure.

Measuring Sound Levels Scientifically

Sound-level meters take authoritative scientific measurements. Known more formally as “exponentially integrating sound-level meters,” these devices convert sound waves into decibel readings. If properly calibrated, they can accurately measure sound levels between 30 to 130 decibels.

Attached to the shaft of the sound-level meter is a condenser microphone. Using a series of filters, amplifiers, and integrators, the meter converts the microphone’s output into a single sound-pressure measurement, which is displayed on the meter’s screen.

Because sound-level meters utilize directional microphones, they are most accurate when pointed in the direction of the noise source. For the measurement of ambient noise sources, the placement of the microphone is less important, and the user may wish to place the device in a central location.

An alternative to the standard sound-level meter is the noise dosimeter, or personal sound exposure meter, a device used regularly in many settings to measure exposure/risk relationships. Worn on a person’s body, its accuracy is somewhat compromised by the acoustical presence of the individual wearing it.

Sound-level meters and dosimeters range in price from \$20 to \$2000 dollars (in 2011). Most acousticians recommend using devices that meet American National Standards Institute (ANSI) specifications.

Measuring devices continue to improve along with the general scientific and technological advance, and purchasing programs are advised to factor this evolution into their plans.

Basic Protection for Musicians

On stage and in life, it is important for musicians to take steps to protect their hearing. Sometimes, however, it is not possible or preferable to completely avoid a loud sound or noisy environment. At these times, musicians and music faculty may wish to explore the following methods of hearing protection:

- Earplugs – often made of foam or silicone; designed to be inserted into the wearer’s ear canal to protect against loud noise; some designed specifically for music applications.
- Earmuffs – often consist of two protective foam pads connected by a headband or strap; designed to cover the wearer’s ears and protect against loud noise
- Acoustical sound shields – generally made of clear plexi-glass or similar material; used to isolate and redirect the noise from a particular instrument or section of a band, orchestra, or ensemble; protects the hearing of musicians directly in front of the shielded instrument or section

Musicians often find that hearing protectors are not comfortable or that they create perceptual changes, even causing users to increase sound-intensity levels to compensate. One solution is to reduce the “average” sound-level exposure in rehearsals by making balanced repertory choices and giving greater attention to dynamic levels, especially in large or amplified ensembles. See Musicians and Risk of Noise-Induced Hearing Loss and Solo and Ensemble.

Protection also comes from regular behaviors such as:

- Avoiding situations likely to pose a danger to hearing health.
- Refraining from certain activities that can endanger hearing mechanisms.
- Maintaining a safe distance from sources of loud noise.
- At loud concerts, sitting or standing a “safe” distance from the stage and from speakers or other amplification devices.
- Keeping MP3 players and other listening devices at “safe” volume levels. MP3 players need special attention. Normally, MP3 players generate about 85 dB at one-third of their maximum volume, 94 dB at half volume, and 100 dB or more at full volume. Translated into daily exposure time, according to NIOSH standards, 85 dB equals 8 hours; 94 dB, 1 hour; and 100 dB, 15 minutes. These numbers assume that an individual is not exposed to any other noise beyond 85 dB during the day.
- Taking care with in-ear monitors, a device that has grown in popularity among musicians, especially in certain types of professional ensembles. These monitors can produce dangerously high sound levels. Musicians should see an audiologist or other qualified professional for a demonstration of safe practices before using an in-ear monitor for the first time and use the device in a manner that protects their hearing health.
- Developing a sense of the extent to which daily exposure has exceeded safe volume levels and durations (see Noise Levels and Risk and Exposure Times and Risk.)
- Taking breaks from exposure to elevated noise levels. (Enjoying quiet time.) See also Note 1 in the section *Exposure Times and Risk*.

Basics Music Professionals Need to Know and Be Able to Do

- Understand and share with others the risks inherent in excessive high-decibel sound exposure, including the risk of permanent hearing damage.
- Recognize that music can be a sound source capable of causing noise-induced hearing loss.
- Maintain familiarity and currency with health and safety codes and with standards and procedures related to noise exposure.
- Make practical assessments of sound levels.
- Apply hearing health knowledge in specific musical contexts, such as performance, production, education, competition, and listening.

Students need to gain these knowledge and skills during the course of their studies and preferably as soon as possible.

Part II. Considerations for Faculty and Administrators

A. Issues for Institutional Decision-Makers

Hearing loss is preventable. It is a serious issue that needs serious attention in music schools and departments. Contextual information for connecting hearing health to the work of music schools in productive ways is provided below.

Facing Complexity

Music schools and departments are focused on music itself, on making, teaching, studying, and otherwise working with music.

This focus is not possible without constant attention to the relationship between music and people and concern for the integrity of that relationship.

In the academic setting, the artistic and academic development and the well-being of students are especially important.

Many institutions have the highest artistic aspirations in one or more types of performance. They teach performance, organize to present performances, and maintain spaces for rehearsal and performance.

While the importance of hearing health is unquestionable, making decisions associated with hearing health in an institutional setting means working with complex mixtures of issues. Hearing health is part of a bigger picture that includes relationships among music, people, students, artistic aspirations, performances, justification, image, and sustainability.

Administrators and faculty need to find ways to address hearing health issues effectively in terms of these and other aspects of the complexities present in their institution.

Complexity is also present because there is a great deal to manage in terms of hearing health itself. For example: identification, coordination, and work with local experts outside the music program; operating orientation, information, and sound-level management programs; working with facilities, equipment and technology issues; producing public information; and factoring knowledge of the legal issues involved into each decision about what to say and what to do.

The following sections address additional considerations for decision-makers as they include hearing health in their portfolio of work on behalf of music and musicians.

Institutional and Individual Responsibility

The basics regarding the relationship of music and noise to hearing health are simple. For institutions, several responsibilities are obvious:

- Information about this relationship needs to be provided as broadly as possible to the musically involved of all ages.
- Individuals and organizations that teach and perform music need to pursue their work in ways that support hearing health.

- Rehearsal, performance, and acoustical considerations need to support hearing health objectives.
- Regulations and codes need to play appropriate guiding roles in institutional decisions.

None of these efforts, however, is a substitute for individual responsibility once basic information and appropriate conditions have been provided. At that point, in an overall sense, the musically involved individual is ultimately responsible for his or her own exposure to sound, including music. This is especially true when the individual is in control of choices about loudness, which is a great deal of the time.

Institutional and individual efforts on hearing health are both important. Each effort is in relationship with the other. But one is not a substitute for the other. Ultimately, like so many other things in music, an individual's decisions on a day-to-day basis are the key to success.

Orientation and information programs on hearing health should make these points clear in terms easily understood by students.

Roles and Interactions

Many professions bring expertise and resources to issues of hearing health. Each has different basic responsibilities and scope. Students also play a critical role.

For administrators and faculty, it is neither prudent nor responsible to act as though general knowledge of the hearing health issue in music can replace professional capability. It is critical to rely on professional expertise and judgment associated with specific areas of expertise and to create cooperative interactions whenever necessary to address a particular issue or problem.

Legally, there is a line between things that everyone can do, such as share accurate information or opinion labeled as opinion, and things that only licensed professionals can do. Crossing that line usually creates dangers for other people and thus, liability. Individuals in schools and departments of music need to know about and observe this line.

The primary roles of professionals in the postsecondary music-related hearing health arena are briefly defined below:

Medical Experts

- **Medical Doctors (M.D.)**

Licensed to diagnose, treat, and recommend preventative measures for individual patients. Also conduct and apply research to the development of protocols associated with medical procedures and individual and public health.

- **M.D. Specialists (most associated with hearing issues)**

- **Family Practice Doctor** – Licensed to treat all members of a family. Possesses general knowledge of all aspects of medicine. Qualified to diagnose a wide variety of conditions and diseases and perform and/or recommend treatment, when appropriate.

- **Internal Medicine Specialist (Internist)** - Licensed to treat many illnesses and conditions. Skilled at treating patients possessing multiple medical issues within one single treatment program. Usually works in an adult patient-oriented practice. Emphasizes prevention and wellness but can also treat problems of the eyes, ears, skin, nervous system, and reproductive organs and those associated with cancer, heart disease, etc.
- **Pediatrician** - Focuses on the preventative and general medical care of children and youth. Also provides care for children who are acutely or chronically ill. Performs routine hearing tests on children. Helps identify hearing loss and communication disorders in newborns, infants, and children.
- **Geriatric Medicine Doctor (Geriatrician)** – Specializes in the treatment of older patients. Is very familiar with conditions associated with aging. Focuses on both prevention and treatment.
- **Audiologist (PhD, EdD, AuD, or MS, among others)**
 Licensed to evaluate, diagnose, manage, and non-medically treat hearing loss and balance disorders in patients. Performs auditory and vestibular (balance) testing. Works closely with medical doctors and hearing aid manufacturers. Advocates for, and supervisors of, hearing loss prevention programs for people exposed to hazardous noise.
- **Otolaryngologist – Ear, Nose, and Throat Specialist (MD or DO degree)**
 Specializes in the medical and surgical management and treatment of patients with diseases and disorders of the ears, nose, and throat. Also treats related conditions of the head and neck.

Administrators, Faculty, and Students

- **Music Administrators in Higher Education**
 Address policy, management, and evaluation issues.
 With respect to hearing, these may include but are not limited to cultivating awareness, facilitating and/or leading the development of information programs for students and faculty, developing hearing health protocols, working with associated facilities issues, creating working relationships with professionals in other areas.
- **Music Faculty in Higher Education**
 Supervise, instruct, and mentor students, both majors and non-majors, within a music department or music program.
 With respect to hearing, these may include but are not limited to developing and maintaining an environment that, to the extent possible, is safe for both self and students within classrooms, rehearsal halls, and concert venues, and informing students and the public about preventative measures related to hearing health.

- **Music Students in Higher Education**

Engage in departmental, extracurricular, and sometimes professional performances. Develop skills learned in classrooms and private lessons through rehearsals and performances.

With respect to hearing, students' behavior, both on and off campus and in both academic and non-academic settings, impacts the hearing health of both themselves and listeners.

Students are responsible for refraining from individual choices and behaviors which could compromise hearing health. This includes but is not limited to being mindful of the volume levels of listening devices and instruments, making use of earplugs or other protective devices when the potential for dangerous noise levels arises, and providing positive example for other students.

- **Institutional Administration**

Provide institutional leadership to faculty, staff, and students.

With respect to hearing, institutional administrators make decisions related to funding, including those related to the maintenance and/or construction of musical facilities, and general institutional policies associated with student health.

Researchers

- **Medical Researchers**

Research the many causes (genetic, environmental, trauma-induced) of hearing loss.

Develop and refine techniques by which to prevent and diagnose the known causes of hearing loss.

Develop and refine potential treatment options.

Conduct clinical trials on patients suffering from hearing loss or deafness.

- **Psychologists and Physiologists**

Study and report on the connections between excessive noise exposure and psychological conditions.

Examine the effects of hearing loss on quality of life.

Provide psychological treatment and counseling to individuals affected by hearing loss.

- **Medical Schools and University Hospitals**

Support and/or coordinate institution-wide hearing health awareness programs, orientations, or advocacy campaigns.

Work with departments, such as music and education, to develop partnerships that promote hearing safety.

- **Music-related Researchers**

Study issues of music and hearing health in professional, academic, and private settings.

Develop hearing health information useful to musicians, students, and consumers of music.

Provide analyses and recommendations for music policymakers.

Designers

- **Acousticians and Architects**

Design and construct spaces, including practice rooms, rehearsal halls, and concert venues, which optimize the appearance and sound of musical performances.

Consider and manage the impact of noise levels when designing facilities for musicians and music students, when placing the audience within the performance space, when siting electronic speakers and other elements of amplification systems, and when making other multiple design decisions where sound is a factor.

Advise institutional leaders regarding specific acoustical treatments, such as sound insulation for rooms and panels and padding to absorb and/or redirect sound.

Make suggestions as to the use and placement of acoustical shields in specific performance spaces.

Ensure that all designs meet noise criteria (NC) standards, as defined by the acoustics industry and the American National Standards Institute (ANSI).

- For more information:
 - **Acoustical Society of America** - <http://acousticalsociety.org>
 - **Acoustics.com** - <http://www.acoustics.com>

Facilities and Equipment Personnel

- **Facilities, Equipment, and Risk Management Personnel**

Maintain proper upkeep of rehearsal and performance spaces.

Evaluate the suitability of certain classrooms, rehearsal spaces, and other campus facilities for both instrumental and vocal rehearsals and performances.

Ensure that all facilities meet legal acoustical codes for their intended use.

Maintain university-wide compliance with structural and acoustical criteria established by the Occupational Safety and Health Administration (OSHA).

Be mindful of American National Standards Institute (ANSI) standards related to acoustical codes, especially S12.60-2010, "Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools."

Understand proper protocols for reporting potential health hazards, music-related and other.

Health and Safety Standards Organizations

The following organizations establish and revise parameters, limits, and specifications based on specific findings.

- The National Institute for Occupational Safety and Health (NIOSH) - <http://www.cdc.gov/niosh>
- American National Standards Institute (ANSI) - <http://www.ansi.org>
- Occupational Safety and Health Administration (OSHA) - <http://www.osha.gov>

Legal Counsel

- **Legal Counsel**

Provide guidance, advice, and representation to institutional administration and faculty.

Maintain access to and provide interpretations of laws, rules, cases, and decisions related to health and safety, including hearing health and noise-induced hearing loss.

Review documents, presentations, programs, policies, and other activities in light of legal requirements and prudent action.

Participate in formulating policies for music faculty and administrators regarding consultation and engagement with licensed medical experts, with particular attention to legal cases involving individual hearing health.

Information and Message Considerations

Music schools and departments produce many types of public information, including information for students and faculty. All such public information is intended to reflect positively on the field of music, the value of music study, and the quality of the institution's music program.

Music schools and departments cost money. Constant expenditure justification is usually necessary. Justification includes maintaining an accurate and positive image about music and

music study. Performance is a major indicator of achievement and value in most academic settings.

The future of a college- or university-based music program depends on external belief in its value and on its ability to bring credit to the institution as a whole. Music is in jeopardy if it is viewed as a real or potential liability.

Music is a complex field with many issues and connections. For musicians, hearing health is a critical part of a larger whole. Hearing health is a central concern, but music remains the core concern. Naturally, for various hearing health professionals, the opposite is the case. However, for optimum public information success on hearing health questions, music and hearing health professionals must work together.

The administrative challenge is obvious. Music administrators need to seek accuracy, balance, and relationship as information is provided to students who are future music professionals, students majoring in other fields, the larger academic community, and the public at large.

Information about any subject can be worded in ways that produce a variety of impressions and effects on individuals and groups. For example, the message, "Music produces hearing loss" denigrates music generically. The underlying theme is negative toward music itself and to any encounter with it. In contrast, the message, "Enjoy music in ways that support your hearing health" lifts both music and hearing health into a positive relationship.

Honesty and integrity are essential. Oversimplification often produces misrepresentation. A statement can be literally true, but mislead by what is left unstated.

Public information about music and hearing health needs to be comprehensive, even when the message is brief. The following questions may be useful in testing messages of any length about music and hearing health for balance, relationship, honesty, and integrity.

1. Does the message itself and its underlying theme:

- build respect for the value of engagement with music and music study?
- produce attention to basic hearing health issues associated with loudness and duration?
- connect music to hearing health in a positive way?

2. If it addresses or has an impact on any of the topics below, does the message:

- indicate or allude to the multiple sources of influence on individual hearing health?
- inspire personal responsibility and engagement in managing one's own exposure to loud sounds or noise?
- place facts and numbers in contexts that produce comprehensive factual clarity? For example, are decibel readings presented with descriptions of realities such as physical specifications of performance and rehearsal spaces, distance from music or other sound sources, the fact that many soloists and ensembles do not play loudly all the time, the frequency of loudness in different types and genres of music, and so forth?

- affirm the relationship between individual and institutional roles in promoting hearing health?
- reflect the distinction between general information and the provision of professional advice or individual medical diagnosis or treatment?
- engender cooperation and trust among those with various responsibilities for music and for hearing health in the institution?

Legal Issues

Hearing health has legal dimensions just like every other issue in our society. Although not the first consideration, these legal dimensions are extremely important to consider in developing and operating a hearing health program in a school or department of music.

The following items are intended as a springboard for consultation with legal counsel and local consideration and action in the music school.

- Provide information about hearing health to all associated with the program. Review the comprehensive nature of the issue. If possible, engage licensed medical personnel to present medical information and answer questions about medical issues.
- Provide facilities that meet legally recognized acoustical codes for their intended use.
- Ensure the accuracy and currency of any hearing information you provide.
- Document the source of any information provided by the medical or research communities. Use only authoritative sources.
- Develop and use a policy statement that separates the functions of information and referral on one hand, and medical diagnosis, advice, and treatment on the other.
- Clarify to all faculty, administrators, and staff that under no circumstances is anyone to attempt to provide advice of a medical nature unless licensed to do so. Warn of the dangers inherent in even being construed as offering such advice.
- Present hearing health issues comprehensively, especially in general orientations.
- Emphasize the importance of individual responsibility and that the scope of this responsibility extends beyond music.
- Explain what the institution does with regard to hearing health and connect each item with individual responsibility at all levels.
- Document the basic elements of any hearing health program you develop and use (see Developing Hearing Health Objectives in Schools of Music). This includes but is not limited to documenting:
 - points made in general orientations of students and faculties;
 - policies and procedures regarding hearing health in various aspects of the program; and

- acoustical studies, considerations, and decisions during assessment, building, and renovation.
- Be consistent. Follow any and all procedures that you have established. Change your documented procedures before changing your practices.
- Place appropriate disclaimers on published information and Web sites as applicable to the text, for example:
 - *The information provided here is for information purposes only and is not a substitute for medical advice or treatment by a licensed professional.*
 - *The information provided here is for information purposes only by the [name of organization], an association of [characteristics of members, e.g. medical doctors].*
 - *The information provided here is not a substitute for each individual's responsibility to cultivate his or her own hearing health on a daily basis.*
 - *The information provided here is current as of [date]. Newer information may be available.*
- Work in the context of the health management and other applicable systems at your institution.
- Have your hearing health programs, procedures, and published information reviewed by institutional or other qualified attorneys before putting them into place and periodically thereafter, especially when substantive changes are proposed.
- Work with your attorneys to develop a legally defensible and technically accurate hearing health approach.

B. Developing Hearing Health Objectives in Schools of Music

Introduction

The following objectives are associated with achieving a specific goal: developing and maintaining a comprehensive hearing health program in a school or department of music.

There are many other ways of stating and organizing objectives for this purpose.

However, the items below provide the content and action areas recommended for any set of objectives guiding local decision-making.

Individual institutions decide on the specific means for accomplishing these and any other objectives they establish regarding hearing health.

Of course, the means chosen need to accomplish the objective.

These statements are not accreditation standards, and must not be referenced as such. Statements of NASM standards are found only in the *NASM Handbook*.

Links to resources or further information are provided as applicable.

1. Orient entering music students.

Entering students need information about:

- The fundamentals of hearing health.
- The facts about loud sounds and noise-induced hearing loss.
- Avoiding risks and preventing damage when performing and listening to music.
- School or departmental policies and practices, and mechanisms for addressing concerns.
- Links and referrals to medical expertise and assistance.
- Personal responsibility.

Music programs are also encouraged to lead in the development of awareness campus wide, particularly in cooperation with other interested groups.

To assist with student orientations and other awareness programs, NASM and PAMA have created the following documents, which may be edited to fit the needs and goals of the institution, school, or department of music.

Protect Your Hearing Every Day: Information and Recommendations for Student Musicians

A Sample Order and Script for Music Student Orientation

Standard Version

Version for Customization

Student Text Version of the Orientation Script

Standard Version

Version for Customization

Protecting Your Hearing Health: Student Information Sheet on Noise-Induced Hearing Loss

Standard Version

Version for Customization

2. Orient and engage faculty, staff, and administrators.

In addition to information listed for students, faculty and staff need information about:

- Sound-level monitoring.
- The role and relationship to medical professionals.
- How to work with students on hearing health issues, and with school or department mechanisms for addressing concerns.

Basic information on hearing health for faculty, staff, and administrators can be found in the following NASM/PAMA document. Like the student documents listed above, it too may be altered to fit the needs and goals of the institution, school, or department of music.

Information and Recommendations for Faculty and Staff in Schools of Music

3. *Define and teach basic information needed by music professionals.*

a. All Musicians

- (1) How hearing may be permanently damaged by excessive high-decibel exposure.
- (2) How music can be a sound source capable of causing NIHL.
- (3) Health and safety codes, standards and procedures related to noise exposure.
- (4) How to make practical assessments of risks of hazardous noise, considering level and duration of the exposure.
- (5) How to apply hearing health knowledge in specific musical contexts such as performance, production, education, competition, and listening.

b. Future Music Teachers

In addition to items 3.a.(1) through (5) above, the knowledge and skill to:

- (6) Teach students about hearing health.
- (7) Manage various ensemble-based instructional activities in ways that produce a positive relationship among artistic goals, expressive possibilities, and hearing health.

4. *Secure cooperative consultative relationships with local medical experts, especially with regard to:*

- a. Content and presentation texts and events associated with orientation and education.
- b. Reviews of the school's hearing health policies and protocols.
- c. Notice of new information applicable to music schools.

5. *Maintain a system for referring individuals to licensed medical professionals, including but not limited to:*

- a. Clear policies about maintaining distinctions between
 - (1) Sharing basic information or observations and
 - (2) Medical advice.
- b. Simple criteria and protocols for determining that referral is indicated.
- c. A list of medical professionals that accept referrals.

6. *Develop and maintain acoustically appropriate facilities.*

- a. Meet established health and safety standards in terms of the ways specific facilities are actually used.
- b. Work closely with acousticians and architects.

7. *Assign spaces for practice, rehearsal, and performance that are acoustically appropriate for the volume of the sound source and the purpose of use.*

- a. Inventory spaces and rooms by cubic volume in relation to number of simultaneous users, numbers of uses, natures of sound sources, and exposure time.
- b. Base assignments on actual sound-level measurements as well as other considerations.

8. *Create guidelines and protocols regarding noise exposure for personnel in solo and ensemble rehearsals and performances, for example:*

- a. Use of noise reduction devices such as earplugs and sound shields.
- b. Guidelines and protocols for the duration of rehearsals at various sound levels.
- c. Information for students about possible exposure levels in individual practice, small ensembles, and work with electronic and amplified sound.

9. *Make word and image choices that serve both music and hearing health. (See Information and Message Considerations.)*

10. *Sustain a consultative relationship with legal counsel, especially with regard to Legal Issues.*

C. The Administrator's Role: Regular Coordination in a Dynamic Setting

Consider Interacting Relationships

Administrators work in dynamic settings.

The factors creating specific situations change, as do the relationships of the factors to each other.

These changes occur on different schedules and in different proportions in individual schools and departments.

Each institution is unique, and there are no detailed formulas that work universally.

Common objectives and factors regarding hearing health need to be incorporated into a custom design that is resilient enough to succeed in the larger dynamic of the school as a whole.

Looking holistically from the administrative perspective, major areas engaged in dynamic action and relationships with hearing health include:

- The art of music itself and creative and performance developments within it.
- Educational efforts in music, including associated time, expertise, and resource allocations.
- Personnel – students, faculty, administrators, medical experts, researchers, etc.
- Knowledge, research, scholarship, and new developments in the field of hearing health.
- Current and evolving protocols, regulations, standards, and legal considerations.
- Facilities, equipment, and technology.
- Approaches and systems for providing information means and protocols for factoring hearing health issues into operational, artistic, and educational decisions.
- Evaluation for specific purposes such as adequacy, currency, and improvement.
- Images and values building for music, musicians, and the music school.

Remember the Influence of Size and Scope

The scope and complexity of working with relationships among these factors is normally related to the size, scope, and complexity of the music program. The number of students and the types and levels of degree or program offerings have great influence on the type and nature of hearing health coordination needed.

Create a Local Plan

The first challenge is to build an objective-based local plan that takes all important factors into account.

The choice of **objectives**, their working, ordering, and means for achievement need to be as simple as possible given the size and scope of the program.

Simplicity can promote efficiency. Efficiency usually produces incentives to participate.

Participation is necessary because the aggregate result is produced by a vast number of individual decisions.

Plan development is strengthened by consultations involving music faculty, students, hearing health professionals, attorneys, and other related parties.

Consider the Local Plan in Relation to Local Objectives

A second challenge is to take each basic element of the local plan chosen and consider it carefully in terms such as the dynamic relationship among:

- The fundamental specific objective (hearing health orientation for entering students, or coordination with local health professionals, for example);

- Common knowledge, and specialized information or research associated with the specific objective;
- Availability, accessibility and probability of internal and external resources to address the specific objective;
- The fastest, most effective means of reaching the objective in the specific local situation; and
- An assessment of how well the element will work in relationship to other elements and objectives in the larger hearing health plan and in the purposes of the music school or department.

These considerations provide the basis for (a) making adjustments to specific elements and the plan as a whole, (b) completing the entire plan, and (c) implementing the plan with confidence.

Coordinate the Constituencies

A third challenge in the promotion of hearing health is to develop and maintain the regular coordination within the school's hearing health effort. Some of the most important administrative coordination issues are:

- Remaining sufficiently current with hearing health issues to engage at a strategic decision-making level for the school.
- Ensuring that analysis and action are based on current, accurate, and authoritative information.
- Sustaining the means to accomplish any single hearing health goal.
- Sustaining the means to maintain a productive relationship between accomplishing any single goal and the entire set of goals.
- Sustaining the means to accomplish the set of hearing health goals both together, and in relationship to other goals providing energy to the work of the school or department.
- Cultivating the relationship of hearing health goals to artistic and educational missions, and to the artistic decision-making authority and responsibilities of individuals and groups.
- Allocating and managing time, schedules, and sequences associated with various hearing health efforts.
- Engaging personnel within the school and maintaining liaisons with local professionals and groups, including the development of teams for specific projects.
- Building a culture of cooperation and common effort, based in part on maintaining clarity about specific roles and relationships among issues, specific efforts, and personnel.
- Establishing effective means for evaluating the effectiveness of the local hearing health plan and using results and analyses to improve the plan.

Resources – Information and Research

NASM-PAMA Resource Documents and Orientation Materials

Information and Recommendations for Faculty and Staff in Schools of Music

Protect Your Hearing Every Day: Information and Recommendations for Student Musicians

A Sample Order and Script for Music Student Orientation

Standard Version

Version for Customization

Student Text Version of the Orientation Script

Standard Version

Version for Customization

Protecting Your Hearing Health: Student Information Sheet on Noise-Induced Hearing Loss

Standard Version

Version for Customization

Hearing Health Project Partners

National Association of School of Music (NASM)

<http://nasm.arts-accredit.org/>

Performing Arts Medicine Association (PAMA)

<http://www.artsmed.org/index.html>

PAMA Bibliography (search tool)

<http://www.artsmed.org/bibliography.html>

General Information on Acoustics

Acoustical Society of America

(<http://acousticalsociety.org/>)

Acoustics.com

(<http://www.acoustics.com>)

Acoustics for Performance, Rehearsal, and Practice Facilities

Available through the NASM Web site ([click here to purchase](#))

An Acoustics Primer for Music Spaces (Wenger Corporation)

<http://www.wengercorp.com/Lit/Wenger%20Acoustics%20Primer.pdf>

Health and Safety Standards Organizations

American National Standards Institute (ANSI)
(<http://www.ansi.org/>)

The National Institute for Occupational Safety and Health (NIOSH)
(<http://www.cdc.gov/niosh/>)

Occupational Safety and Health Administration (OSHA)
(<http://www.osha.gov/>)

Medical Organizations Focused on Hearing Health

American Academy of Audiology
(<http://www.audiology.org/Pages/default.aspx>)

American Academy of Otolaryngology – Head and Neck Surgery
(<http://www.entnet.org/index.cfm>)

American Speech-Language-Hearing Association (ASHA)
(<http://www.asha.org/>)

Athletes and the Arts
(<http://athletesandthearts.com/>)

House Research Institute – Hearing Health
(<http://www.hei.org/education/health/health.htm>)

National Institute on Deafness and Other Communication Disorders – Noise-Induced Hearing Loss (<http://www.nidcd.nih.gov/health/hearing/noise.html>)

Other Organizations Focused on Hearing Health

Dangerous Decibels
(<http://www.dangerousdecibels.org>)

National Hearing Conservation Association
(<http://www.hearingconservation.org/>)



Basic Information on Hearing Health

Information and Recommendations for Faculty and Staff in Schools of Music

**National Association of Schools of Music
Performing Arts Medicine Association**

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**Basic Information on Hearing Health
Information and Recommendations for
Faculty and Staff in Schools of Music**

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Basic Information on Hearing Health

Information and Recommendations for Faculty and Staff in Schools of Music

Introduction

The National Association of Schools of Music (NASM) and the Performing Arts Medicine Association (PAMA) have developed a comprehensive overview of hearing health issues for postsecondary schools and departments of music.

This document provides a comprehensive overview for administrators and faculty.

It is oriented toward decision-making about hearing health in the context of a school or department of music.

Information of a medical nature is provided by PAMA; information regarding contextual issues in music programs, by NASM.

***Please note:** Information in this Web resource is subject to change at any time without prior notice.*

Use the hyperlinks in the fast tracks below or in the [table of contents](#) to go to specific sections.

Fast Tracks

- [The Basic Issue](#)
- [Noise Levels and Risk](#)
- [Exposure Times and Risk](#)
- [Hearing Health in Schools and Classrooms](#)

1. Organizations

NASM, founded in 1924, is an organization of schools, conservatories, colleges and universities with approximately 630 accredited institutional members. It establishes national standards for undergraduate and graduate degrees and other credentials and is the national music accrediting agency. NASM also provides information to potential students and parents, consultations, statistical information, professional development; and policy analysis.

PAMA, founded in 1989, is an organization comprised of dedicated medical professionals, artists, educators, and administrators with the common goal of improving the health care of the performing artist. Members of PAMA are professionals in fields that include research, education, and clinical practice who hail from all corners of the globe.

2. Disclaimers

- a. NASM and PAMA are providing this web resource for institutions that teach music to assist local consideration and action about hearing health.
- b. The information:
 - is generic, presentational, and advisory in character.
 - is oriented far more to musicians and lay persons than to medical, scientific, or research professionals concerned with hearing health.
 - does not substitute for the professional judgments of medical and other professionals working in their areas of documented expertise.
 - is not to be considered as professional advice or to be used as a basis for the medical treatment of specific individuals.
 - does not supersede present and future empirical research that may confirm, contradict, expand, or change the medical or other information provided here at any point in time.
 - in no way serves as the basis for the accreditation function of NASM or as an addition to the accreditation standards and procedures of NASM. (A Handbook containing standards and a set of Membership Procedures are published separately by NASM.)
 - is not an endorsement of the reference materials listed or cited; nor does it represent an endorsement of other opinions, methods, or approaches described in the text.
- c. Health and safety depend in large part on the personal decisions of informed individuals. Institutions have health and safety responsibilities, but fulfillment of these responsibilities can and will not ensure any specific individual's health and safety. Too many factors beyond any institution's control are involved. Individuals have a critically important role and each is personally responsible for avoiding risk and preventing injuries to themselves before, during, and after study or employment at any institution. This set of advisory information on hearing health and institutional actions taken under their influence or independently do not alter or cancel any individual's personal responsibility, or in any way shift personal responsibility for the results of any individual's personal decisions in any instance or over time to any institution, or to NASM, or to PAMA.

3. Acknowledgements

NASM and PAMA acknowledge with gratitude the efforts of the many past and present professionals in various medical, research, and music-related fields who developed the scientific and practical information summarized in this set of resources. They express appreciation to the members of PAMA, NASM, and the American Academy of Audiology who made comments and suggestions on drafts of this and other documents in this Web resource.

4. Reproduction of this Resource for Institutional Use

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Part I. Hearing Health Facts and Concepts

Hearing Health: The Basic Issue

Hearing health is important for everyone. It is critical for music professionals.

Certain types of hearing loss, such as those caused by genetic factors, infections, or head trauma are often unavoidable and sometimes only temporary.

One particular type of hearing loss is often permanent: hearing loss due to noise exposure.

Scientifically, this is referred to as noise-induced hearing loss or NIHL.

The hearing system can be injured not only by a loud blast or explosion but also by prolonged exposure to high decibel levels of sound.

Music of any type and source at high volume that exceeds daily exposure levels and time periods is dangerous. Over time, NIHL can be the result.

Preventative measures need to be taken by individual musicians and by institutions where musicians study and work.

Preventative measures include but are not limited to information, applications of information in decision-making and culture building, and acoustically appropriate performance and rehearsal spaces.

The issue is serious. NIHL is widespread. Statistics vary, but 50 percent of musicians may have problems with hearing loss to some degree.

The danger of noise-induced hearing loss is calculated on the basis of scientific evidence expressed mathematically and in other scientific languages. Individual perceptions about loudness may provide useful indications; however, such perceptions are not a substitute for assessments based on scientific measurement and evidence-based data.

Purpose of this Web Resource

This web resource is focused on hearing health and hearing loss, preventative measures, and how schools and departments of music can work appropriately and comprehensively with associated issues.

This information is to be used in service of a goal in individual institutions to provide conditions that support hearing health.

The first essential is information about hearing health, hearing loss, and preventative action.

Without knowledge of what can happen and how to minimize risk, music students and professionals have little basis for making informed decisions to care for their hearing and that of other musicians with whom they work.

For each school or department of music, hearing health is addressed in a multi-faceted context.

Charting an effective course to promote and provide the best environment for hearing health means working with many issues and forces beyond providing information for students, faculty, and administrators.

To be successful, a comprehensive hearing health program needs to be sustained from year to year.

This resource provides the basis for instructional efforts to provide information and develop a plan for supporting hearing health with a particular focus on minimizing conditions that could contribute to noise-induced hearing loss.

Basic Facts

Music, Noise, and Loudness Levels

Music is not noise, at least not to musicians.

So why are we talking about **Noise-Induced Hearing Loss** in a music setting?

How are music, noise, and hearing health connected?

Authoritative information about hearing health comes from medical research and practice. Both are based in science where “noise” is a general term for sound.

Music is one kind of sound among thousands of others.

Do not be confused or offended by terms. Remember the fundamental point.

A sound that is too loud, or too loud for too long, is dangerous to hearing health, no matter what kind of sound it is or whether the sound is called noise, music, or something else.

Sounds below threshold danger levels produce no risk, no matter how long the exposure time.

Music itself is not the issue. Loudness and its duration are the issues, for music and for all other sound sources.

Decisions about music play an important part in hearing health, but hearing health can be affected by far more sound sources than music. Loud sounds from all sources contribute 24/7 to the daily exposure level.

Musicians are responsible for their art form, and for supporting the well-being of other musicians.

Cultivating the most positive personal and professional relationship between music and hearing health is part of that responsibility.

Like so many issues in music itself, optimum effectiveness depends on balanced applications of knowledge and skill in varying circumstances by thousands of individual student, professional, and amateur musicians day after day.

Noise-Induced Permanent Hearing Loss

The Path of Hearing

Sound enters the outer ear in the form of sound waves. These waves travel through the bones of the middle ear. When they arrive in the inner ear, they are converted into electrical signals which travel via neural passages to the brain. It is then that sound is “heard.”

Middle Ear Damage

Occasionally, the intensity of a very loud impulse noise, like an explosion, can perforate the eardrum or dislodge the miniature bones of the middle ear, causing a conductive hearing loss. In many cases, this damage can be repaired with microsurgery. But such loud noise levels are also likely to send excessive sound levels into the inner ear, where permanent sensorineural hearing damage occurs.

Inner Ear Damage

After a sound passes through the middle ear, it enters the inner ear, also known as the cochlea. Inside the cochlea are tiny hair cells that help transmit sound waves to the brain. Loud noises cause damage to the hair cells, impairing their ability to send neural impulses to the brain.

Severity of Loss

The severity of an individual’s noise-induced hearing loss depends on the severity of this damage to the hair cells of the inner ear.

Severity of damage to these hair cells is normally related to the length and frequency of exposure to loud sounds over long periods of time.

It is important to understand that hair cells do not regenerate and that once hair cells are damaged, they cannot be repaired.

Noise-induced hearing loss is permanent and painless and initially reduces hearing sensitivity for high frequency sounds. If additional noise exposures continue, the damage progresses to greater hearing loss for sounds that are important for speech understanding, as well as music perception.

Noise-Induced Temporary Hearing Loss

Sometimes, after continuous, prolonged exposure to loud noise, an individual may experience temporary hearing loss. During temporary hearing loss, known as Temporary Threshold Shift (TTS), a person’s hearing ability is reduced. Outside noises may sound fuzzy or muted. Normally, this reduction lasts no more than 16 to 18 hours, after which normal hearing levels are restored.

Often during TTS, individuals will experience tinnitus, a medical condition characterized by a ringing, buzzing, or roaring in the ears. Tinnitus may last only a few minutes, but it can also span several hours, or, in extreme instances, last indefinitely.

A series of temporary hearing losses may be a precursor to permanent damage.

Temporary noise-induced hearing loss is reversible with adequate rest and recovery.

Noise Levels and Risk

Prolonged exposure to any noise or sound over 85 decibels can cause hearing loss. A decibel, defined by Merriam-Webster as “a unit for expressing the relative intensity of sounds on a scale from 0 for the average least perceptible sound to about 130 for the average pain level” is abbreviated “dB.”

The longer one’s exposure to a loud noise, the greater the potential for hearing loss.

The closer a person is to the source of a loud noise, the greater the risk for damage to the hearing mechanisms.

Consider these common sounds and their corresponding decibel levels:

30 dB – A Whisper

50 dB – Moderate Rain

60 dB – The Average Conversation

70 dB – Passing Freeway Traffic

80 dB – Alarm Clock

90 dB – Blender, Food Processor, Blow-Dryer; The Subway

100 dB – MP3 Players at Full Volume; Lawnmower, Snowblower

110 dB – Rock Concerts and Sporting Events; Power Tools

120 dB – Jet Planes at Take Off

130 dB – Sirens; Race Cars; Jackhammers

140 dB – Gun Shots; Fireworks

As a general rule, for every 3 dB above the 85 dB threshold, the intensity of a noise rises exponentially. For example, a 100 dB noise or sound has 32 times the destructive power of an 85dB sound or noise.

“Safe” exposure time is reduced by ½ for every 3 dB increase, a time/intensity relationship often referred to as the “exchange rate.” The 3 dB exchange rate is widely accepted as a means for developing scientific, evidence-based assessment of the potential for hearing impairment as a function of noise level and duration. The NIOSH chart in the next section shows the 3 dB exchange rate progression clearly.

Exposure Times and Risk

Two U.S. federal agencies that institute policies and enforce regulations related to on-the-job hearing health are the Occupational Safety and Health Administration (OSHA) and the National Institute for Occupational Safety and Health (NIOSH), a branch of the Centers for Disease Control and Prevention (CDC). By and large, the NIOSH standards are stricter, and they recommend shorter exposure times to sound environments with elevated decibel levels.

**Recommended Maximum Daily Exposure Times to Instances of
Continuous Noise at Various Decibel Levels***

| Decibel Level | NIOSH | OSHA |
|------------------------------------|--------------------------------|--------------------------------|
| 85 dB | 8 hours | 16 hours |
| 88 dB | 4 hours | 10.6 hours |
| 91 dB | 2 hours | 7 hours |
| 94 dB | 1 hour | 4.6 hours |
| 97 dB | 30 minutes | 3 hours |
| 100 dB | 15 minutes | 2 hours |
| 110 dB | 2 minutes | 30 minutes |
| <u>120 dB (close-range)</u> | <u>almost immediate</u> | <u>almost immediate</u> |

***NIOSH and OSHA maintain that the risk for hearing loss is increased when continuous exposure time exceeds these recommended maximums.**

While both OSHA and NIOSH standards are normally applied to industrial facilities where workers face constant and continuous exposure to high sound levels, these recommendations may be applied more broadly to settings beyond the industrial workplace, such as the rehearsal room or the concert hall.

Note 1: OSHA regulations apply to many, many aspects of health and safety at work places of all kinds, including academic institutions.

Note 2: For an application of the above chart to MP3 players, see Basic Protection for Musicians.

Note 3: For more detail regarding the time/intensity relationship or the 3 dB exchange rate, see <http://www.cdc.gov/niosh/docs/98-126/chap3.html>.

Musicians and Risk of Noise-Induced Hearing Loss

Two facts are clear:

- Acute hearing and aural perception are essential for musicians.
- Noise-induced hearing loss is preventable.

Two conclusions are obvious:

- Musicians have basic hearing health responsibilities.
- Sound-level management is a critically important addition to the musician's portfolio of essential disciplines.

Constant attention is necessary because in most instances hearing loss is a gradual process that initially affects a person's ability to hear very high pitched sounds.

Problems with pitch perception and tinnitus may accompany such initial-stage hearing loss, and these may be career-ending for a musician.

Even if debilitating problems do not occur initially, career activity becomes increasingly difficult, and finally impossible as hearing loss proceeds to more advanced stages.

What do these facts and conclusions mean for musicians and for schools and departments of music?

In many cases, musicians are exposed to elevated levels of sound when they rehearse and perform. But such exposure alone does not equal automatic risk of hearing loss. There are many factors involved in benchmarking and determining the risk of exposure.

For musicians, managing hearing health starts with understanding basic facts and avoiding the most obvious problematic situations.

An environment is risky when it is so loud that one must shout to be heard, especially if such loudness is sustained. A list of basics is provided on Noise Levels and Risk.

There is more, however. Like most other decisions in advanced music making, thoughtful judgments about what to do and what not to do for yourself and for others involve gaining in-depth knowledge and applying it with sophisticated understanding.

Research-derived metrics are a good example. Metrics are valuable. The NIOSH and OSHA standards provide an authoritative basis for comparisons and further calculations. Analytical studies and lists of findings about decibel levels by noise source, instrument, ensemble, or genre are important and useful. But such data deserves interpretation and contextualization as it is factored into specific decision-making. Remember that NIOSH and OSHA level and duration calculations refer to non-stop exposure to a constant intensity of sound, not to varying intensities over the same period.

Any metric needs to be used with the understanding that in any rehearsal or performance, a number of variables are interacting at the same time and that these interactions are unique to specific settings and situations.

Four major variables are:

Sound-level variation. In some musical situations, decibel levels are essentially constant. However, in most, decibel levels rise and fall. A rock concert may constantly expose performers and audiences to dangerously high noise levels. A classical string quartet performance is usually characterized by fluctuations between soft and loud, with relatively few moments at peak volume.

Settings. Rehearsals and performances may take place in spaces that are right-sized and shaped for the size and volume levels of the individual performer or ensemble. Such spaces have adequate cubic volume. Other spaces may be too small, thus concentrating noise levels. Such spaces do not have adequate cubic volume. Some have proper acoustical treatment for their musical purposes. Others may not. Some settings feature electronic amplification; others do not. Placement of individual musicians in ensembles is also a factor in sound-level exposure. Settings have a significant effect on sound levels.

Distance. The distances between individual musicians and between performers and audience members influence a person's sound-level exposure. Generally, the closer a person is to the source of music or source of amplification, the greater the sound level. This obvious point has applications in many decisions about hearing health.

Length of Exposure. The amount of loud sound varies by type of music, by composition, style, and setting, and by artistic and personal choice. Length of exposure is critical in calculating whether over exposure is occurring and hearing loss is a consideration.

Measurements can be regarding each of these variables, and calculations can determine the composite effect in any specific setting.

Issues associated with the four variables above are active in terms of sound exposure in Solo and Ensemble experiences.

Solo and Ensemble

Both single instruments and ensembles can produce a range of sound levels. However, unless there are high levels of amplification, ensembles normally produce more sound than single instruments.

For example, a typical piano practice session may average between 60 and 70 decibels, similar to the intensity of average conversation. At these levels there is no danger no matter how long the practice session lasts.

In ensembles, sound levels for musicians involved can easily go beyond the 85 decibel level where risk begins to grow exponentially. For these musicians, danger increases if high volume levels are prolonged, or the space is too small or acoustically inappropriate for the size of the ensemble, or if electronic amplification is involved.

Sound-level meter readings confirm the obvious. In an overall sense, groups of strings produce less sound than groups of woodwinds, brass, or percussion. Normal or average sound levels from various ensemble configurations vary according to their distribution of instruments and the length of time various instrumental combinations normally play.

In both solo and ensemble settings, choices associated with sound levels clearly matter. A one-hour ensemble experience with several minutes of high volume may carry less risk than continuous high volume exposure in hours of solo practice or listening to an MP3 player for extended periods. Days spent with continuous exposure to high levels of sound are risk-filled days indeed.

In music schools, music students normally participate several times each week in conducted or coached ensembles. This fact places an important item into ensemble rehearsal and performance planning: the cumulative effect of sound exposure when it reaches higher than safe dB levels. Planning choices include but are not limited to repertory, rehearsal sequences, repetition frequencies, durations of loudness, use of sound-level meters, dosimeters, or other scientific instruments for monitoring cumulative exposure.

Measuring Sound Levels Scientifically

Sound-level meters take authoritative scientific measurements. Known more formally as “exponentially integrating sound-level meters,” these devices convert sound waves into decibel readings. If properly calibrated, they can accurately measure sound levels between 30 to 130 decibels.

Attached to the shaft of the sound-level meter is a condenser microphone. Using a series of filters, amplifiers, and integrators, the meter converts the microphone’s output into a single sound-pressure measurement, which is displayed on the meter’s screen.

Because sound-level meters utilize directional microphones, they are most accurate when pointed in the direction of the noise source. For the measurement of ambient noise sources, the placement of the microphone is less important, and the user may wish to place the device in a central location.

An alternative to the standard sound-level meter is the noise dosimeter, or personal sound exposure meter, a device used regularly in many settings to measure exposure/risk relationships. Worn on a person’s body, its accuracy is somewhat compromised by the acoustical presence of the individual wearing it.

Sound-level meters and dosimeters range in price from \$20 to \$2000 dollars (in 2011). Most acousticians recommend using devices that meet American National Standards Institute (ANSI) specifications.

Measuring devices continue to improve along with the general scientific and technological advance, and purchasing programs are advised to factor this evolution into their plans.

Basic Protection for Musicians

On stage and in life, it is important for musicians to take steps to protect their hearing. Sometimes, however, it is not possible or preferable to completely avoid a loud sound or noisy environment. At these times, musicians and music faculty may wish to explore the following methods of hearing protection:

- Earplugs – often made of foam or silicone; designed to be inserted into the wearer’s ear canal to protect against loud noise; some designed specifically for music applications.
- Earmuffs – often consist of two protective foam pads connected by a headband or strap; designed to cover the wearer’s ears and protect against loud noise
- Acoustical sound shields – generally made of clear plexi-glass or similar material; used to isolate and redirect the noise from a particular instrument or section of a band, orchestra, or ensemble; protects the hearing of musicians directly in front of the shielded instrument or section

Musicians often find that hearing protectors are not comfortable or that they create perceptual changes, even causing users to increase sound-intensity levels to compensate. One solution is to reduce the “average” sound-level exposure in rehearsals by making balanced repertory choices and giving greater attention to dynamic levels, especially in large or amplified ensembles. See Musicians and Risk of Noise-Induced Hearing Loss and Solo and Ensemble.

Protection also comes from regular behaviors such as:

- Avoiding situations likely to pose a danger to hearing health.
- Refraining from certain activities that can endanger hearing mechanisms.
- Maintaining a safe distance from sources of loud noise.
- At loud concerts, sitting or standing a “safe” distance from the stage and from speakers or other amplification devices.
- Keeping MP3 players and other listening devices at “safe” volume levels. MP3 players need special attention. Normally, MP3 players generate about 85 dB at one-third of their maximum volume, 94 dB at half volume, and 100 dB or more at full volume. Translated into daily exposure time, according to NIOSH standards, 85 dB equals 8 hours; 94 dB, 1 hour; and 100 dB, 15 minutes. These numbers assume that an individual is not exposed to any other noise beyond 85 dB during the day.
- Taking care with in-ear monitors, a device that has grown in popularity among musicians, especially in certain types of professional ensembles. These monitors can produce dangerously high sound levels. Musicians should see an audiologist or other qualified professional for a demonstration of safe practices before using an in-ear monitor for the first time and use the device in a manner that protects their hearing health.
- Developing a sense of the extent to which daily exposure has exceeded safe volume levels and durations (see Noise Levels and Risk and Exposure Times and Risk.)
- Taking breaks from exposure to elevated noise levels. (Enjoying quiet time.) See also Note 1 in the section *Exposure Times and Risk*.

Basics Music Professionals Need to Know and Be Able to Do

- Understand and share with others the risks inherent in excessive high-decibel sound exposure, including the risk of permanent hearing damage.
- Recognize that music can be a sound source capable of causing noise-induced hearing loss.
- Maintain familiarity and currency with health and safety codes and with standards and procedures related to noise exposure.
- Make practical assessments of sound levels.
- Apply hearing health knowledge in specific musical contexts, such as performance, production, education, competition, and listening.

Students need to gain these knowledge and skills during the course of their studies and preferably as soon as possible.

Part II. Considerations for Faculty and Staff

Please find below a number of ways you can promote hearing health in your faculty or staff role.

Hearing Health in Music Classrooms, Studios, Rehearsals, and Other Spaces

- Help students understand the importance of hearing health and their responsibility for acting responsibly.
- As a teacher or conductor, you have a significant role in maintaining volume levels in the classroom that do not exceed reasonable levels, especially for long periods. If you are concerned about volume levels in your classroom or rehearsal space related to either room size or construction or to class enrollment, notify an administrator. Large ensembles may not always need to rehearse at full volume.
- Monitor sound levels in your classroom and rehearsal and performance spaces by utilizing available tools, such as a sound-level meter, especially if there is a reasonable chance that sound levels are high for long periods.
- Provide breaks for your students during rehearsal. This “quiet time” is beneficial to both their ability to concentrate and to their hearing health.
- If appropriate, speak with students and administrators about protective devices such as earplugs and sound shields.
- If you suspect that a student is having difficulty hearing (or if he or she reports such a difficulty), refer the student to the appropriate student health personnel at the institution. Your advice *must not* take the place of that of a licensed medical professional. Acting in this capacity exposes you to potential liability.

Ideas and Recommendations for Music Schools and Departments

Here are some ideas, courtesy of other institutions, schools of music, and departments:

- Institute a hearing health awareness policy within the music school or department.
- Establish a mechanism for addressing concerns related to issues of hearing health for faculty, staff, and students.
- Invest in a sound-level dosimeter or other sound-level meter or appropriate sound measuring tool. From time to time, measure sound levels in instructional and performance spaces to ensure that they remain within acceptable levels.
- Consider limiting the size of rehearsal groups, or utilizing a larger space when conducting rehearsals. When appropriate, move marching band or pep band rehearsals outside to a sports field or other open space. Remember: the smaller the rehearsal or performance space, the more concentrated the sound.
- Line problematic rehearsal spaces with heavy drapes to help absorb sound.

- Apply carpet to the floors of problematic rehearsal rooms to help absorb sound.
- Place acoustical shields in front of the brass and percussion sections to protect the hearing of the musicians directly in front of these sections.
- Consider making performance-grade earplugs available to students, either on a complimentary basis or for purchase.
- Place treble brass musicians on risers. This way, higher frequency sound waves, such as those played by a trumpet player, will go over the heads of the musicians in the sections in front of them.
- Elevate loudspeakers to near ear level so that they provide musicians with better sound quality at lower levels of intensity.
- Place instrumental groups back from the lip or edge of the stage to achieve optimal acoustics in the audience.

Conclusion

As educators, you and your colleagues are tasked with preparing the next generation of musicians. Some may go on to play professionally, others may decide to teach, and still others will embrace music as a life-long hobby. Whatever their future aspirations, students' hearing health is vital to their success as musicians and to their overall happiness.

Hearing health is essential, too, for faculty and staff engaged in playing and teaching music.

Certain behaviors and exposure to certain sounds can, over time, damage hearing. It is important to understand and avoid those risk factors that can compromise hearing ability.

With this document, we hope we have been able to shed some light on a very important issue and perhaps inspired you to take steps in various aspects of your own work.

Resources – Information and Research

NASM-PAMA Resource Documents and Orientation Materials

Information and Recommendations for Administrators and Faculty in Schools of Music

Protect Your Hearing Every Day: Information and Recommendations for Student Musicians

A Sample Order and Script for Music Student Orientation

Standard Version

Version for Customization

Student Text Version of the Orientation Script

Standard Version

Version for Customization

Protecting Your Hearing Health: Student Information Sheet on Noise-Induced Hearing Loss

Standard Version

Version for Customization

Hearing Health Project Partners

National Association of School of Music (NASM)

<http://nasm.arts-accredit.org/>

Performing Arts Medicine Association (PAMA)

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An Acoustics Primer for Music Spaces (Wenger Corporation)

<http://www.wengercorp.com/Lit/Wenger%20Acoustics%20Primer.pdf>

Health and Safety Standards Organizations

American National Standards Institute (ANSI)
(<http://www.ansi.org/>)

The National Institute for Occupational Safety and Health (NIOSH)
(<http://www.cdc.gov/niosh/>)

Occupational Safety and Health Administration (OSHA)
(<http://www.osha.gov/>)

Medical Organizations Focused on Hearing Health

American Academy of Audiology
(<http://www.audiology.org/Pages/default.aspx>)

American Academy of Otolaryngology – Head and Neck Surgery
(<http://www.entnet.org/index.cfm>)

American Speech-Language-Hearing Association (ASHA)
(<http://www.asha.org/>)

Athletes and the Arts
(<http://athletesandthearts.com/>)

House Research Institute – Hearing Health
(<http://www.hei.org/education/health/health.htm>)

National Institute on Deafness and Other Communication Disorders –
Noise-Induced Hearing Loss
(<http://www.nidcd.nih.gov/health/hearing/noise.html>)

Other Organizations Focused on Hearing Health

Dangerous Decibels
(<http://www.dangerousdecibels.org>)

National Hearing Conservation Association
(<http://www.hearingconservation.org/>)



Protect Your Hearing Every Day

Information and Recommendations for Student Musicians

Standard Version

**National Association of Schools of Music
Performing Arts Medicine Association**

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Protect Your Hearing Every Day

Introduction

In working toward a degree in music, you are joining a profession with a long and honored history. Part of the role of any professional is to remain in the best condition to practice the profession.

For all of you, as aspiring musicians, this involves safeguarding your hearing health. Whatever your plans after graduation – whether they involve playing, teaching, engineering, or simply enjoying music – you owe it to yourself and your fellow musicians to do all you can to protect your hearing.

As you may know, certain behaviors and your exposure to certain sounds can, over time, damage your hearing.

You may be young now, but you're never too young for the onset of hearing loss. In fact, in most cases, noise-related hearing loss doesn't develop overnight. (Well, some does, but we'll address that issue later in this document.) But the majority of noise-induced hearing loss happens gradually.

So the next time you find yourself blasting music through those tiny earbuds of your iPod or turning up the volume on your amp, ask yourself, "Am I going to regret this someday?" You never know; you just might. And as a musician, you cannot afford to risk it.

The bottom line is this: If you're serious about pursuing a career in music, you need to protect your hearing. The way you hear music, the way you recognize and differentiate pitch, the way you play music; all are directly connected to your hearing. Do yourself a favor: protect it. I promise you won't regret it.

Disclaimer

The information in this document is generic and advisory in nature. It is not a substitute for professional, medical judgments. It should not be used as a basis for medical treatment. If you are concerned about your hearing or think you may have suffered hearing loss, consult a licensed medical professional.

Purpose of this Resource Document

The purpose of this document is to share with you some information on hearing health and hearing loss and let you know about the precautionary measures that all of us should practice daily.

Music and Noise

This paper addresses what is termed “noise-induced” hearing loss. You may be wondering why we’re referring to music—this beautiful form of art and self-expression—as “noise.”

Here’s why: What we know about hearing health comes from medical research and practice. Both are based in science where “noise” is a general term for sound. Music is simply one kind of sound. Obviously, there are thousands of others. In science-based work, all types of sound, including music, are regularly categorized as different types of **noise**.

Terminology aside, it’s important to remember this fundamental point: A sound that is too loud, or too loud for too long, is dangerous to hearing health, no matter what kind of sound it is or whether we call it noise, music, or something else.

Music itself is not the issue. Loudness and its duration are the issues. Music plays an important part in hearing health, but hearing health is far larger than music.

All of us, as musicians, are responsible for our art. We need to cultivate a positive relationship between music and our hearing health. Balance, as in so many things, is an important part of this relationship.

Noise-Induced Permanent Hearing Loss

Let’s first turn to what specialists refer to as “noise-induced permanent hearing loss.”

The ear is made up of three sections, the outer, middle, and inner ear. Sounds must pass through all three sections before signals are sent to the brain.

Here’s the simple explanation of how we experience sound:

Sound, in the form of sound waves, enters the outer ear. These waves travel through the bones of the middle ear. When they arrive in the inner ear, they are converted into electrical signals that travel via neural passages to the brain. It is then that you experience “hearing” the sound.

Now, when a **loud** noise enters the ear, it poses a risk to the ear’s inner workings.

For instance, a very loud sound, an explosion, for example, or a shotgun going off at close range, can actually dislodge the tiny bones in the middle ear, causing conductive hearing loss, which involves a reduction in the sound level experienced by the listener and a reduction in the listener’s ability to hear faint sounds. In many cases, this damage can be repaired with surgery. But loud noises like this are also likely to send excessive sound levels into the inner ear, where permanent hearing damage occurs.

The inner ear, also known as the **cochlea**, is where most hearing-loss-related ear damage tends to occur. Inside the cochlea are tiny hair cells that are responsible for transmitting sound waves to the brain. When a loud noise enters the inner ear, it can damage the hair cells, thus impairing their ability to send neural impulses to the brain.

The severity of a person’s noise-induced hearing loss depends on the severity of the damage to these hair cells. The extent of the damage to these cells is normally related to the **length and frequency** of a person’s exposure to loud sounds **over long periods of time**.

Because noise-induced hearing loss is painless, you may not realize that it's happening at first. Then suddenly one day you will realize that you're having more and more trouble hearing high frequency sounds – the ones that are the most high-pitched. If you don't start to take precautions then, your hearing loss may eventually also affect your ability to perceive both speech sounds and music.

It is very important to understand that these hair cells in your inner ear cannot regenerate. Any damage done to them is permanent. At this time, there is simply no way to repair or undo the damage.

***FACT:** According to the American Academy of Audiology, approximately 36 million Americans have hearing loss. One in three developed their hearing loss as a result of exposure to noise.*

Noise-Induced Temporary Hearing Loss

Now it's also important to note that not all noise-induced hearing loss is necessarily permanent. Sometimes, after continuous, prolonged exposure to a loud noise, we may experience what's called "noise-induced temporary hearing loss."

During temporary hearing loss, known as **Temporary Threshold Shift (TTS)**, hearing ability is reduced. Outside noises may sound fuzzy or muted. Normally, this lasts no more than 16 to 18 hours, at which point your hearing levels will return to normal.

Often during this Temporary Threshold Shift, people will experience tinnitus, a medical condition characterized by a ringing, buzzing, or roaring in the ears. Tinnitus may last only a few minutes, but it can also span several hours, or, in extreme instances, last indefinitely.

Also, if you experience a series of temporary hearing losses, you may be well on the way to permanent damage sometime in the future.

Noise Levels and Risk

Now, how do you know when a noise or sound is too loud—when it's a threat to your hearing health? Most experts agree that prolonged exposure to any noise or sound over **85 decibels** can cause hearing loss. You may have seen decibels abbreviated "dB." They are the units we use to measure the intensity of a sound.

Two important things to remember:

1. The longer you are exposed to a loud noise, the greater the potential for hearing loss.
2. The closer you are to the source of a loud noise, the greater the risk that you'll experience some damage to your hearing mechanisms.

At this point, it helps to have some frame of reference. How loud are certain noises?

Consider these common sounds, their corresponding decibel levels, and the recommended maximum exposure times established by the National Institute for Occupational Safety and Health (NIOSH), a branch of the Centers for Disease Control and Prevention (CDC).

| Sound | Intensity (dB) | Maximum Recommended Exposure (approx.)* |
|-------------------------------------|----------------|---|
| A Whisper | 30 | Safe, No maximum |
| Rainfall (moderate) | 50 | Safe, No maximum |
| Conversation (average) | 60 | Safe, No maximum |
| Freeway Traffic | 70 | Safe, No maximum |
| Alarm Clock | 80 | Safe, No maximum |
| | 85 | Potential Damage Threshold |
| Blender, Blow-dryer | 90 | 2 hours |
| MP3 Player (full volume), Lawnmower | 100 | 15 minutes |
| Rock Concerts, Power Tools | 110 | 2 minutes |
| Jet Plane at Takeoff | 120 | Unsafe, Immediate risk |
| Sirens, Jackhammers | 130 | Unsafe, Immediate risk |
| Gunshots, Fireworks (close range) | 140 | Unsafe, Immediate risk |

*NIOSH-recommended exposure limits

You can listen to sounds under 85 dB for as long as you like. There is no risk involved, well, except for the risk of annoyance. But seriously, for sounds in this lower decibel range, listening to them for hours on end does not pose any real risk to your hearing health.

85 dB is the magic number. Sounds above the **85 dB threshold** pose a potential threat to your hearing when you exceed the maximum recommended exposure time.

MP3 players at full volume, lawnmowers, and snowblowers come in at 100 dB. The recommended maximum exposure time for these items is 15 minutes.

Now, before you get too worried and give up mowing the lawn, remember, there are ways to reduce your exposure.

For instance, turn down the volume on your MP3 player. Did you know that normally, MP3 players generate about 85 dB at one-third of their maximum volume, 94 dB at half volume, and 100 dB or more at full volume? Translated into daily exposure time, according to NIOSH standards, 85 dB equals 8 hours, 94 dB equals 1 hour, and 100 dB equals 15 minutes. Do yourself a favor, and be mindful of your volume.

Also, remember to wear a pair of earplugs or earmuffs when you mow the lawn or when you use a snowblower.

When you're dealing with sounds that produce between 120 and 140 dB, you're putting yourself at risk for almost immediate damage. At these levels, it is imperative that you utilize protective ear-coverings. Better yet, if it's appropriate, avoid your exposure to these sounds altogether.

FACT: More than 30 million Americans expose themselves to hazardous sound levels on a regular basis.

Musicians and Noise-Induced Hearing Loss

Nowadays, more and more is being written about the sound levels of certain musical groups. It's no secret that many rock concerts expose performers and audiences to dangerously high levels of noise. The ringing in your ears after a blaring rock concert can tell you that. But now professional and college music ensembles are under similar scrutiny.

It's true that musicians are exposed to elevated levels of sound when they rehearse and perform music. But that doesn't equal automatic risk for hearing loss.

Take for instance a typical practice session on the piano. When taken at close range to the instrument over a limited period of time, a sound level meter fluctuates between a reading of 60 and 70 decibels. That's similar in intensity to your average conversation (60dB). There will, of course, be moments when the music peaks and this level rises. But these moments are not sustained over several hours. At least not under normal practice conditions.

While the same is true for most instruments, it is important to understand that certain instrumental sections tend to produce higher sound levels. Sometimes these levels relate to the piece of music being performed and to notational requirements (*pianissimo*, *fortissimo*); other times, these levels are what naturally resonate from the instrument.

For example, string sections tend to produce decibel levels on the lower end of the spectrum, while brass, percussion, and woodwind sections generally produce decibel levels at the higher end of the spectrum.

What's important is that you are mindful of the overall volume of your instrument and of those around you. If you're concerned about volume levels, share your concerns with your instructor.

FACT: *Approximately 50% of musicians have experienced some degree of hearing loss.*

Mindful Listening

Now, let's talk about how you can be proactive when it comes to music and hearing loss.

It's important to think about the impact noise can have on your hearing health when you:

1. Attend concerts;
2. Play your instrument;
3. Adjust the volume of your car stereo;
4. Listen to your radio, CD player, and MP3 player.

Here are some simple ways to test if the music is too loud:

It's too loud (and too dangerous) when:

1. You have to raise your voice to be heard.
2. You can't hear someone who's 3 feet away from you.
3. The speech around you sounds muffled or dull after you leave a noisy area.
4. You experience tinnitus (pain, ringing, buzzing, or roaring in your ears) after you leave a noisy area.

Evaluating Your Risk for Hearing Loss

When evaluating your risk for hearing loss, ask yourself the following questions:

1. How frequently am I exposed to noises and sounds above 85 decibels?
2. What can I do to limit my exposure to such loud noises and sounds?
3. What personal behaviors and practices increase my risk of hearing loss?
4. How can I be proactive in protecting my hearing and the hearing of those around me?

Basic Protection for Musicians

As musicians, it's vital that you protect your hearing whenever possible.

Here are some simple ways to reduce your risk of hearing loss:

1. When possible, avoid situations that put your hearing health at risk.
2. Refrain from behaviors which could compromise your hearing health and the health of others.
3. If you're planning to be in a noisy environment for any significant amount of time, try to maintain a reasonable distance from the source of the sound or noise. In other words, there's no harm in enjoying a fireworks display, so long as you're far away from the launch point.
4. When attending loud concerts, be mindful of the location of your seats. Try to avoid sitting or standing too close to the stage or to the speakers, and use earplugs.
5. Keep the volume of your music and your listening devices at a safe level.
6. Remember to take breaks during a rehearsal. Your ears will appreciate this quiet time.
7. Use earplugs or other protective devices in noisy environments and when using noisy equipment.

Future Steps

Now that you've learned about the basics of hearing health and hearing loss prevention, we encourage you to keep learning. Do your own research. Browse through the links provided at the end of this document. There's a wealth of information out there, and it's yours to discover.

Conclusion

We hope this resource document has made you think more carefully about your own hearing health. Just remember that all the knowledge in the world is no match for personal responsibility. We've given you the knowledge and the tools; now it's your turn. You are responsible for your exposure to all sorts of sounds, including music. Your day-to-day decisions have a great impact on your hearing health, both now and years from now.

Do yourself a favor. Be smart. Protect your precious commodity. Protect your hearing ability.

Resources – Information and Research

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The National Institute for Occupational Safety and Health (NIOSH)

(<http://www.cdc.gov/niosh/>)

Occupational Safety and Health Administration (OSHA)

(<http://www.osha.gov/>)

Medical Organizations Focused on Hearing Health

American Academy of Audiology

(<http://www.audiology.org/Pages/default.aspx>)

American Academy of Otolaryngology – Head and Neck Surgery

(<http://www.entnet.org/index.cfm>)

American Speech-Language-Hearing Association (ASHA)
(<http://www.asha.org/>)

Athletes and the Arts
(<http://athletesandthearts.com/>)

House Research Institute – Hearing Health
(<http://www.hei.org/education/health/health.htm>)

National Institute on Deafness and Other Communication Disorders –
Noise-Induced Hearing Loss
(<http://www.nidcd.nih.gov/health/hearing/noise.html>)

Other Organizations Focused on Hearing Health

Dangerous Decibels
(<http://www.dangerousdecibels.org>)

National Hearing Conservation Association
(<http://www.hearingconservation.org/>)



Protecting Your Hearing Health

Student Information Sheet on Noise-Induced Hearing Loss

Standard Version

**National Association of Schools of Music
Performing Arts Medicine Association**

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Protecting Your Hearing Health

An NASM – PAMA

Student Information Sheet on Noise-Induced Hearing Loss

- **Hearing health is essential to your lifelong success as a musician.**
- **Your hearing can be permanently damaged by loud sounds**, including music. Technically, this is called Noise-Induced Hearing Loss (NIHL). Such danger is constant.
- **Noise-induced hearing loss is generally preventable.** You must avoid overexposure to loud sounds, especially for long periods of time.
- The closer you are to the source of a loud sound, the greater the risk of damage to your hearing mechanisms.
- Sounds over 85 dB (your typical vacuum cleaner) in intensity pose the greatest risk to your hearing.
- Risk of hearing loss is based on a combination of sound or loudness intensity and duration.
- Recommended maximum daily exposure times (NIOSH) to sounds at or above 85 dB are as follows:
 - 85 dB (vacuum cleaner, MP3 player at 1/3 volume) – 8 hours
 - 90 dB (blender, hair dryer) – 2 hours
 - 94 dB (MP3 player at 1/2 volume) – 1 hour
 - 100 dB (MP3 player at full volume, lawnmower) – 15 minutes
 - 110 dB (rock concert, power tools) – 2 minutes
 - 120 dB (jet planes at take-off) – without ear protection, sound damage is almost immediate
- Certain behaviors (controlling volume levels in practice and rehearsal, avoiding noisy environments, turning down the volume) reduce your risk of hearing loss. Be mindful of those MP3 earbuds. See chart above.
- The use of earplugs and earmuffs helps to protect your hearing health.
- Day-to-day decisions can impact your hearing health, both now and in the future. Since sound exposure occurs in and out of school, you also need to learn more and take care of your own hearing health on a daily, even hourly basis.
- It is important to follow basic hearing health guidelines.
- It is also important to study this issue and learn more.
- If you are concerned about your personal hearing health, talk with a medical professional.
- If you are concerned about your hearing health in relationship to your program of study, consult the appropriate contact person at your institution.
- This information is provided by the National Association of Schools of Music (NASM) and the Performing Arts Medicine Association (PAMA). For more information, check out the other NASM-PAMA hearing health documents, located on the NASM Web site at the URL linked below.
http://nasm.arts-accredit.org/index.jsp?page=NASM-PAMA_Hearing_Health