

Health and Safety in Music at Five Towns College

Five Towns College puts the highest priority on the physical and emotional health of our student body, our faculty and our staff. In accordance with the National Association of Schools of Music, we seek to inform students, faculty and staff of all potential hazards, health or safety issues that might arise due to activities relevant to the study of music. The information provided below seeks to inform all students, faculty and staff of reasonable guidelines to insure avoidance of injury and illness related to all educational activities at the college.

We seek to raise awareness for our students, faculty and staff as to the connections between any intensive studies and/or work at the college and conditions that could arise from those activities. This includes any possible issues involving listening, participation, or attendance at performances, independent personal or ensemble practice, all manners of teaching, and general involvement in music and the related areas of specialty and study. This includes but is not limited to information regarding hearing, vocal and physical health, injury prevention, and the proper operation and handling of any campus materials, equipment or technology.

The following information is defined to inform all participating parties of risks involved in the performance and practice of music. The policies stated do not in any way replace personal responsibility in the assumption of risks or shift blame for personal injuries, poor judgment, or reckless behavior to Five Towns College. Five Towns College seeks to indemnify itself from assumption of responsibility for any individual risks as stated below that are beyond the control of the college.

- All intensive activity in any field incurs a level of risk. Musicians, both instrumental and vocal have the potential to suffer injury related to that activity. Such injuries could include but are not limited to repetitive motion injuries, carpal tunnel syndrome, tendinitis, laryngitis or vocal nodes. Lack of proper judgement such as inattention to overuse, force, poor technique, fatigue and general illness or poor health can contribute greatly to pain and disability and in the worst cases cause permanent damage to the performer.
- All sources of authority on the health and wellness of performers recommend a reasonable life style and efforts to remain in good condition. Maintain good general health through proper rest, exercise, diet and hydration. Avoid smoking, drinking and drug use that may impair both physical abilities and judgement. Pay special attention to technical elements and pacing to avoid over work and taxing the student /performer beyond their current abilities. Schedule ample time for breaks and reflection on the activities performed. Most importantly, do not ignore symptoms of distress or fatigue, and avoid practice or performance when the body is clearly taxed beyond what is a reasonable amount of physical or emotional stress. Know your own limitations, and seek to improve and grow by gentle challenges; - do not attempt to perform or practice beyond your current abilities.

- Evaluate how life activities could contribute to physical fatigue that will limit your practice and performance abilities. Over use of cell phones and computers, extensive driving, shouting, exposure to artificial environments or allergens could compound challenges with health and injury. When symptoms persist beyond a reasonable amount of time, seek professional assistance, possibly including the assistance of a medical professional.
- Creative individuals tend to be more sensitive to mental wellness issues and serious musicians are no strangers to mental and physical stress. Be aware that these higher levels of stress and anxiety can contribute to a greater risk of depression and other mental illnesses. Any concerns or issues should be brought to the attention of a medical professional as well as the college counselor. All college officials and employees are available to direct those needing assistance with such issues.
- Actively work to avoid hearing loss. Professional musicians are at particular risk for hearing loss in practice, performance and the activities involved in daily life. Take the risk of permanent hearing loss seriously, and limit the exposure to excessively loud, excessively long noises exceeding 85 dB. Use earplugs when necessary and avoid situations where amplified music or sound is excessive. Take care to adjust levels on personal devices in addition to care taken in practice, ensembles and amplified performance. Five Towns College noise samples from a variety of ensembles, classrooms, spaces and events have been consistently monitored within the safe limit of 80dB.
- Use care when operating and moving equipment. Risk of lifting injury and burns are a concern when working with Audio or Theater equipment in our environment. Reasonable caution and insuring a proper knowledge of the safe use of any item is essential in avoiding injury and damage. Always use safe lifting and carrying techniques when moving any equipment, and err on the side of caution. If you think an item is too heavy, wait for assistance.

Five Towns College takes the health and safety of all members of our community very seriously and trusts that all students, faculty and staff understand their own personal responsibility in choices relating to their own health. Participation in any activities on campus or related to the school in any way, assumes that all individuals will act reasonably and rationally in the preservation of the well-being of all involved in any stated activities. As Five Towns College has no control of factors involved in personal judgment, it can thereby not be responsible for safety issues beyond the control of the college.

Any concerns about wellness or environmental issues are welcome and should be brought to the attention of the department chair or any college official for remediation. Additionally, faculty and staff are referred to these documents: (1) Basic Information on Neuromusculoskeletal and Vocal Health: Information and Recommendations for Faculty and Staff in Schools of Music – NASM/PAMA: July 2013 DRAFT; and (2) Basic Information on Hearing Health: Information

and Recommendations for Faculty and Staff in Schools of Music – NASM/PAMA: November 2011.

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

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Basic Information on Neuromusculoskeletal and Vocal 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 neuromusculoskeletal and vocal health issues for postsecondary schools and departments of music.

This document provides a comprehensive overview for faculty and staff.

It is oriented toward decision-making about neuromusculoskeletal and vocal 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

- [Neuromusculoskeletal and Vocal Health: The Basic Issues](#)
- [Contributing Factors](#)
- [Neuromusculoskeletal Issues Affecting the Body](#)
- [Neuromusculoskeletal Issues Affecting the Voice](#)
- [Neuromusculoskeletal and Vocal Health in Music Classrooms, Studios, Rehearsals, and Other Spaces](#)

1. Organizations

NASM, founded in 1924, is an organization of schools, conservatories, colleges and universities with approximately 640 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 composed of dedicated medical professionals, artists, educators, and administrators with the common goal of improving the healthcare of the performing artist. PAMA members are professionals in fields that include research, education, and clinical practice, and 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 neuromusculoskeletal and vocal 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 neuromusculoskeletal and/or vocal 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.
 - does not serve 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 cannot 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 neuromusculoskeletal and vocal health and institutional actions taken under their influence or independently do not relieve the individual from personal responsibility for appropriate, prudent, and safe behavior or action, nor do they shift such responsibility and liability for the consequences of inappropriate, imprudent, and/or unsafe behavior or action 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 and NASM 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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DRAFT

Part I. Neuromusculoskeletal and Vocal Health Facts and Concepts

Neuromusculoskeletal and Vocal Health: The Basic Issues

The human neuromusculoskeletal system is comprised of the nervous system, the muscular system, and the skeletal system. Together, these systems support the body's physical structure and enable movement.

In these resource documents, the term “neuromusculoskeletal” is used to encompass not only overt physical movements (the pressing of a key, the strumming of a string), but also the small internal movements our bodies make, for example to produce breath and modify vocal sounds.

Therefore, vocal health is referred to as a component of neuromusculoskeletal health within these documents. When the term “neuromusculoskeletal” is used, vocal health is included. Direct references to vocal health – for singers, instrumentalists, and future music teachers alike – are interspersed throughout the text. Special attention is devoted to issues of vocal health in the sections neuromusculoskeletal issues affecting the voice and vocal protection.

Good health and healthy behaviors are important to all musicians, regardless of instrument and area of specialization.

For example, although singers are usually provided with more detailed information during their voice studies, basic overview understanding of vocal health is essential for all musicians. All use their voice in speaking, and many are engaged with the singing voice in their roles as conductors, coaches, teachers, recording engineers, researchers, therapists, and so forth.

The various neuromusculoskeletal and vocal disorders that affect musicians have many varied contributing factors. Some may be genetic in nature or result from an infection. Others may be the result of trauma or injury. Still others are related to certain behaviors, either in isolation or those that are repeated over time.

Musicians coping with or developing certain neuromusculoskeletal conditions, complications, or disorders may find that they have a negative impact on their ability to play, sing, and practice music.

Preventative measures need to be taken by individual musicians and institutions where musicians study and work. These may include, but are not limited to the provision of information, applications of information in decision-making and culture building, and modifications to the musician-instrument interface.

Purpose of this Web Resource

This web resource is focused on neuromusculoskeletal health, on neuromusculoskeletal disorders related to the musician's body and voice, on preventative measures, and on how schools and departments of music can work appropriately and comprehensively with associated medical, educational, 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 neuromusculoskeletal and vocal health.

The first essential is information about neuromusculoskeletal and vocal health 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 neuromusculoskeletal and vocal health and that of other musicians with whom they work.

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

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

To be successful, a comprehensive neuromusculoskeletal and vocal 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 neuromusculoskeletal and vocal health with a particular focus on minimizing conditions that could contribute to singing and playing-related neuromusculoskeletal disorders.

Basic Facts

Music, the Musician, and Neuromusculoskeletal Health

For serious musicians, especially those studying, singing, and playing music at advanced levels, “days off” are few and far between.

A musician’s practice routine is often physically demanding and time-intensive.

Certain musicians, at some point in their careers, may develop one or more neuromusculoskeletal conditions, complications, or disorders related to their work as a musician.

Decisions about practice and performance play an important part in the neuromusculoskeletal health of musicians, but numerous factors contribute to an individual’s neuromusculoskeletal fitness.

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

Cultivating the most positive personal and professional relationships between musical performance and neuromusculoskeletal 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.

The Neuromusculoskeletal System

The musculoskeletal system is a complex system of muscles, tendons, ligaments, bones, joints, and associated tissues that move the body, allow for speech, and that help the human body to maintain its form.

The term “neuromusculoskeletal” expands upon “musculoskeletal” to include the nervous system.

The nervous system coordinates voluntary and involuntary actions and transmits signals to different parts of the body.

The nervous system is comprised of the central nervous system (CNS) and the peripheral nervous system (PNS). The central nervous system includes brain and spinal cord. The peripheral nervous system is made up primarily of nerves, which allow the central nervous system to communicate with the rest of the body.

Vocal Anatomy

The human voice is produced by four component systems. These are often referred to as the “generator,” the “vibrator,” the “resonator,” and the “articulator.”

The “generator” is the breath provided by the lungs. The principle muscle involved in breath is the diaphragm, a dome-shaped muscle that extends along the bottom of the rib cage. The diaphragm is assisted by various muscles in the abdomen, ribs, chest, and back.

The “vibrator” is the larynx, commonly referred to as “the voice box.” Horizontally stretched across the larynx are two infoldings of mucous membrane called vocal folds, or more frequently “vocal cords.” When breath regulated by the generator passes along the vocal folds, vibrations occur.

The “resonator” is the resonating cavity above the larynx that is responsible for giving the voice its tonal quality. This resonating cavity includes the vocal tract, much of the pharynx (the throat), the oral cavity, and the nasal passages.

The “articulator” includes the tongue, lips, cheeks, teeth, and palate. These structures help to shape sounds into recognizable words and specific vocalizations.

These four component parts work together to produce human speech and singing.

Disorders of the Neuromusculoskeletal System

The causes and contributing factors of neuromusculoskeletal disorders vary, but they generally fall into the one of the following categories: (1) genetic or related to a pre-existing medical condition, (2) trauma- or injury-related, (3) behavior-related.

Common symptoms of neuromusculoskeletal disorders include pain, stiffness, aching, throbbing, cramping, and muscle weakness.

Some disorders may be permanent, while others may be temporary.

Those disorders that are temporary may respond well to rest and/or behavior modification.

Sustained behavior modification may lead to the elimination or reduction of certain symptoms or disorders.

Contributing Factors

The causes of behavior-related neuromusculoskeletal disorders are manifold. However, most fit into one of two basic categories or factors. They are: 1) overuse and/or misuse and 2) genetic factors.

1. Overuse/Misuse

The human body has certain physical limits. Exceeding these limits can often lead to injury. In the arts-medicine arena, “overuse” is defined as a practice or activity in which anatomically normal structures are used in a so-called normal manner, but to a degree that has exceeds their biological limits. Such overuse produces certain physical changes, often accompanied by corresponding symptoms or complaints. The degree of excessive activity needed to produce these results varies from person to person and seems to be related to a person’s individual anatomy and physiology.

Another key term in this category is misuse. “Misuse” is defined as a practice in which anatomically normal structures are used in an abnormal manner and/or to an excessive degree, sufficient to produce specific symptoms. Such improper use of these structures places certain bodily structures under stress.

Related to both overuse and misuse is abuse. Abuse should be considered as a causative or contributing factor when an activity is performed not only excessively (overuse) or improperly (misuse), but also in a conscious, willful manner. Such self-imposed abuse often produces deleterious physical effects. Under certain circumstances, both overuse and misuse can turn into abuse. A common example of abuse is “playing through the pain.” This abuse involves persisting in long intervals of practice or performance in the face of pain without appropriate rest breaks or activity modification. Some examples of vocal abuse in singers include repeated instances of singing too loudly or singing out of range. Abuse may also be the use of dangerous substances.

2. Genetic Factors

For instrumentalists, the most common genetic factor influencing behavior-related neuromusculoskeletal disorders is hypermobility. It is also known as joint hyperlaxity or the trait of being “double jointed.” Such instability of certain joints may predispose an individual to muscle pain syndromes and/or tendinitis, an inflammation of the tendon. (A tendon is a tough band of fibrous connective tissue that connects muscle to bone.)

Hypermobility joints possess a greater than normal range of motion. Individuals with hypermobile joints have the tendency to compensate for the instability of the joint by using more muscle tension when completing movements or tasks involving the joint. While this extra muscle tension allows for better control over certain movements, such tension can actually increase one’s risk of damaging or straining a muscle.

Individuals with hypermobile joints are generally advised to monitor and actively reduce the amount of tension that they carry in their muscles. Specific strengthening exercises can also help, and in some instances, people with hypermobile joints may be well served by external methods of joint support, such as small ring splints or tape.

Musicians and Risk Factors

Two facts are clear:

- Neuromusculoskeletal health is essential for musicians.
- Many behavior-related neuromusculoskeletal disorders are preventable.

Two conclusions are obvious:

- Musicians have basic neuromusculoskeletal health responsibilities
- Healthy neuromusculoskeletal behaviors are a critically important addition to the musician's portfolio of essential disciplines.

Constant attention is necessary, because in many cases neuromusculoskeletal damage develops gradually over time.

The severe or advanced symptoms of certain neuromusculoskeletal disorders may be career-ending for a musician.

Even if debilitating problems do not occur initially, career activity becomes increasingly difficult and finally impossible as neuromusculoskeletal disorders proceed to more advanced stages.

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

Musicians necessarily engage in repeated neuromusculoskeletal behaviors when they rehearse and perform. But such behaviors do not equal automatic risk of one or more neuromusculoskeletal disorders. There are many factors involved in benchmarking and determining the inherent physical risk.

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

A behavior is risky when it involves overuse, misuse, or abuse of certain bodily components, or if it fails to recognize and adapt to an individual's physical limitations, genetic or otherwise. A list of basics is provided in *Contributing Factors*.

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.

In all musical settings, a number of variables are interacting at the same time. These interactions are unique to specific settings and situations.

Four major variables influence a musician's risk for singing- and playing-related neuromusculoskeletal disorders. Some are intrinsic; others are extrinsic to the musician. Some may be modifiable; others, non-modifiable.

The four main categories of risk factors include:

1. *Intrinsic factors – non-modifiable.*

- a) *Gender.* Studies reveal a greater prevalence of problems in female than male instrumentalists. This seems to be related to the smaller average size of the female hand and fingers, as well as the relatively smaller bulk and cross-sectional dimensions of their muscles. On average, female muscle strength is 15% less than that of males.

With regard to vocal range, or the span of “musically useful” pitches that a singer can produce, female musicians tend to have higher ranges than their male counterparts.

- b) *Anatomy.* For instrumentalists, intrinsic factors such as height, hand size, lung capacity, and joint hypermobility may affect the ways students play certain instruments and, in some cases, may affect their choice of repertoire.

For singers, intrinsic factors include lung capacity, vocal range, tessitura, and timbre among others. These factors affect the assignment of voice type (bass, baritone, tenor, countertenor, contralto, mezzo-soprano, and soprano) and, as a result, the parts and songs that singers are expected and selected to sing.

Anatomy is unchangeable, so it is important to develop technique and an approach to playing and singing music that takes this situation into account.

2. *Intrinsic factors – modifiable.*

- a) *Stress and psychological health.* Musicians, like anyone else, are more susceptible to injuries, pain, etc. when under stress and/or depressed. Many of the neuromusculoskeletal problems for which musicians are at risk can, if they become chronic, contribute to a situation that may lead to depression. It is important for musicians to recognize the importance of their psychological health as a part of their overall physical health.

- b) *Motivation and effort.* Improving one’s muscle strength and endurance depends on motivation and consistent effort. Exercise and conditioning are important. In some instances, musicians may need to seek expert guidance from a physical therapist, vocal coach, or other specialist.

3. *Extrinsic factors – non-modifiable.*

- a) *The assigned musical repertoire.* Certain musical pieces pose particular physical and vocal challenges.

- b) *Venue.* Once selected, the space in which one is performing can make injury more or less likely. The acoustics, temperature, lighting, and seating all have an effect on a musician’s performance.

- c) *Instrument.* While instruments can be modified to some extent, some characteristics cannot be changed. The frequency of injuries is higher among players of those instruments requiring many repetitions of finger action, as well as instruments that must be held in difficult postures.

Players of large instruments have a greater prevalence of problems. Long arms are needed to hold and play the instrument. Hands must stretch wider to press strings, keys, or valves; this requires greater muscle tension and increased use of the smaller and weaker intrinsic hand muscles. Additionally, these instruments are more difficult to play quickly than smaller instruments because of the greater size and complexity of keywork and valve travel, or greater space between strings and fingerboard.

4. *Extrinsic factors - modifiable*

- a) *Time spent playing or singing.* Perhaps the single most important risk factor that musicians can manage is time: how much time one spends practicing, frequency and nature of rest breaks during practice sessions, how quickly one increases practice time when a major performance is approaching, and how one approaches more technically demanding passages.
- b) *Non-music-related activities.* An often-overlooked risk factor involves non-music-related activities, some of which can be sources of overuse or misuse.

Fitness and conditioning activities, including sports participation, may place excessive demands on the neuromusculoskeletal system if not monitored carefully by the participant.

Loud social events and those in which cigarette smoke or alcohol are in abundance pose a serious risk to vocal health.

Similarly, some forms of outside employment may also be physically or vocally demanding.

Neuromusculoskeletal Issues Affecting the Body

Muscle Pain

Whether one ascribes muscle pain to overuse, misuse, postural factors, tension, technical problems, or poor conditioning, the principal underlying cause of muscle pain is sore muscles.

Muscles that are fatigued become physically shortened. With continued use they are placed under greater tension, and this ultimately may lead to microscopic damage and disruption of the muscle fibers, a condition known as *muscle strain*.

Muscle contraction is a physical-chemical process. When the necessary chemical compounds are in short supply, muscles can no longer operate at optimal efficiency. Furthermore, muscle contraction produces lactic acid; when this substance accumulates in tissues, it minimizes the muscle's ability to continue efficient contractions.

Both of these consequences of excess muscle use will cause pain during and after the period of use. Once the period of activity is over, some of these side effects will correct themselves. In other instances, muscular pain will continue for variable periods of time.

Playing-related neuromusculoskeletal disorders in all age groups are more commonly seen in specific body locations. Paramount among these are the shoulders, neck, hands/fingers/wrists, and lower back.

Some of these locations are more common in specific instruments, e.g., thumb problems in clarinetists, lower back strain and pain in double bass players.

Neuropathies

“Neuropathy” is a general medical term that refers to diseases or malfunctions of the nerves. Neuropathies are classified according to the types or location of the affected nerves.

Focal neuropathy is neuropathy that is restricted to one nerve or group of nerves, or to a particular area of the body. Symptoms usually appear suddenly and can include pain; sensory disturbances, such as numbness, tingling, “pins and needles” sensations, burning, or even itching; and weakness. In the case of bodily extremities, the pain may occur at the site of a nerve compression or entrapment, which occurs when a nerve passes through a narrowed channel bounded by bone, fibrous bands, bulky muscles, or enlarged arteries on its way to or from its ultimate destination.

In other cases, the pain may be distributed anywhere along the course of the nerve. Muscle weakness and impaired dexterity are often later effects.

The three most commonly identified entrapment neuropathies include 1) carpal tunnel syndrome at the wrist, 2) ulnar neuropathy, and 3) thoracic outlet syndrome.

Carpal tunnel syndrome occurs when the median nerve, which runs from the forearm into the palm of the hand, becomes pressed or squeezed at the wrist. The carpal tunnel – a narrow, rigid passageway of ligament and bones at the base of the hand – contains the median nerve and several tendons. When irritated or strained, these tendons may swell and narrow the tunnel, compressing the median nerve. The result can be pain, weakness, or numbness in the hand and wrist that radiates up the arm. Causes are numerous and varied.

Ulnar neuropathy is a condition in which the ulnar nerve, which runs from the neck along the inside edge of the arm into the hand, becomes inflamed due to compression of the nerve. Symptoms include tingling, numbness, weakness, and pain, primarily along the elbow, the underside of the forearm, and along the wrist or inside edge of the hand. Compression of the ulnar nerve is often linked to repetitive wrist or elbow movements. For musicians, sustained elbow flexion, particularly among players of bowed instruments, has been known to contribute to this condition in some cases.

Thoracic outlet syndrome is a group of disorders that occur when the blood vessels or nerves in the thoracic outlet – the space between the collarbone and first rib, become compressed. Symptoms include pain in the neck and shoulder areas and numbness in fingers.

Dystonia

Dystonia is defined as a disorder of sustained muscular contractions, producing unwanted movements or abnormal postures. The cause of dystonia remains unclear.

Focal dystonia is dystonia that affects a particular area of the body. Because men are more likely to develop focal dystonia, it is hypothesized that genetic or hormonal factors may be involved. Additionally, repetitive movements, especially those that are painful, seem to trigger it.

In the instrumental musician, dystonia typically presents symptoms that are localized to the upper limb in keyboard, string, percussion, and woodwind players, and that involve the embouchure in brass and some woodwind players.

The right hand of keyboard players and the left hand of string instrumentalists are most commonly affected.

Neuromusculoskeletal Issues Affecting the Voice

The more common neurological voice disorders in the music student include phonatory instability, vocal strain, and vocal fold motion abnormalities.

Phonatory Instability

Phonation is the process by which air pressure generated by the lungs is converted into audible vibrations. A method of phonation called “voicing” occurs when air from the lungs passes along the vocal folds at the base of the larynx, causing them to vibrate.

Production of a tonal, pleasant voice with smooth changes in loudness and pitch depends upon the symmetrical shape and movement of the vocal folds.

Phonatory instability occurs when there is asymmetrical or irregular motion of the vocal folds that is superimposed on the vocal fold vibration. Phonatory instability often manifests itself as an unsteadiness, hoarseness, or roughness of voice. The condition can be short or long term.

Short-term causes of phonatory instability include fatigue, certain medications, drug use, and anxiety. These problems tend to resolve rapidly with removal of the cause, but remain if the causative agent fails to be eliminated.

Over-the-counter allergy medications, antidepressants, and high-caffeine drinks, which stimulate the nervous system, can cause vocal tremors, a form of phonatory instability.

Vocal Strain and Vocal Fold Abnormalities

Overuse of the voice, whether by singing or speaking, can produce vocal strain. Unlike playing an instrument, singers must be aware of problems singing at the extremes of vocal range, especially the upper end. Both duration and intensity of singing are as important as they are for instrumentalists.

Misuse activities can occur also; examples of this are attempting repertoire that is beyond the individual’s stage of vocal maturity and development, and improperly learning and practicing certain vocal styles, such as belting.

Prolonged overuse can, in some cases, lead to the development of nodules on the vocal folds. The nodules appear initially as soft, swollen spots on the vocal folds, but as vocal abuse continues, they transform into callous-like growths. Vocal nodules require specialized and prolonged treatment and rehabilitation and can be disastrous for singers.

Basic Protection for All Musicians

On stage and in life, it is important for musicians to take steps to protect their neuromusculoskeletal health. Musicians and music faculty whose playing-and singing-related behaviors make them susceptible to certain neuromusculoskeletal conditions and disorders may wish to explore the following methods of neuromusculoskeletal health protection:

- Warming up before practice and performance. As appropriate, engage in physical, vocal, and musical warm-up exercises. Mobilize muscles and joints in order to increase blood flow to those body parts that will be moving rapidly and frequently during the playing and performing of music. Lubricate your vocal folds.
- Taking a break from practice and rehearsal whenever possible. 5 minutes rest every half hour seems to be ideal.
- Limiting excessive practice time and stress. Set daily limits, and vary repertoire during practice sessions.
- Avoiding excessive repetition of difficult repertoire, especially if progress is slow.
- Avoiding repertoire that is beyond one's technical or physical reach.
- Refraining from sudden increases in practice times. Instead, try to reduce total practice time before juries, recitals, etc. in order to avoid "peaking" too early.
- Ensuring proper posture and technique. Learn to support both the instrument and the body by engaging bigger rather than smaller muscles. If appropriate, adapt the instrument or make use of external support mechanisms, such as shoulder rests, neck straps, and flute crutches. Singers, stand up straight with knees slightly bent.
- Maintaining good "mental hygiene." This includes getting adequate sleep, good nutrition, regular exercise, and spending time with friends and family. Refrain from hazardous or recreational drug use. Seek the help of a mental health professional when appropriate.
- Allowing for relaxation. Injuries are much less likely to occur in persons who are both physically and psychologically fit. Stress management is as important as practice management.

Vocal Protection

It is equally important for musicians to take steps to protect their vocal health. This holds true for all musicians, regardless of performance medium or area of specialization. Musicians may wish to explore the following methods of vocal health protection:

- Drinking plenty of water. The vocal folds need to be lubricated with a thin layer of mucus in order to vibrate efficiently. The best lubrication is achieved by drinking plenty of water. Aim to drink at least eight glasses of water a day.
- Avoiding and/or limiting consumption of caffeinated and alcoholic beverages, as they pull water out of your system and deplete the vocal folds of needed lubrication. If you choose to drink caffeine or alcohol, be sure to sufficiently increase your water intake.
- Not smoking. Smoking irritates and dries out the lining of the larynx. It contributes to decreased vocal quality, promotes reflux laryngitis, and increases the need for throat clearing and "smoker's cough." Smoking is also extremely detrimental to lung function, which can make breathing, speaking, and singing more difficult. Also, work to avoid exposure to secondhand smoke.

- Being mindful of antihistamine usage, which dries out the vocal tissues. Be sure to stay well hydrated if you are taking allergy medication. Certain other medications, both prescription and over-the-counter, may have a similar drying effect. When in doubt, check with your doctor and, if appropriate, ask about suitable alternatives.
- Avoiding dry air environments. Forced heat, air conditioners, and climates with low levels of environmental moisture can be hard on your vocal health. Consider using a humidifier at night to compensate for the dryness.
- Avoiding yelling or raising your voice unnecessarily.
- Avoiding throat clearing and voiced coughing.
- Using vocal amplification systems when available and appropriate.
- Resting your voice, especially if you are sick. Remember, it's important to give yourself adequate time to recover.

A Special Consideration – Marching Music

Marching music is an important part of many colleges and universities. It is usually connected with athletic programs and events. The marching musician must not only be able to play an instrument at a high level of skill, but do it while moving along a street or across an athletic field, often at rapid rates and with irregular movement patterns. Additional physical capabilities are necessary for this to be accomplished without danger. Marching musicians require high levels of physical conditioning, strength, and endurance; they must be in good general health and physically fit.

Additionally, training in marching music produces an additional litany of activity-related physical disorders that must be considered in any school's health program. Problems unique to marching music include lower extremity injuries such as sprained ankles, toe contusions, and knee strains. Carrying heavy instruments places a great physical demand on the neck, torso, lower back, and legs. Training usually occurs outside during the summer, sometimes in high heat and high humidity. Sunburn and dehydration can occur all too easily in the absence of preventative measures. Finally, marching units are usually much larger than most indoor ensembles, and their sound levels often exceed recommended levels, especially during long rehearsals. Times of rest and rehydration are vital for marching units.

Basics Music Professionals Need to Know and Be Able to Do

- Understand and share with others the risks inherent in excessive and improper neuromusculoskeletal use while playing and singing music, including the risk of prolonged or permanent damage to musculoskeletal and neurological tissues.
- Recognize that playing and singing music in inappropriate ways or for extended times can cause playing and singing-related neuromusculoskeletal disorders.
- Monitor practice time and intensity, choice of repertoire, and playing and singing techniques to prevent the development of playing- and singing-related disorders.

- Apply health knowledge in specific musical contexts, such as practice, 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.

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Part II. Considerations for Faculty and Staff

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

Neuromusculoskeletal and Vocal Health in Music Classrooms, Studios, Rehearsals, and Other Spaces

- Help students understand the importance of neuromusculoskeletal and vocal health and their ultimate responsibility for acting with care and appropriate restraint. If you teach performance, help students understand health issues specific to their instrument or the voice.
- Provide time for your students to physically and musically “warm up” at the start of rehearsal.
- Encourage singers to begin their warm ups by vocalizing in the most comfortable mid-range of their voice before gradually moving to the higher and lower extremes of their vocal range.
- Provide breaks for your students during rehearsal. This rest time is beneficial to their ability to concentrate and to protect their hearing, vocal, and neuromusculoskeletal health.
- Work to avoid seating and visibility issues within ensembles.
- Encourage proper playing posture and breath support among instrumentalists.
- Encourage singers to stand up during practice and rehearsal and to make use of effective posture and breath support.
- If appropriate, speak with students and administrators about musician support mechanisms, such as shoulder rests, neck straps, and flute crutches.
- Consider the use of amplification devices for singers, especially during rehearsals.
- If you suspect that a student is developing a neuromusculoskeletal or vocal condition or disorder (or if he or she reports a physical difficulty in playing, singing, or speaking), 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 neuromusculoskeletal health awareness policy within the music school or department.
- Establish a mechanism for addressing concerns related to issues of neuromusculoskeletal health for faculty, staff, and students.
- Consider making performance-grade musician support mechanisms available to students, either on a complimentary basis or for purchase.

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' neuromusculoskeletal health is vital to their success as musicians and to their overall happiness.

Neuromusculoskeletal and vocal health are essential, too, for faculty and staff engaged in playing and teaching music.

The playing- and singing-related overuse, misuse, or abuse of certain muscles, joints, ligaments, tendons, and vocal tissues can contribute to the development of certain neuromusculoskeletal disorders. Outside, non-musical behaviors that physically strain the body or the voice, or that compromise a musician's psychological health, may also be contributing factors. It is important to understand and avoid those risk factors that can compromise neuromusculoskeletal fitness and 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 new or additional 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 Neuromusculoskeletal Health 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 Neuromusculoskeletal Health: Student Information Sheet

Standard Version

Version for Customization

Protecting Your Vocal Health: Student Information Sheet

Standard Version

Version for Customization

Neuromusculoskeletal and Vocal 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>

Organizations Focused on Neuromusculoskeletal and Vocal Health

American Academy of Neurology

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

American Academy of Orthopaedic Surgeons

(<http://www.aaos.org>)

American Academy of Otolaryngology – Head and Neck Surgery

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

American Association for Hand Surgery

(<http://www.handsurgery.org>)

American Laryngological Association
(<http://www.alahns.org>)

American Physical Therapy Association
(<http://www.apta.org>)

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

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

National Association of Teachers of Singing
(<http://www.nats.org>)

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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 faculty and staff.

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 cannot 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 relieve the individual from personal responsibility for appropriate, prudent, and safe behavior or action, nor do they shift such responsibility and liability for the consequences of inappropriate, imprudent, and/or unsafe behavior or action 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 $\frac{1}{2}$ 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*

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
120 dB (close-range)	almost immediate	almost immediate

***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)

<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](#))

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/>)