Endurance and Strength Training for Musicians: Experiential Learning & Research

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This paper is a collaborative effort by the Artistry in Action Spring Semester students. The students have spent the semester engaging in experiential learning, consisting of personalized one-on-one training sessions with kinesiology students and independent training sessions. This paper is a result of the extensive research that has gone into this project, intending it to be a helpful resource for other musicians and students facing common challenges of full-time music life. Each section is followed by a list of recommendations, applying research to practical lifestyle tips.

Table of Contents

Body Awareness and Posture, *Bethany Fuller*

Understanding the limits of the body with a knowledge of posture and body awareness makes a more effective musician. One music trainer said that "instruments alone do not create music; it is our bodies and our movements that do."[1] As musicians, if we do not take care of our bodies, it will be harder to perform to our potential. Often a musician experiences pain or injury because of posture. According to one professional, "The pain appears in a pattern typically corresponding with the instrument-specific body posture."[2] This means that for a musician, the pain that appears will correlate to their instrument. For example, a violinist could potentially have pain in their shoulder whereas a pianist may have pain in their arms. According to the National Library of Medicine, "Posture is how you hold your body."[3] In 1917, Harvard did a study to measure how many Americans have bad posture. The study found that 80% of Americans had bad posture. This study, being the first recorded study on posture, compelled many other researchers to conduct studies as well. According to this study, posture is a problem for many people; to correct bad posture, one has to know what good posture looks like. Good posture is recognizing the three natural curves of the back at the neck, mid-back, and lower back, and knowing the sits bones. The sits bones are the bones that allow one to roll around in the chair. One should sit squarely on their sits bones with their head positioned above their shoulders, and the top of the shoulder should be aligned with the hips. According to the National

[1] Eady, Ashley. "Majoringinmusic." *Music Major - Majoring in Music*. 30 Apr. 2019. Accessed 08 Mar. 2024. https://majoringinmusic.com/body-mapping-helps-musicians/#:~:text=After%20all%2C%20instruments%20alone%20do,and%20our%20movements%20that%20do.&text=The%20process%20by%20which%20one,sometimes%20referred%20to%20as%20BMG).

[2] Ohlendorf, Daniela, et al. "Fit to Play: Posture and Seating Position Analysis with Professional Musicians - A Study Protocol." *Journal of Occupational Medicine and Toxicology*, vol. 12, no. 1, 1 Mar. 2017, doi:10.1186/s12995-017-0151-z.

[3] MedlinePlus. "Guide to Good Posture." *MedlinePlus*, U.S. National Library of Medicine. 27 Oct. 2017. Accessed 08 Mar. 2024. https://medlineplus.gov/guidetogoodposture.html.

Library of Medicine, "The key to good posture is the position of your spine" so these three curves in the back should be maintained but not increased for good posture.[4] For a musician, the key is keeping a good posture at your instrument. The National Library of Medicine defines postural awareness as "the subjective conscious awareness of body posture that is mainly based on proprioceptive feedback from the body periphery to the central nervous system."[5] In simple terms, posture awareness is the ability to consciously recognize the way a person holds their body. A person maintaining good posture away from his instrument is more likely to sustain good posture while playing his instrument. Posture can also have an impact on a musician's sound when practicing or performing. If a musician is slumped over, it is difficult to get a confident sound out of the instrument. Maintaining a good posture can support musicality.

Injuries among musicians are a common problem; musculoskeletal disorders are one of the most common health problems among professional musicians. Musculoskeletal disorders are "soft-tissue injuries caused by sudden or sustained exposure to repetitive motion, force, vibration, and awkward positions."[6] According to one site, "Musicians do some of the most complex and demanding physical movement of any profession."[7] Many techniques have been created to help musicians play to their fullest potential at their respective instruments including the Alexander Technique, the Feldenkrais Method, Body Mapping, and others; out of these, the

[4] MedlinePlus. "Guide to Good Posture."
[5] Cramer, Holger, et al. "Postural Awareness and Its Relation to Pain: Validation of an Innovative Instrument Measuring Awareness of Body Posture in Patients with Chronic Pain - BMC Musculoskeletal Disorders." *BioMed Central*. 6 Apr. 2018. Accessed 08 Mar. 2024. https://bmcmusculoskeletdisord.biomedcentral.com/articles/10.1186/s12891-018-2031-9#:~:text=Postural%20awareness%2C%20as%20we%20define,to%20the%20central%20nervous%20system.
[6] Lu, Ming-lun. "Musculoskeletal Health Program." *Centers for Disease Control and Prevention*. 21 Mar. 2022. Accessed 08 Mar. 2024. https://www.cdc.gov/niosh/programs/msd/default.html#:~:text=Musculoskeletal%20disorders%20(MSDs)%20are%20soft,limbs%2C%20neck%20and%20lower%20back.
[7] "How the Alexander Technique Can Help Musicians." *The Complete Guide to the Alexander Technique*. 2 Jan. 2024. Accessed 08 Mar. 2024. https://alexandertechnique.com/musicians/.

Alexander Technique is the most famous. This technique facilitates relaxation by giving opportunities to feel calming qualities not only in a musician's activities but also in a person's daily activities. It is used by professional musicians to learn how they can be mindful of their posture, and setup, and how they use their bodies while playing to reduce tension and prevent injury. The Alexander Technique has been proven to make a music performance more fluid and lively thereby making it less tense and stiff. The Alexander technique does not solve problems of pain; it simply makes things better rather than worse. The technique involves examining one's mindset and considering questions such as, "What am I doing with my use of me that could be corrected?" Exercises in an Alexander technique class may include constructive rest, constructive counting, perspective change, and posture renewal. This technique says that musicians should take time to breathe, renew their posture, and consciously relax their muscles before practicing or performing.

Recommendations:

According to the complete guide to the Alexander Technique, constructive rest is "an extremely effective self-help tool for Alexander Technique students, and for anyone else who wants a simple practical way of releasing excess tension from their body."[8]

There are a variety of approaches to this rest but the three general factors are:

1. Lay on a firm surface
2. Raise your knees in relation to your hips

[8] Alexandertechnique.com. "Alexander Technique Constructive Rest." *The Complete Guide to the Alexander Technique*. 11 Nov 2022. Accessed 04 Apr. 2024. https://alexandertechnique.com/constructiverest.

3. Support your head with something

Besides these three universal things, teachers mostly dispute the differences of what you think or do not think about while doing constructive rest. While at your instrument, sit up straight but relaxed and think about your body before and while you play. If you are experiencing pain, figure out the source and where it is happening. You should sit squarely on your sits bones with your shoulders aligned with your hips and visualize engaged muscle groups in preparation for practice. During practice, stand away from your instrument, breathe, and renew your posture and balance.

Warming Up, *Sophia Landry*

As a musician, warming up increases productivity and prevents setbacks. To understand this, one must understand what warming-up looks like away from the music stand. According to Merriam Webster warming-up means "to engage in exercise or practice especially before entering a game or contest." In essence it means to get ready. This would include primarily warming up mentally. Mental training is absent from the object of study. It involves having a goal-oriented mindset to improve physical and technical issues. This includes increasing self-esteem. A study on elements of mental training paraphrases Donald R. Liggett saying, "development of physical skills through mental training is strongly related to a better performance and strengthened self-confidence."[9] Mental training involves visualizing the task at

[9] Immonen, Outi, and Inkeri Ruokonen. *(PDF) Elements of Mental Training in Music - Researchgate*, Elsevier Ltd. Sele. Dec 2012. Accessed 20 Apr. 2024. www.researchgate.net/publication/257716359_Elements_of_Mental_Training_in_Music.

hand, keeping the material in memory, and analyzing every part of the object of study before putting it into action. Mental training involves intense focus without any distractions. For each part of the warm-up process to succeed in improving a player, that player must be fully dedicated to visualizing, memorizing, and analyzing.

Not only must a player be ready to perform mentally, but physically as well. This is where stretching comes into play. It is important to note that stretching must always follow warm up and should never occur before. There are some exceptions, for example, when the activity at hand does not require strenuous exercise. Stretching prepares the body for physical activity by increasing blood flow which carries oxygen and nutrients to the muscles. The level of physical activity required for performance impacts the intensity of the warm-up. One must assess which muscle groups are used in practice and performance and start warming up. This involves static stretching (the most common type of stretching) to eliminate muscle tightness and increase range of motion (ROM). Static stretching is where a specific position is held so that the targeting muscle is tense through the stretch. The greatest effect to ROM through static stretching "occurs between 15 and 30 seconds."[10] In conclusion, focused and engaged mental and physical preparation increases a player's mindset and performance.

A musician is essentially an athlete. Lauren Rioux, a violin performer, and teacher, writes in her blog, "We rely on our body to respond with speed, precision, flexibility, and consistency. We train, practice, study, repeat…"[11] The body and musicianship go hand in hand. A musician

[10] Page, Phil. "Current Concepts in Muscle Stretching for Exercise and Rehabilitation." *International Journal of Sports Physical Therapy*, U.S. National Library of Medicine, Feb. 2012. www.ncbi.nlm.nih.gov/pmc/articles/PMC3273886/.

[11] Brennan, Callie. "How-to Prevent Music Related Injury: Small Muscle Athlete Edition." *Jam With Lauren*. Jam With Lauren, February 17, 2021. Last modified February 17, 2021. Accessed 19 Apr. 2024. https://www.jamwithlauren.com/blog/how-to-prevent-music-related-injury-small-muscle-athlete-edition.

cannot expect to be successful without understanding and taking care of his or her body. This is where warming-up becomes a necessary part of any musician's routine. The mental side of a musician's routine can directly match that of an athlete. As stated in the previous paragraph, this includes visualizing the task at hand, keeping the material in memory, and analyzing every part of the object of study before putting it into action. Mental warm-up also includes eliminating distractions and focusing on the tasks at hand, whether in a practice session or a big performance. The physical side of the warm-up process might look slightly different for a musician. Depending on the musician's principle – piano, brass, strings, etc. – this process varies. According to Kay Hooper, a veteran piano and Alexander Technique Teacher, 35 of the 640 recognized muscles in the body control hand movements, with 17 located in the hand and 18 in the forearm. Using the hand as an example, one can see how necessary muscles are in the musical-making process. Once a musician recognizes the muscles they use during practice and performance, he or she can focus on applying static stretching to those areas. Doing so will eliminate muscle tightness and increase range of motion (ROM). This enables the musician to start performance efficiently with a properly stretched and warmed-up body.

After finishing his or her practice session, the musician should incorporate a cool-down routine. The point of the cool down routine is to help the body recover from the mental and physical intensity of the performance or practice session. Most musicians are familiar with cool-down exercises on their instrument, but they will often neglect cooling down their body. This physical routine may look similar to the physical warm-up routine. It involves placing special attention on areas of the body used during practice or performance, yet extending the time utilized during the warm-up. For example, rolling the neck from side to side may be used in the warm-up and cool-down routines, yet the cool-down routine would involve holding the neck in

those positions for longer. A stable cool-down routine improves the musicians' sense of well-being. In a study on vocal cool-down exercises and their impact on the vocalist, many of the vocalists noticed an improvement in their performance.[12] Almost 80% confirmed they would continue using vocal cool-down exercises in their music routine.

Recommendations:

Warming up physically is essential to a productive practice session. As you start your practice session, here are some procedures you should follow.

Start with joint rotations beginning with the toes and working up or the fingers and working down.

- Perform both clockwise and counterclockwise circular motions to help the joints function more easily.

Work through breathing exercises to warm up the lungs and relax the body.

- As you go through these exercises, work on clearing the mind of all distractions and concentrate on the fundamentals of your playing.
- Try inhaling for 4 counts, holding it for 4, and then exhaling for 4 counts (Box breathing)
- Try taking a breath in and then releasing it in a sharp exhale. Inhale, then exhale forcefully and push all the air out of your lungs.
- Experiment with other breathing exercises.

[12] Ragan, K. *The Impact of Vocal Cool-down Exercises: A Subjective Study ...* Accessed 19 Apr. 2024. https://kariragan.com/wp-content/uploads/2020/06/The-Impact-of-Vocal-Cool-Down-JOV-2015-.pdf.

Once the body is warmed up with air and movement, start relaxed static stretching. Focus on these areas:

- Back
- Sides
- Neck
- Forearms and wrists
- Triceps
- Chest

Now that the body has been warmed up physically and mentally, you can begin warming up on your instrument. It is important to keep in mind that stretching must always follow warm up and should never occur before.

Physical Exercise, *Audrey Marinelli*

Structured physical exercise enhances a musician's playing ability and overall well-being. Studies have shown how beneficial physical exercise, specifically strength training, is for the human body. According to the World Health Organization, more than 80% of the world's population is insufficiently physically active.[13] To prevent sedentary behavior and provide a healthy lifestyle, WHO recommends adults aged 18-64 years "should do at least 150-300 minutes of moderate-intensity aerobic physical activity…throughout the week."[14] First, it is important to define the terms we use. The National Library of Medicine defines exercise as, "any

[13] World Health Organization. *Physical Activity*. 5 October 2022. https://www.who.int/news-room/fact-sheets/detail/physical-activity.
[14] World Health Organization. *Physical Activity.*

bodily movement produced by skeletal muscles that results in energy expenditure."[15] So, the exertion of energy, rather than movement, is the defining characteristic of exercise. The most fundamental aspect of physical exercise is the muscle and the larger role of all the muscles in a body. When a muscle is first activated, "all of the fibers it serves are simultaneously activated and develop force."[16] An important aspect of any physical exercise is the musculoskeletal system, consisting of bones, ligaments, tendons, cartilage, and the muscles attached. It is essential to understand how body movements affect this system and what stress movement places on it. One more definition would clarify physical exercise and the multiple components involved. Muscular strength is defined as, "the ability to generate maximum external force" and these external forces are defined as, "the forces acting between an athlete's body and the environment."[17] After creating a working understanding of the human body and how it affects physical exercise, it is helpful to address specific aspects of physical exercise. Physical exercise can be broken down into two general categories: strength training and cardio building, although both categories also impact the other. Multiple different activities, such as "conditioning, calisthenics, core training, Pilates, yoga"[18] and many others may fall under the term fitness. After extensively investigating what physical exercise looks like for the human body, it is beneficial to dig deeper into what that would mean for the musician's body. First, one must address which muscles or muscle groups are involved in a musician's practice and performance,

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[15] Caspersen, C. J., Powell, K. E., & Christenson G. M. *Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research.* Public Health Rep. 1985 Mar-Apr; 100(2): 126–131. Accessed 20 Apr. 2024. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1424733/?page=1.

[16] National Strength & Conditioning Association (U.S.), Earle, Roger W., & Baechle, Thomas R. *Essentials of Strength Training and Conditioning.* Human Kinetics: 2008. Accessed 20 Apr. 2024. https://www.google.com/books/edition/_/rk3SX8G5Qp0C?hl=en&gbpv=1&pg=PR9&dq=define+strength+training.

[17] National Strength & Conditioning Association (U.S.), Earle, Roger W., & Baechle, Thomas R. *Essentials of Strength Training and Conditioning*.

[18] Paoli, A. & Bianco, A. What Is Fitness Training? Definitions and Implications: A Systematic Review Article. Iran J Public Health. 2015 May; 44(5): 602–614. Accessed 20 Apr. 2024. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4537617/.

specifically looking at common physical movements involved in making music. While playing most instruments, the arms, shoulders, wrists, and hands are involved in the music-making process. Biceps, deltoids, latissimus dorsi, pectoralis major and minor, triceps brachii, trapezius, rhomboids, and other muscles will be used. However, the whole body is involved in making music. For example, each musician uses his core and lower body while sitting or standing to play his instrument. These muscles would include the gluteus maximus, soleus, tibialis anterior, hamstrings, and quadriceps, along with other muscles.[19] Many core muscles are used in playing instruments or singing. Due to the various muscles specifically and indirectly used while making music, musicians would benefit to do exercises such as the bench press, dumbbell bicep curls, barbell or dumbbell shrug, seated cable row, sit-ups, squats, leg press, calf raises, back extension, and various other exercises.[20] Any form of cardio training, whether that be jogging, sprinting, HIIT, or Zumba, could be helpful and strengthening for the musician. Stretching is vitally important for a musician's body, and should be paired with other forms of physical exercise. Yoga, Pilates, qigong, and tai chi are beneficial stretching and breathing physical exercises. Under the broader category of strength training, there are various subsets, such as exercising with free weights, body weight, or weightlifting machines. Using body weight to exercise is beneficial in allowing a greater range of motion than that provided by using dumbbells or machine workouts. In body weight exercises, multiple muscle groups work together, allowing multiple muscles to be strengthened at one time. Body weight exercises are convenient, time efficient,

[19] Brown, Lee E. *Strength Training*. Human Kinetics: 2007. Accessed 20 Apr. 2024. https://www.google.com/books/edition/Strength_Training/SOjE7VQ2iWkC?hl=en&gbpv=1&pg=PP3&printsec=frontcover.

[20] Brown, Lee E. *Strength Training.*

involve a low financial responsibility, and are extremely functional, as they mimic everyday activities.[21]

The overall benefits of cardio building are important to the health of an individual. Specifically, "the cardiovascular system plays key roles in the regulation of the body's acid-base system, fluids, and temperature."[22] Strength training is beneficial as it aids in muscular strength, builds endurance and balance, and enhances flexibility. Just as physical exercise is crucial for athletes, structured physical exercise allows musicians to better their craft. It is important as a musician to build strength and cardio, aiding in a stronger overall body. Aaron Williams, a professor at the Royal College of Music concludes that consistent exercise directly correlates to musical efficiency. Prolonged time sitting or standing requires strong muscles, and unless these muscles are being built through physical exercise, the musician will quickly burn out and not be physically strong enough to perform and practice. According to one researcher, "muscular weakness produced by prolonged seating should be treated through healthy physical activity habits. With that it will be achieved, on the one hand, to elongate the shortened musculature and in the other hand, to activate muscles that present inactivity, having positive effects on prevention".[23] Some results of physical activity in musicians may include a greater awareness of which muscles are being used with playing the instrument, stronger muscles to use while practicing, a prevention of wear and tear on the body, and less possibility of injuries due to

[21] Harvard Health Publishing. *The advantages of body-weight exercise.* 15 February 2022. Accessed 20 Apr. 2024. https://www.health.harvard.edu/exercise-and-fitness/the-advantages-of-body-weight-exercise.
[22] National Strength & Conditioning Association (U.S.), Earle, Roger W., & Baechle, Thomas R. *Essentials of Strength Training and Conditioning*.
[23] Gallego-Cerveró, Clara, et. al. *The physical training for musicians. Systematic review.* Sportis Scientific Journal of School Sport Physical Education and Psychomotricity. September 2019. Accessed 20 Apr. 2024. https://www.researchgate.net/profile/Clara-Gallego-Cervero/publication/335840102_The_physical_training_for_musicians_Systematic_review/links/5d7f92e7a6fdcc66b000867c/The-physical-training-for-musicians-Systematic-review.pdf.

incorrect muscle use.[24] As a fellow musician stated, "The ability to transfer body weight either standing or sitting can be an important part of injury reduction and also performance enhancement."[25] It is so vital to not only warm up and strengthen instrument-specific muscles. For example, one pianist explained that he had to choose reverse motion exercises, such as chest and back exercises, to help his turned-in shoulders. This posture was a result of endless hours at the piano, and he formulated a workout routine to aid in correcting that. It is so vital to not only warm up and strengthen instrument-specific muscles. For example, one pianist explained that he had to choose reverse motion exercises, such as chest and back exercises, to help his turned-in shoulders. This posture was a result of endless hours at the piano, and he formulated a workout routine to aid in correcting that.[26]

The mind to muscle connection is vital to physical exercise. The process of thinking about the muscles used in an exercise activates the muscle differently than if no thought was directed towards the muscle during the exercise. According to an exercise physiologist, "when we focus our mind and attention to our movements, the neurons within our brain fire and send signals to our muscle fibers to contract."[27] It is important for both the mind and the body to work together when exercising. Focusing on using a specific muscle or set of muscles results in "increased muscle activity at relative loads between 20 and 60%."[28] In an article by Arizona State University, mind-muscle connection is defined as, "a way in which the athlete consciously

[24] Gallego-Cerveró, Clara, et. al. *The physical training for musicians. Systematic review.*
[25] PhysioTec. *Music is Physical- The Importance of Exercise for Musicians*. 15 February 2021. Accessed 20 Apr. 2024. https://www.physiotec.com.au/music-is-physical-the-importance-of-exercise-for-musicians/.
[26] Keynotes.com. *A Musician's Fitness Routine.* Accessed 20 Apr. 2024. https://www.key-notes.com/blog/a-musician-s-fitness-routine.
[27] Maharaj, Shriya. *Mind-Muscle Connection Exercise Program for Brain Injury Recovery*. 2 August 2021. Accessed April 20, 2024. https://propelphysiotherapy.com/exercise/mind-muscle-connection-exercise-program/.
[28] Calatayud, Joaquin, et. al. National Library of Medicine. *Importance of mind-muscle connection during progressive resistance training.* 23 December 2015. Accessed 20 Apr. 2024. https://pubmed.ncbi.nlm.nih.gov/26700744/.

and deliberately creates a muscle contraction."[29] In an article by Arizona State University, mind-muscle connection is defined as, "a way in which the athlete consciously and deliberately creates a muscle contraction" [30]Practically speaking, this looks like moving slowly, allowing your brain to think through each step and movement, connecting the action to a thought process. As one exercises, she should visualize the muscle contracting and relaxing while performing the exercise, allowing the movement to be calculated, rather than haphazard, causing potential injury.[31]

Just as it is important for athletes to properly warm up their bodies before a game, so it is important for a musician to be physically warmed up before a performance. As the Harvard Medical School journal explains, "One way to warm up is by practicing moves you'll perform later."[32] Because a musical performance requires such vigorous physical involvement, it is important for a musician's muscles to be warmed up and ready for a performance.

Recommendations:

Some helpful pre-performance exercises would include:

- Squats
- Banded stretching
- Lunges
- Light upper body exercises
- Light core strengthening

[29] Arizona State University. *The Mind-Muscle Connection*. Accessed 20 Apr. 2024. https://wellness.asu.edu/blog/mind-muscle-connection.
[30] Arizona State University. *The Mind-Muscle Connection*.
[31] Maharaj, Shriya. *Mind-Muscle Connection Exercise Program for Brain Injury Recovery*.
[32] Godman, Heidi. Harvard Health Publishing. *The best exercises for your warm-up.* 1 November 2022. Accessed 20 Apr. 2024. https://www.health.harvard.edu/exercise-and-fitness/the-best-exercises-for-your-warm-up.

Sleeping and Taking Breaks, *Sydney Davis*

Sleep is essential to functioning properly. Many factors contribute to having a good night's sleep, such as the quality and quantity of sleep; *quality* is defined as how many hours spent asleep, and *quantity* refers to the recommended hours of sleep for the subject's age group. Good sleep quantity includes falling asleep within thirty minutes of lying down, waking up once per night (if at all) and returning to sleep within twenty minutes, and feeling rested and energized upon waking up for the day.[33] Missing the recommended hours of sleep every night could indicate stress or anxiety, which could lead to sleep insomnia. It can also hinder proper function of the immune system. Studies show that sleeping less can affect the hormones that signal hunger cues, resulting in altered appetite or food cravings. Other studies show the effects of sleep on memory functionality: while the body sleeps, the brain processes information from the day.[34] The National Council on Aging asserts that about 30% of adults exhibit symptoms of insomnia, with 10% having insomnia that impacts their daily activities. Sleep apnea affects 9-38% of the general population. Experiencing good sleep and maintaining healthy, consistent sleep hygiene supports not only effective, efficient brain function but also the quality of one's mood, stress level, and general sense of well-being, in addition to decreasing the risk for many diseases and disorders.[35]

Since healthy sleep requires a delicate balance of quality and quantity, it is important to be judicious of taking daytime naps. Just as the purpose of nighttime sleep is to feel more rested

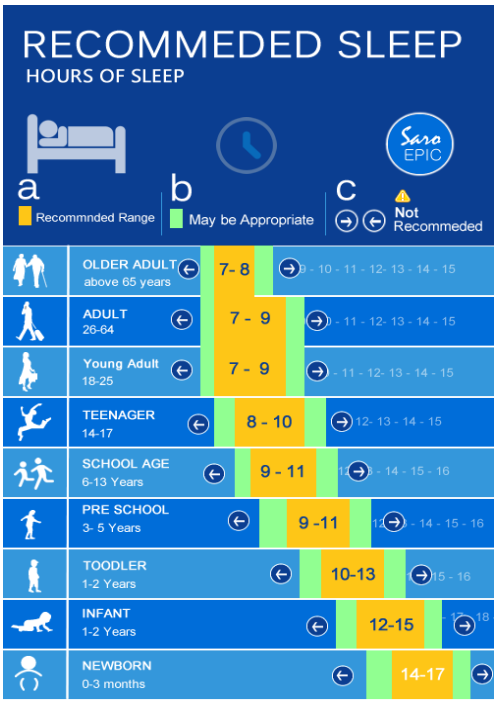
[33] Suni, Eric. *Sleep Quality: How to Determine If You're Getting Poor Sleep.* Sleep Foundation. 8 Dec. 2023. www.sleepfoundation.org/sleep-hygiene/how-to-determine-poor-quality-sleep#:~:text=Sleep%20quality%20is%20different%20from,as%20at%20least%20seven%20hours.
[34] Salas, Rachel. *Rest up: Sleep Powers Your Social Life.* Johns Hopkins Medicine. 8 Aug. 2021. www.hopkinsmedicine.org/health/wellness-and-prevention/rest-up-sleep-powers-your-social-life.
[35] Marshall, Steven. *Sleep Statistics and Facts*. Sleep Statistics and Facts, National Council on Aging. 11 Mar. 2024. www.ncoa.org/adviser/sleep/sleep-statistics/#:~:text=More%20than%20a%20third%20of,38%25%20of%20the%20general%20population.

and energized with improved reaction time and memory, daytime naps can yield the same benefit. However, sleeping too long could result in a groggy feeling and interrupt the circadian rhythm, compromising night sleep. Consistently dysregulated or interrupted circadian rhythm results in sleep problems, performance issues (difficulty focusing, memory problems, brain fog); emotional and social difficulties (decreased stress management and emotional well-being); health challenges and fatigue.[36] Researchers recommend several strategies to prevent these side effects and to get the full benefit of the nap. Creating a calm, relaxed environment helps signal the brain that it is time to rest. The most effective daytime naps have been described as occurring before 3 p.m. for a maximum time of ten to twenty minutes. These parameters protect the quality and quantity of nighttime sleep.[37] Other strategies for promoting circadian rhythm alignment are engaging in light therapy, taking melatonin supplements, or adjusting the sleep schedule.

Integrating breaks throughout the course of the day ensures a musician's optimal productivity and serves as a protection factor against injury. Researchers categorize types of breaks into four sections: relaxation (stretching), social (personal interaction with colleagues), cognitive (reading), and nutritional (having a snack). Reports indicate that employees who experience more psychological detachment from work during off-hours say that they are more satisfied. It is important to consistently incorporate breaks both during work in the off hours (nights, weekends, vacations).[38] During break periods, one should intentionally engage in physical activities that use different parts of the brain than the centers that focus on reading and

[36] Brian, Lucy and Guo, Lulu. *Circadian Rhythm*. Sleep Foundation. 15 Mar. 2024. www.sleepfoundation.org/circadian-rhythm#:~:text=If%20you%20don't%20sleep,cycle%20of%20day%20and%20night.
[37] Olsen, Eric. *How to Get a Great Nap.* Mayo Clinic, Mayo Foundation for Medical Education and Research, 9 Nov. 2022. www.mayoclinic.org/healthy-lifestyle/adult-health/in-depth/napping/art-20048319.
[38] Weir, Kirsten. *Give Me a Break*. Monitor on Psychology. American Psychological Association. Jan. 2019. www.apa.org/monitor/2019/01/break.

processing music and playing the instrument, such as taking a walk outside or stretching. This action allows one part of the brain to rest, while another part is active. Subjects who incorporate this technique report experiencing increased mental focus and also improved moods. Adding physical activity encourages healthy blood flow and production of endorphins, which also support cognitive activity. For musicians, taking breaks is beneficial to prevent overplaying and mental, emotional, and physical fatigue, which could lead to problems sleeping.[39] Managing one's time and energy productively requires prioritizing appropriate breaks, in order to achieve one's goals.



[40]

Recommendations:

[39] Michigan State. *Breaks during the Workday*. Toward a Respectful Workplace. Accessed 20 Apr. 2024. workplace.msu.edu/breaks-during-the-workday/#:~:text=Taking%20a%20break%20from%20work,1.
[40] Penn State. *SiOWfa16: Science in Our World: Certainty and Controversy*. Accessed 21 Apr. 2024. https://sites.psu.edu/siowfa16/2016/10/21/why-do-we-sleep-how-much-sleep-do-we-need/

- Get the recommended amount of sleep for your age group.
- Take a 30 minute nap before 3pm, if needed.
- Take breaks! While taking a break, use a different part of your brain (i.e. taking a walk, eating a snack, stretching, or talking to friends).

Injury Prevention and Recovery, *Elizabeth Dorey*

Injury prevention and recovery builds lasting endurance in musicians. Musicians participate in physical activity which can lead to injuries when playing. In fact, two-thirds of professional orchestral musicians incur playing-related injuries, nearly all of which are preventable.[41] When discussing injury prevention, the first step needed is to consider the causes of injuries: misuse, overuse, or accidents.[42] Misuse is employing movements or postures that are contrary to the body's nature.[43] It includes slouching, misaligned posture, poor habits, or poor techniques. Overuse consists of overusing muscles, joints, and tendons.[44] Muscles are affected by repetitive or hard-hitting movements. Tendons attach the muscles to the bones and are a big part of inflammation. Nerves are impacted by these swelling tissues and can put pressure on the tendons and joints. These are all parts of the body that can be subjected to overuse. Some results of overuse can lead to carpal tunnel syndrome, tendinitis, or bursitis (from repetitive motions).[45] Accidents are the third area that leads to injuries among musicians. One aspect of accidents in

[41] Klickstein, Gerald. "Injury Prevention, I-II." *The Musician's Way: A Guide to Practice, Performance, and Wellness*. Oxford ; New York : Oxford University Press, 2009, pp. 229.
[42] Klickstein, Gerald. "Injury Prevention, I-II." pp. 231.
[43] Klickstein, Gerald. "Injury Prevention, I-II." pp. 233.
[44] Klickstein, Gerald. "Injury Prevention, I-II." pp. 234.
[45] University of Nevada, Las Vegas. *Performance Injuries*. 30 Aug. 2023. Accessed 08 Mar. 2024. www.unlv.edu/music/injuries#:~:text=Instrumental%20musicians%20are%20at%20risk,syndrome%2C%20tendinitis%2C%20and%20bursitis.

musicians is the anatomical difference between everyone.[46] Every body size is different, and because of this, not all instruments fit each performer as needed to prevent injuries.[47] The body's range of motion in shoulders, hands, and fingers can all affect the musician's overall health. It is best to get accommodations for each person's specific body size if experiencing issues. This can entail getting a different sized instrument or tools to benefit correct posture such as higher shoulder rests.

Injury prevention and recovery for musicians go together. Many of the paths to recovery from injuries are also the steps provided to prevent injuries in the first place. The first step if experiencing any type of injury is to see a doctor before any self-care.[48] Secondly, when preventing or recovering from an injury, always watch for warning signs. These can be a sense of fatigue, pain, loss of range of motion, or odd sensations like tingling that aren't usually experienced. Thirdly, to prevent injuries of overuse, every musician should warm up before, during, and after playing. This includes, but is not limited to, stretching, performing breathing exercises, and loosening tight muscles in areas that are used to play that specific instrument. Warming up reduces the chance of injury because the muscles used for performing are not as tight. Taking breaks is another important aspect of preventing and recovering from injuries of overuse.[49] When practicing or performing, a musician should always have the correct posture which prevents injuries from occurring because of misuse.[50] This includes balancing on the sitting bones, standing balanced on both legs with pliable knees, aligning the spine, and releasing tension in the shoulders.

[46] Horvath, Janet. *Playing (Less) Hurt*. Hal Leonard, 2010. pp 23.
[47] Klickstein, Gerald. "Injury Prevention, I-II." pp. 234.
[48] Klickstein, Gerald. "Injury Prevention, I-II." pp. 240.
[49] Klickstein, Gerald. "Injury Prevention, I-II." pp. 244
[50] Horvath, Janet. *Playing (Less) Hurt*. pp 35.

Recommendations:

- Always see a doctor if experiencing pain or warning signs.
- Warm up before playing.
- Take several breaks when playing for long periods of time.
- Stretch before, during, and after playing.
- Use Ice/ Heat.

Nutrition and Hydration, *Chénie Guidinger*

To fuel practice and provide optimal performance, musicians need to be intaking nutritious foods and hydrating properly. The standard American diet does not provide the nutrients needed to sustain musicians for optimal practice and performance. According to the Journal of the Academy of Nutrition and Dietetics, "Nearly half of all American adults have one or more chronic diseases that are related to poor-quality diets."[51] Eating nutritious foods and hydrating properly bolsters mental and physical activity, especially for musicians who practice many hours a week, in addition to performance time. A study done by Anthony Merlino on percussionists, shares that "playing [an] … instrument requires long states of physical motion and high physical intensity."[52] Since musicians utilize energy while practicing and performing, nutrition and hydration should be a major consideration.

[51] Wilson MPH, Magdalena M. *American Diet Quality: Where It Is, Where It Is Heading, and What It Could Be.* Journal of the Academy of Nutrition and Dietetics, vol. 116, no. 2. Feb. 2016. pp. 302–310. https://www.sciencedirect.com/science/article/pii/S2212267215015117?casa_token=2z82fzgZS_gAAAAA:QtxaP99KWdKmZ3CArsGSKBWef2PzzvOE-Rr551jaakkRHqJr_WLvfRX-k4v9Geirqjie3khdgXk#bib4.

[52] Merlino, Anthony Joseph. *The Percussionist Bodybuilder: Optimizing Performance Through Exercise and Nutrition.* UNLV Theses, Dissertations, Professional Papers, and Capstones. University Libraries. Aug. 2014. https://digitalscholarship.unlv.edu/cgi/viewcontent.cgi?article=3197&=&context=thesesdissertations&=&sei-

How much water should a musician be drinking and what should they be eating? The suggested amount of daily hydration is 72-102 fluid ounces of water depending on gender and weight.[53] Staying hydrated ensures good physical and mental condition.[54] Water is connected to blood flow, fluid in the joints, saliva and so many more functions. When dehydrated, musicians could suffer from headaches, fatigue, and dizziness.[55] During heavy practice, long rehearsals and outdoor gigs, sweating is inevitable. Electrolyte drinks are according to Oxford, "drinks containing … sodium and potassium salts, usually to replace mineral salts lost during sweating."[56] Often people will think they are drinking enough water, but still suffer from dehydration. This could be because of a lack of minerals and salts in your body, which electrolyte drinks will provide. Lack of sleep and tiredness is common among musicians, and caffeine seems like a positive alternative. However, caffeine has been proven to dehydrate[57] and fuel anxiety.[58] Caffeine when consumed in large doses (500mg or higher) produces negative side effects.[59] Caffeine draws out several good minerals in your body creating a mineral deficiency,

redir=1&referer=https%253A%252F%252Fscholar.google.com%252Fscholar%253Fhl%253Den%2526as_sdt%253D0%25252C41%2526q%253Dmusicians%25.

[53] News in Health. *Hydrating Health*. 17 May 2023. https://newsinhealth.nih.gov/2023/05/hydrating-health.

[54] CDC. *Water and Healthier Drinks*. Accessed 21 Apr. 2024. https://www.cdc.gov/healthyweight/healthy_eating/water-and-healthier-drinks.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fhealthywater%2Fdrinking%2Fnutrition%2Findex.html#print.

[55] Benelam, B., and L. Wyness. *Hydration and Health: A Review.* Nutrition Bulletin, vol. 35, pp. 3–25. British Nutrition Foundation Nutrition. 2010. https://onlinelibrary.wiley.com/doi/pdfdirect/10.1111/j.1467-3010.2009.01795.x.

[56] Oxford Reference. *Overview Electrolyte Drink.* Accessed 21 Apr. 2024. https://www.oxfordreference.com/display/10.1093/oi/authority.20110803095746103.

[57] St. Olaf College. *Staying Hydrated*. Accessed 21 Apr. 2024. https://wp.stolaf.edu/musician-health/staying-hydrated/.

[58] Sawyer, et al. *Caffeine and Human Behavior: Arousal, Anxiety, and Performance Effects.* J Behav Med 5. 1982. pp. 415–439. doi.org/10.1007/BF00845371.

[59] Zduńska, Anna, et al. *Caffeine for Headaches: Helpful or Harmful? A Brief Review of the Literature*. Nutrients, vol. 15, no. 14. July 2023. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10385675/.

such as magnesium (magnesium helps manage stress during stressful situations).[60]

A nutritious diet looks different for everyone, but there are some foundational aspects to help guide what a musician should eat. Protein is an important part of what gives adults energy and should be highly valued in musicians diets to bring optimal performance and practice. Studies have shown that 10%-35% of our energy comes from protein.[61] The recommended daily protein intake is 0.8 g per kg of body weight. However, the specific amount protein needed is different for every person based on weight, gender, and physical activity.[62] Less energy during practice sessions and performances may be a result of not eating enough protein. Vitamins and minerals are an essential part of nutrition. They do not give energy directly, but they ensure that a musician's body is performing as well as possible.[63] Fruits and vegetables are a great source of vitamins and minerals. Magnesium is connected to "over 300 enzymes in the body" which affects energy levels, joints tightness, and stress. Before and during a performance, musicians experience a lot of stress, which depletes the body of magnesium. Bananas and spinach are great sources of magnesium. A single banana has 32 mg of magnesium.[64] On a performance day, eating calming foods can help with anxiety and nervousness. Eating chicken, eggs, spinach, cottage cheese, bananas, and fermented foods has been proven to reduce anxiety. Foods high in

[60] Faryadi, Dr. Qais. *The Magnificent Effect of Magnesium to Human Health: A Critical Review*. International Journal of Applied Science and Technology, vol. 2, no. 3. p. 118–126. Mar. 2012. https://www.dr-qais.com/Qais%20Journal/Magnesium.pdf.

[61] Pencharz, Paul B., et al. *Recent Developments in Understanding Protein Needs- How Much and What Kind Should We Eat?* Appl. Physiol. Nutr. Metab., vol. 41. pp. 577–580. Mar. 2016. https://cdnsciencepub.com/doi/pdf/10.1139/apnm-2015-0549?download=true.

[62] Lonnie, Marta, et al. *Hydration and Health: A Review*. Protein for Life: Review of Optimal Protein Intake, Sustainable Dietary Sources and the Effect on Appetite in Ageing Adults, vol. 10. Public Med Central. Mar. 2018. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5872778/#:~:text=Daily%20Quantity,age%20%5B28%2C29%5D.

[63] Better Health Channel. *Vitamins and Minerals.* Accessed 21 Apr. 2024. https://www.betterhealth.vic.gov.au/health/healthyliving/Vitamins-and-minerals#.

[64] U.S. DEPARTMENT OF AGRICULTURE. *Bananas, Raw.* 1 Apr. 2019. https://fdc.nal.usda.gov/fdc-app.html#/food-details/173944/nutrients.

magnesium, vitamin C and D have a calming effect and focus a musician's brain for a performance.[65]

Recommendations:

Everyone is different and should adjust what they eat based on their bodies and if needed, consult a doctor.

What musicians should eat and drink daily:

- Protein: The recommended amount of protein is 0.8 grams per kg of body weight.
    - For an average male (age 18-24), 56 grams of protein.
    - For an average female (age 18-24), 46 grams of protein.
- Fruit and Vegetables: The recommended amount is 1 cup of each.
- Water: the recommended amount of water is 80 oz.

On a performance day, musicians need food that will provide endurance.

Ideal performance day:

- Foods to avoid: Energy drinks, sugary and salty foods, and fatty foods.
- Food to consider: Lots of water, electrolyte drinks, foods high in protein, fresh fruit, and vegetables.
- An ideal meal could be a turkey sandwich, on wheat bread with leafy greens, a bowl of Greek yogurt, a banana and electrolyte drink.

[65] Brosh, Andra. *A REPORT ON ANXIETY AND HOW TO HEAL YOUR MOOD WITH FOOD*. Accessed 21 Apr. 2024. https://static1.squarespace.com/static/5a7400de9f07f5cb5300166f/t/60514ddd8dbff27212a6d043/1615941085825/anxietyreportPDF.pdf.

Performance Anxiety, *Nicholas Evener*

Musicians are under constant stress to learn and perfect a variety of music and techniques. One study found that "one-third of the [music] students experienced stage fright as a problem."[66] Stage fright, or anxiety, is characterized by an increased heart rate. One study discovered: "Throughout the HR [Heart Rate] recordings, we have observed that musicians present a heightened HR while playing (in soloists, mean and maximum HR were 72% and 85%MTHR [Maximum Theoretical Heart Rate], respectively)."[67] It is very normal for musicians to experience anxiety. Pinpointing the exact causes of performance anxiety is difficult as most studies are based on subjective questionnaires.[68] There are, however, some commonalities across the board, the foremost being hypertension.

Hypertension is "an independent risk factor for cardiovascular disease, and it is considered to be the most important modifiable risk factor for cardiovascular morbidity and mortality."[69] Hypertension can cause shortness of breath, heart attacks, damage to the arteries, and brain damage.[70] Favorably, aerobic exercises can increase a person's ability to control hypertension, in turn reducing anxiety. One study implemented a training session on marathon runners and the conclusion was that "Training for and completing a marathon even at relatively low exercise intensity reduces central blood pressure and aortic stiffness—equivalent to a ~4-

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[66] Studer, Regina, et al. *Stage Fright: Its Experience as a Problem and Coping with It.* International Archives of Occupational and Environmental Health, vol. 84, no. 7. pp. 761–771. Oct. 2011. *ETH Library*, doi: 10.1007/s00420-010-0608-1

[67] Inesta, Claudia, et al. *Heart Rate in Professional Musicians*. Journal of Occupational Medicine and Toxicology, vol. 3, no. 16. July 2008. doi:10.1186/1745-6673-3-16.

[68] Chanwimalueang, Theerasak, et al. *Stage Call: Cardiovascular Reactivity to Audition Stress in Musicians.* PLoS ONE, vol. 12, no. 4. Apr. 2017. https://doi.org/10.1371/journal.pone.0176023.

[69] Borjesson, Mats, et al. *Physical Activity and Exercise Lower Blood Pressure in Individuals with Hypertension: Narrative Review of 27 RCTs*. Jan. 2016.

[70] Mayo Clinic. *High Blood Pressure Dangers: Hypertension's Effect on Your Body.* Accessed 2 Mar. 2024. https://www.mayoclinic.org/diseases-conditions/high-blood-pressure/in-depth/high-blood-pressure/art-20045868.

year reduction in vascular age."[71] Marathon training is different from musical training, yet both deal with hypertension. According to an article on the effects of physical exercise on blood pressure, "during acute aerobic activity of sufficient intensity, the systolic pressure increases while the diastolic pressure unchanged or increases marginally."[72] Systolic pressure is the force of blood against artery walls when the heart is beating, and diastolic pressure is the force of blood against artery walls when the heart is resting.[73] Dr. Anthony L. Komaroff, MD, of Harvard University describes this effect on blood pressure: "While you are exercising, your blood pressure (along with your pulse) goes up, to supply the additional blood flow that your exercising muscles need. Otherwise, regular exercise lowers your blood pressure throughout the day."[74] By exercising, musicians teach their bodies how to manage higher blood pressure, which lowers blood pressure even when not involved in exercising. One study found that individuals with anxiety disorders showed a higher prevalence of hypertension compared to the general population (37.9% vs. 12.4%).[75] Hypertension often indicates anxiety, and musicians need to be aware of this as tension is the enemy of the musician.

Proper breathing can also help reduce anxiety. W. Timothy Gallwey notes the importance of breathing in his book *The Inner Game of Tennis*, he explains how breathing can relax your mental state. "The second my mind starts wondering... I bring it gently back to my breath and relax in its natural and basic motion. In this way, by the time the next point is ready to start, I am

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[71] Bhuva, Anish N., et al. *Training for a First-Time Marathon Reverses Age-Related Aortic Stiffening.* Journal of the American College of Cardiology, vol. 75, no. 1. pp. 60–71. Jan. 2020. 3https://www.jacc.org/doi/10.1016/j.jacc.2019.10.045?_ga=2.147191217.705417942.1709850916-456435252.1709232443.

[72] Chanwimalueang, Theerasak, et al. *Stage Call: Cardiovascular Reactivity to Audition Stress in Musicians.*

[73] Mayo Clinic. *High Blood Pressure Dangers: Hypertension's Effect on Your Body.*

[74] Komaroff, MD, Anthony L. *How Does Exercise Affect Blood Pressure?*. Oct. 2023.

[75] Wu, En-Liang. *Increased Risk of Hypertension in Patients with Anxiety Disorders: A Population-Based Study.* Journal of Psychosomatic Research, vol. 77, no. 6. pp. 522–527. Dec. 2014. ScienceDirect, https://www.sciencedirect.com/science/article/pii/S0022399914003584.

able to be more concentrated than I was in the midst of the previous one."[76] Focusing on just breathing is very practical for mental and physical focus. Controlled breathing needs to be properly understood as the act of inhaling and exhaling to release tension. The amount of air inhaled for everyday breathing "averages 10% total lung capacity in most people and can increase up to 50% during exercise."[77] When doing breathing exercises, one must relax the muscles in the airways to get an "oh" shape when breathing in or out. Breathing is also important to brain function. According to Agnes Wan, "Some scientists have claimed 90 percent of our energy comes from oxygen. Therefore, to keep the muscles involved in music making working properly... it is particularly important that a musician maintains an optimal level of oxygen in his or her body— through effective breathing..."[78] Effective breathing allows for better blood flow throughout the body, which produces energy for the brain. Optimal brain performance will allow for better focus not just on hard musical lines, but also for the parts of performing that have become second nature to the performer. One study found "delayed memory was degraded at a hemoglobin concentration 5.7 g/dl when breathing room air in comparison to the test at hemoglobin concentration of 12.7 g/dl."[79] In other words, the lower the transport level of oxygen on the body, the more the person experience delayed memory.

It is essential to consider how breathing should be approached. In *The Inner Game of Tennis*, Galloway elaborates on breathing when he states "By nature, human beings inhale

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[76] Galloway, W. Timothy. *The Inner Game of Tennis*. New York: Random House, 1974.

[77] Sheridan, Patrick, and Sam Pilafian. *Guide to The Breathing Gym*. Focus on Music, 2021.

[78] Wan, Agnes. *What Relaxation Means for Musicians*. *American Music Teacher*, vol. 65, no. 6, JSTOR. pp. 8–11. July 2016. https://www.jstor.org/stable/26385977.

[79] Weiskopf, Richard B., and et al. *Oxygen Reverses Deficits of Cognitive Function and Memory and Increased Heart Rate Induced by Acute Severe Isovolemic Anemia.* Anesthesiology, vol. 96, ASA Publications. pp. 871–877. Apr. 2002. https://pubs.asahq.org/anesthesiology/article/96/4/871/39244/Oxygen-Reverses-Deficits-of-Cognitive-Function-and.

automatically after exhalation… However, problems may arise when a person holds their breath for too long after having inhaled, which leads to a decrease in oxygen supply and an increase in the amount of carbon dioxide in the blood stream…"[9] The exhalation is just as important as the inhalation. Having effective breathing habits will increase the effectiveness of your brain. Having an effective breath also helps with hypertension by creating healthy blood flow.

Recommendations

1. Aerobic Exercises- All the Aerobic Exercises should be conducted regularly. On performance day, a light version of one's typical exercise routine should be conducted with several hours to recover before the performance. If a routine has not yet been established, then it is not recommended that the performer should exercise the day of the performance.
    - Swimming-Swimming can help develop muscles, fix joint issues, and (most relevant to Performance anxiety) increase mental calmness.[80]
    - Here are some additional resources:
        - https://www.sciencedirect.com/science/article/abs/pii/S1934148209005516
        - https://www.jospt.org/doi/abs/10.2519/jospt.1996.23.6.376
        - https://jms.mabjournal.com/index.php/mab/article/view/1911
    - Jogging/Running-Moderate or high intensity is recommended for best results.[81]
    - Additional Resources:

[80] Becker, Bruce E. *Aquatic Therapy: Scientific Foundations and Clinical Rehabilitation Applications.* PM&R, vol. 1, no. 9. ScienceDirect, pp. 859–872. Sept. 2009. https://www.sciencedirect.com/science/article/abs/pii/S1934148209005516.

[81] Mikkelson, Kathleen, and et al. *Exercise and Mental Health.* Maturitas, vol. 106, ScienceDirect. Sept. 2017. https://www.maturitas.org/article/S0378-5122(17)30856-3/abstract.

- https://www.researchgate.net/publication/8113172_Effects_of_aerobic_exercise_on_anxiety_sensitivity
- https://www.acc.org/latest-in-cardiology/articles/2020/01/06/13/45/reduced-bp-arterial-stiffness-seen-in-first-time-marathon-runners

2. Breathing Exercises- These recommendations are not exclusive to performance days or high stress moments; they can also be used to help with fatigue.[82] If dizziness occurs, you should stop doing the exercise and sit down. The first thing ones must do before doing any intensive breathing exercises is to stretch. Recommended stretches are:

- Tension Release- Take a deep breath in, tense up by gradually flexing each muscle starting at either head or (preferably) toes, then exhale and explode the tension and air into a relaxed state.
- Flop Over- Spread feet shoulder width apart, bend over slowly, take deep slow breaths, feel the rise and fall of the body, slowly rise while inhaling, roll up one vertebrate at a time, when at the top exhale and shake it out, repeat process once or twice more. Do not rise too fast or dizziness can occur.
- Yoga Breathe (this one should be done once or twice at the conclusion of every breathing exercise)- Join hands together and raise them above your head while taking a deep breath, exhale (should sound like a giant sigh) while bringing hands back down. Every time should be as relaxed as possible. The idea is to release any tension on the way down.

Breathing exercises in daily practice:

[82] Kim, Sang-Dol, and Hee-Seung Kim. *Effects of a Relaxation Breathing Exercise on Fatigue in Haemopoietic Stem Cell Transplantation Patients.* Clinical Nursing, vol. 14, no. 1, Wiley. pp. 51–55. Jan. 2005. https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1365-2702.2004.00938.x.

- Pops- Place the back of the hand on the mouth, try to breathe through the mouth for 4-8 seconds, release the hand from the mouth (which should create a popping sound), repeat several times.
- Pops variation 1- Starts the same way as Pops but instead of breathing for 4-8 seconds, try to inhale to full capacity. Once full, hold air in, remove hand, sip in more air once to three times, hold for 2-4 seconds, then exhale half of the air, hold for another 2-4 seconds, then completely exhale. For maximum exhalation, switch to a hissing sound at the end of the final exhale.
- Oral Shape- Inhale on a notated patter a measure (common time) of either quarter notes or of eighth notes at <60 bpm, exhale on the same pattern that was inhaled, repeat several times. When breathing in the mouth should be in the shape of "oh". For a more intensive exercise, try varying the notated pattern to include things like polyrhythms, mixed meter, etc.
- Metered Breathing- There are several ways of doing this, but all of them revolve around the same pattern: inhale for a set time, exhale for a longer set time. Here is an example: Inhale for four counts, exhale for four counts, inhale for four counts, exhale for eight counts, inhale for three counts, exhale for sixteen counts, inhale for three counts, exhale for twenty-four counts, inhale for two counts, exhale for thirty-two counts. Holds may be placed between inhalation and exhalation. Always conduct this at <60 bpm for maximum effectiveness.

Here are some other resources:

- https://bulletproofmusician.com/the-best-way-to-breathe-for-reducing-stress/

- https://www.davidearll.com/uploads/4/6/9/9/46999899/breathing_for_a_better_band.pdf

Hearing Health, *Alexa Winnberg*

Musicians rely heavily on their ears when practicing their craft. Protecting the longevity of hearing abilities should be a top priority among musicians due to the risks associated with their surroundings. Factors such as location within an ensemble, duration of exposure, pitch level and frequency, and microphone usage contribute to risks faced daily by musicians. The daily recommended noise exposure limit according to the National Institute for Occupational Safety and Health (NIOSH) is 85 A-weighted decibels (dB(A)).[83] According to a study conducted by Camp and Horstman of University of Washington, some orchestral musicians routinely exceed the recommended levels of noise exposure.[84] The study measured the sound levels experienced by various instrumentalists during *Gotterdammerung* from Wagner's Ring Cycle. Average sound levels for brass and woodwind players ranged from 87-96 dB(A), with lower levels for string players ranging from 81-93 dB(A). This poses a significant threat to hearing health longevity. Losing hearing also affects temporal processing abilities. This includes side effects such as failing to recognize speech in loud environments, difficulties in reverberant rooms, and sound localization difficulties.[85] All of these are major concerns, especially for orchestral musicians.

[83] *Noise and Occupational Hearing Loss*, CDC.gov, Accessed March 5, 2024, from https://www.cdc.gov/niosh/topics/noise/noise.html#:~:text=NIOSH%20recommends%20wearing%20hearing%20protection,chosen%20correctly%20and%20used%20consistently.

[84] Royster, et. al. *Sound exposures and hearing thresholds of symphony orchestra musicians*. Acoustical Society of America, Vol. 89, No. 6, June 1991.

[85] Rawool, Vishakha. *The Effects of Hearing Loss on Temporal Processing.* The Hearing Review, 2006. Accessed February 27, 2024 from https://hearingreview.com/practice-building/practice-management/the-effects-of-hearing-loss-on-temporal-processing

To build and maintain a musical career, hearing protection is vital. Studies have shown that cardiovascular fitness can play a role in hearing conservation.[86] In a study conducted by Miami University, three groups were separated by relative levels of fitness and were tested using fitness and hearing exercises. After testing, they discovered a 42% difference in hearing ability between the groups, with the least amount of hearing loss belonging to the group with the highest level of fitness.[87] Additionally: "Hearing loss measured at 3000 Hz and 4000 Hz in the low-cardiovascular-fitness group was on average 87% and 75% worse, respectively, than the average hearing loss of the medium- and high-cardiovascular-fitness groups following noise exposure."[88] Another method of encouraging long-term hearing protection is investing in earplugs. One commonly used brand is Earasers. These earplugs are most often used by musicians but have also been used by motorcyclists and the military. A study done by the Airforce Research Laboratory observed whether Earasers were superior to foam earplugs, specifically when used in conjunction with outer ear protection. When collecting baseline data for the study, it was observed that Earasers allowed for the most variation in Hertz levels, while the foam earplugs, predictably, maintained the same levels of dampening across all frequencies.[89]

A recent development in this field has been the introduction of electronic earplugs, designed to monitor noise levels and adjust accordingly. A clinical trial conducted in Australia found that these types of earplugs proved to be more effective than standard musician earplugs.[90] It included 26 musicians, with one orchestra performing predominantly in the pit and the other

[86] Hutchinson, et. al. *Does cardiovascular health mediate hearing ability?* American College of Sports Medicine, 1993.
[87] Hutchinson, et. al. *Does cardiovascular health mediate hearing ability?*
[88] Hutchinson, et. al. *Does cardiovascular health mediate hearing ability?*, p. 870
[89] Gallagher, et. al. *Investigating Double Hearing Protection: Performance of Filtered Earplugs Paired with Headsets/Helmets.* Airforce Research Laboratory, 2022, p. 16.
[90] O'Brien, et. al. *A Clinical Trial of Active Hearing Protection for Orchestral Musicians*. Journal of Occupational and Environmental Hygiene, 2014.

on the stage. In polling musicians who had previously used earplugs, the study reported: "59% (13) [of the participants] felt the new earplugs were a significant improvement on previous earplugs; 23% (5) felt they were some improvement; 9% (2) felt that they were slightly worse or neither better nor worse; and 9% (2) felt the new plugs were much worse than previous earplugs."[91] Across the board, most musicians were able to easily listen to other musicians within the ensembles and could follow the direction of the conductor. One common complaint was an increased difficulty in hearing one's own sound, although some musicians noted they may acclimate to the difference over time. According to the study: "…68% (15) of the trial group felt the earplugs became easier to use in various situations over the course of the trial, however some players actually found the earplugs became more difficult to use while playing their instrument."[92] There are many factors that go into choosing hearing protection, and personal taste is certainly a part of that. While there is still room for improvement in this field, musician earplugs are a practical solution for hearing protection.

Recommendations:

1. Always be aware of the noise levels in a given environment.
    - App recommendations:
        - NIOSH Sound Level Meter
2. If noise levels exceed the recommended range given by the National Institute for Occupational Safety and Health (85 dB), wear earplugs.
    - Standard:
        - Earasers (priced at $40)

[91] O'Brien, et. Al. *A Clinical Trial of Active Hearing Protection for Orchestral Musicians*, p. 456.
[92] O'Brien, et. Al. *A Clinical Trial of Active Hearing Protection for Orchestral Musicians*, p. 457.

- Electronic:
    - MP-915 Musicians Electronic Earplug (cited in the study, priced at $300)