

CHAPTER 5

c0005 Musicians' Health Problems: A Psychophysiological Approach

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p0010 The Performing Arts Medicine Association, dedicated to improving the well-being of performing artists, began in the 1983 and now has grown as an international multi-disciplinary organization including physicians, audiologists, psychologists, therapists, performers, educators, researchers, and administrators. The chapters in this book on Hearing Health, Neuromusculoskeletal and Vocal Health, and Psychological Health lay the basic groundwork for clinical assessment of common health problems among musicians.

p0015 Doidge,¹ in his book "the Brain that Changes Itself", made popular the concept of neuroplasticity, that the nervous system is changeable, malleable, or modifiable. He has recently further explored this concept in "the Brain's Way of Healing."² However, when confronted by the extraordinary rates of injury among musicians as published by Ackermann,³ psychological as well as physical risk factors urgently need to be targeted for risk reduction strategies especially early in musical training. For example, in professional orchestras, there is an 84% lifetime prevalence and 50/50 chance of playing hurt. With the refinement of neural imaging and other technology, a growing body of evidence can lead to a greater understanding of the risks to health and interventions to treat or prevent adverse health outcomes. The Musicians' Clinics of Canada was created in 1986 at the request of the Organization of Canadian Symphony Musicians to address the unmet health care needs of musicians in Canada. Chong⁴ reviewed this experience. The Artists' Psychophysiology and Ergonomic Laboratory (APELab) has been constructed to evaluate treatment interventions in ongoing *n*-of-1 clinical trials.

p0020 Many neurological aspects of music making and listening have been outlined in the writings of Jourdain,⁵ Levitin,⁶ and Sacks⁷ exploring the underlying biological structures involved in the neural processing of music. Schlaug⁸ has studied the effect of musical training on the auditory-motor tract called the arcuate fasciculus and shows that the musician has a larger tract

in both hemispheres than in the nonmusician. Zatorre's group (2009)⁹ studied the effects of music on the dopamine binding in the caudate and ventral striatum demonstrating anticipation and experience temporal responses implicated in movement and pleasure. Altenmuller,¹⁰ however, describes the dark side of the increasing specialization and prolonged training in musicians that could result in loss of control and degradation of skilled movement known as focal dystonia. Musical performance continues to be studied, for example, how the activation of the brain networks involved in reward, emotion, and motivation mediates powerful effects on neuroplasticity. Understanding how psychological factors such as anxiety and perfectionist tendencies are implicated in the development of motor control problems is a prioritized area of research. An excellent example of these concepts can be seen in the documentary "Two Hands" where Leon Fleisher¹¹ describes in intimate detail the stress of the life of a concert pianist and then his struggles with focal dystonia.

Coyle,¹² in the Talent Code, identifies three key elements to develop optimal performance—deep practice, ignition, and master coaching by the myelination of neural networks increasing speed and accuracy of movements and thoughts. He describes three rules of deep practice—Rule One: Chunk It Up; Rule Two: Repeat It; and Rule Three: Learn to Feel It. Wolff¹³ stated that the body will adapt to demands or shed, the "use it or lose it" principle. Hebb¹⁴ stated that "when an axon of cell A is near enough to cell B and repeatedly or persistently takes part in firing it, some growth process or metabolic change takes place in one or both cells such that A's efficiency, as one of the cells firing B, is increased" or more simply stated "cells that fire together, get wired together". But then the phenomenon called "mirror neurons" was accidentally discovered while studying the grasping movement of a monkey, which has led researchers such as Iacoboni¹⁵ to explore this in social environments and culture. Theorell¹⁶ in a systematic review of 59 studies evaluating work and

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depressive symptoms found that there was moderately strong evidence for high psychological demands, low decision latitude, and bullying as having significant impact on the development of depressive symptoms. Lesser evidence was shown for psychological demands, effort reward imbalance, low support, unfavorable social climate, lack of work justice, conflicts, limited skill discretion, job insecurity, and long working hours. The juxtaposition of this evidence creates a construct upon which health care professionals and educators can develop clinical and pedagogical environments that foster musical performance excellence or the contrary, high-risk environments for injury and illness.

p0030 Mate¹⁷ in "When the Body Says No—the Cost of Hidden Stress" comes to the following conclusions: (1) Who gets ill and who does not are not random acts of fate, but very much related to our social and emotional lives; (2) Contrary to mainstream medical practice, both ancient wisdom and modern science tell us the mind and body cannot be separated nor can individual humans be separated from their psychological and social relationships; (3) Understanding these unities helps us to maintain or to regain health; and (4) Authentic self-expression is the key—including but not limited to artistic self-expression. Stress is a major factor in the onset of all chronic illness having its origins in emotions resulting in measurable physical events in the body involving the brain, hormone, immune, and other physiological systems. The cumulative experience of adverse childhood, educational, occupational, and personal events creates a chronic stress response that may lead to health effects such as heart disease, stroke, diabetes, cancer, arthritis, multiple sclerosis, and dementia.

p0035 Felitti¹⁸ found that the number of Adverse Childhood Experiences (ACEs) in a study of over 17,000 individuals was strongly associated with adulthood high-risk health behaviors such as smoking, alcohol and drug abuse, promiscuity, and severe obesity, and correlated with ill-health including depression, heart disease, cancer, chronic lung disease, and shortened lifespan. Compared to an ACE score of zero, having four adverse childhood experiences was associated with a sevenfold increase in alcoholism, a doubling of risk of being diagnosed with cancer, and a fourfold increase in emphysema; an ACE score above six was associated with a 30-fold increase in attempted suicide. What neurobiological mechanisms could explain such a strong dose response relationship.

p0040 Selye¹⁹ was the first to demonstrate the existence of biological stress building upon the ideas of Bernard and Cannon's "homeostasis" into the "general

adaptation syndrome" whereby the body copes with stress by activating the hypothalamic–pituitary–adrenal axis (HPA axis) system and then recovers. McEwen²⁰ went further to show that in the face of stressful situations and stimuli, activation of neural, neuroendocrine, and neuroendocrine-immune mechanisms occurred. This adaptation has been called "allostasis" or maintaining stability through change through hormonal mediators of the stress response, cortisol, and epinephrine or adrenaline. However, when the stress is chronic over a long-time period the resulting "allostatic overload" accelerates disease processes by chemical imbalances in the autonomic nervous system, central nervous system, neuroendocrine, and immune systems. Four conditions that lead to allostatic overload are: (1) Repeated frequency of stress responses to multiple novel stressors; (2) Failure to habituate to repeated stressors of the same kind; (3) Failure to turn off each stress response in a timely manner due to delayed shut down; and (4) Inadequate response that leads to compensatory hyperactivity of other mediators. Sapolsky²¹ in the documentary "Stress—Portrait of a Killer" elegantly reviews the effects of allostatic overload and implications for long-term health from prolonged exposure to the stress hormone cortisol where inequalities of rank exist in hierarchical social and environmental structures.

Porges²² explores in the "Polyvagal Theory" the regulation of the autonomic nervous system. This theory outlines the structure and function of the two distinct branches of the vagus nerve that originates in the medulla, both of which are inhibitory in nature via the parasympathetic nervous system (PNS). The vagal system is in opposition to the sympathetic-adrenal "fight or flight" system, which is involved in mobilization of the defense survival response. The dorsal branch of the vagus originates in the dorsal motor nucleus and is considered the older branch. This branch is also known as the "vegetative vagus" because it is associated with primal survival strategies such as freezing when threatened, conserving metabolic resources. The dorsal vagal complex (DVC) provides primary control of subdiaphragmatic visceral organs and maintains regulation of the digestive processes. The ventral vagal complex (VVC) or social engagement system is more sophisticated to modulate behavioral and affective responses to increasingly stressful environments. This branch is also known as the "smart vagus" because it is associated with the regulation of sympathetic nervous system or "fight or flight" system. This VVC regulates the defense survival circuits and provides primary control of supra-diaphragmatic visceral organs, such as the esophagus, bronchi, pharynx, and larynx and the heart. When vagal

tone to the heart is high the vagus acts as a restraint or brake limiting heart rate however when vagal tone is low there is less inhibition to the mobilization of the "fight or flight" response. As the vagus plays such an integral role in the PNS by the regulation of heart rate, the amplitude of respiratory sinus arrhythmia (RSA) is a good index of PNS activity to see how the vagus modulates heart rate activity in response to stress. This creates psychophysiological intervention strategies that could have an enormous potential to protect musicians from the effects of chronic stress.

p0050 The high rates of injuries among musicians have been largely documented by measures of playing-related musculoskeletal disorders (PRMDs) as described in the systematic review of incidence and prevalence by Zaza²³ leading to the widely held belief that ergonomic interventions such as postural correction and modification of technique could reduce the risk of injury. However, Gevirtz²⁴ proposed that sympathetic nervous system (SNS) innervated muscle spindles connects musculoskeletal system to the story of defense survival "fight or flight" responses resulting in myofascial pain and muscle tension. The possibility that there are more than biomechanical risk factors involved in the mechanism of injuries must be considered to provide a comprehensive model for diagnosis, treatment, and prevention.

p0055 Miller²⁵ reviewed the role of inflammation on psychological health problems such as depression (MDD) and as a common mechanism of disease with elevation of inflammatory cytokine production. This elevated production has been linked back to the excitotoxicity of the chronic stress hormone cortisol on the glial cells that are the "glue" of the nervous system responsible for support of the neural networks, process of myelination, and neuro-regulation of the immune system. There are three types of glial cells: (1) astrocytes; (2) oligodendrocytes; and (3) microglia, the latter most responsible for regulation of immune function. Under chronic stress activation the psychopathological process leads to major adverse health consequences and most importantly chronic pain as reviewed by Milligan.²⁶ Loggia²⁷ demonstrated the elevation of a marker of glial activation in patients with chronic low back pain compared to controls that herald a new era in the study of the pathophysiology and treatment of pain and depression.

p0060 Kenny²⁸ found a complex relationship between severity of PRMD and depression in the Australian professional orchestra study. In three groups, there was an association between pain and depression; however, the fourth group denied depression but had the most severe

pain suggesting somatization of their psychological distress. There was also a strong relationship between PRMD severity and music performance anxiety (MPA). These findings are indeed profound and highlight the need to reduce the stress of musical performance, beginning as early as possible in the rehabilitation process. In addition, this evidence points to new treatment targets to ameliorate the effects of chronic stress.

Slavich²⁹ proposes a "social signal transduction theory" of depression whereby situations involving social threat are represented in the central nervous system such as the anterior insula and dorsal anterior cingulate cortex (dACC) that process experiences of negative affect and distress. These connect to lower level subcortical structures such as the hypothalamus and brainstem that influence systemic inflammation by modulating the activity of the HPA axis and SNS increasing production of proinflammatory cytokines and inflammatory responses. Major life stressors especially involving interpersonal stress and social rejection are among the strongest risk factors for depression that elicit profound changes in behavior including depressive symptoms such as sad mood, anhedonia, fatigue, psychomotor retardation, and socio-behavioral withdrawal. The risk to health from adverse cortisol effects from psychologically traumatic events is 22 times, equivalent to the health risks from tobacco and asbestos.

Lanius³⁰ in the text "The Impact of Early Life Trauma on Health and Disease—The Hidden Epidemic" comprehensively examines various aspects of the issue. The connection of parental verbal anger and peer verbal bullying is associated with cortical and subcortical structural abnormalities in the arcuate fasciculus, cingulate, fornix, insula, and superior temporal gyrus shown by diffusion tensor imaging. Offord³¹ constructed the Ontario Child Health Study, which has yielded epidemiological evidence significantly influencing healthcare systems and policy makers. The American Academy of Pediatrics³² issued a policy statement stating that psychological maltreatment is as harmful as physical assault and includes spurning, terrorizing, isolating, exploiting, corrupting, denying emotional responsiveness, and mental health/medical/educational neglect. The film Whiplash³³ written and produced by Damien Chazelle portrays a first-year university jazz drumming student subjected to traumatic stress and abuse by the conductor and teacher. This film graphically illustrates the connection to the above evidence in the music industry and the need to establish policies on healthy boundaries. More recently awareness has increased due to the uncovering of widespread physical, psychological, and sexual abuse in high profile cases.

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p0075 Epel³⁴ studied the effect of chronic stress in a group of mothers of handicapped children and found that psychological elements such as (1) seeing red; (2) rumination; (3) threat to ego; and (4) negative mind wandering, shortened telomere length; 1 year of chronic stress equaled 6 years of biological aging. Telomere length, a measure of cellular aging, is regulated by the enzyme telomerase, and Blackburn³⁵ received the Nobel Prize in Medicine for this research on telomeres. Ornish³⁶ found that comprehensive lifestyle changes such as diet, exercise, stress management, and social support increased telomere length in a group of men with early prostate cancer. The same intervention program has been effective at reversing heart disease. Now much interest in the emerging field of integrative medicine has focused on the evaluation of antiinflammatory diets, development of exercise programs to increase core stability and cardiovascular fitness, the widespread acceptance of mindfulness-based meditation and yoga, and attention to healthy boundaries in interpersonal relationships. If these types of integrative medicine programs with an increased awareness on health and wellness were implemented on a large-scale basis in rehabilitation and music education, a significant positive health impact could be achieved.

p0080 Solovitch,³⁷ in a heartfelt account of her story "Playing Scared" as a gifted pianist struggling with MPA, underscores the need to recognize and treat musician health problems early to prevent dropping out of music education and to suffer a lifelong loss of the pleasure to perform music in public. LeDoux,³⁸ one of the foremost researchers in psychological health has put forward the premise that fear and anxiety are not innate states waiting to be unleashed from the brain in response to threatening stimuli but instead experiences that are assembled cognitively from the psychophysiological responses of the body. This has enormous implications for treatment and prevention in that interventions must address both conscious and underlying unconscious processes of anxiety and harness the powers of neuroplasticity. He posits that feelings and working memory are made from a soup of ingredients including (1) executive function such as attention, monitoring, labeling, and attributing; (2) memory including semantic, episodic, autobiographical, and implicit; (3) body response feedback including behavioral and physiological; (4) brain arousal; (5) survival circuit activity; and (6) sensory processing. The driving force of defensive responses and supporting physiological responses in the brain and body is the amygdala; which accelerates the response. The ventromedial prefrontal cortex (VMPFC) is the brake on these responses. By understanding the neural

circuitry of threat memories involving the VMPFC, hippocampus and amygdala, the conditioning and extinction of defense survival responses becomes possible. The development of extinction techniques to enhance exposure therapy effectiveness will become useful in reducing the chronic stress from musical performance and traumatic events that may occur during music education and competition. How music students at risk from chronic stress will be identified early for these interventions will be an enormous challenge for clinicians and music educators.

Van der Kolk³⁹ in the most comprehensive text to date "The Body Keeps the Score" reviews some of the neurobiological evidence in treating trauma survivors from combat veterans, victims of accidents and crimes, those touched by the hidden toll of sexual and family violence, and communities and schools devastated by abuse, neglect, and addiction. Crucial in the healing from trauma is the presence of safe and secure attachments mediated by oxytocin and the provision of treatments based on restoring the capacity of the body and mind to self-regulate. Interventions such as cognitive behavioral therapy (CBT) and eye movement desensitization and reprogramming (EMDR) are proposed interventions. Yoga shows enormous promise as a treatment as well as a modality to prevent the deleterious effects of chronic stress and to improve resilience. It is possible that biofeedback interventions including surface electromyography (sEMG), heart rate variability, and neurofeedback will form the foundation for trauma treatment in the future. Ogden⁴⁰ similarly reviews the neurobiological evidence upon which to design a treatment approach based on sensorimotor techniques to down regulate defensive survival responses and to upregulate neural networks to create safety and integration of somatic stabilization with self and attuned relationships. Siegel⁴¹ has been enormously influential in creating "interpersonal neurobiology", a framework for maintaining mental health and well-being by promoting secure attachment, mindfulness meditation, and effective psychotherapy. Ongoing trials of various forms of meditation as described by Epel⁴² may provide evidence of slowing the rate of cellular aging. Given that effective treatments are available based on these neurobiological mechanisms the challenge for the music industry and educators is to design referral systems to identify musicians at risk and provide access to interventions for healing.

Williamon⁴³ in "Musical Excellence" reviews some ground rules for achieving musical excellence, examines effective and efficient practice methods, and then introduces methods for enhancing musical achievement.

Although the goal of musical training is to optimize strategies to maximize performance, reducing the risks of illness and injury is of paramount importance. Some of the techniques such as physical fitness, Alexander technique, biofeedback and neurofeedback, mental skills training, and cognitive feedback may have some benefit to enhance resilience of the musician under chronic stress; however, more needs to be done to identify those at risk and to make treatment accessible. Kenny⁴⁴ comprehensively examines MPA with various conceptualizations of the problem and continues to examine various treatment approaches. Although there may be effective treatments for MPA, those students at risk must be identified early and have access to effective and efficient treatment modalities.

p0095 Morton⁴⁵ in "The Authentic Performer—Wearing a Mask and the Effect on Health" examines the connection between authenticity and health, being an authentic performer, perseverance or abuse in training, and the relationship between body language and creating balance with authenticity, which are germane to creating a safe environment in the performing arts industry education as well as pursuing artistic excellence. The US Preventive Services Task Force⁴⁶ has released recommendations on the benefits and harms of screening for depression. Screening should be implemented with adequate systems in place to ensure accurate diagnosis, effective treatment, and appropriate follow-up. Tuning the music industry and educational environment to listen for both physical and psychological health problems will require the education of musicians in these issues and will create a conversation of what methodology could be implemented to address the early recognition of musicians at risk.

p0100 This body of evidence can now be utilized to create a psychophysiological approach for treatment in musician rehabilitation and prevention utilizing quantitative measurement technology. Although Performing Arts Medicine is a relatively new field of endeavour compared to Sports Medicine, the medical problems of performing artists are alarming common and career threatening. Medical problems of performing artists require specialized clinical and educational interventions targeted at populations exposed to highly stressful activities and environments. Since 1986 the Musicians' Clinics of Canada has treated over 10,000 musicians with muscle fatigue, anxiety, depression, nerve entrapments, and various stress-related medical conditions. The acronym MADNESS—muscle fatigue, anxiety, depression, nerve entrapments, and stress syndromes—encompasses the spectra of observed

medical phenomenon and creates the possibility for targeted treatment interventions.⁴⁷ In Canada healthcare services are universal, accessible, and portable across the provinces, except Quebec, allowing the performing artist to seek medical consultations and obtain treatment interventions for their occupational health problems.⁴⁸

Specific risk factors that have been identified⁴⁹ are as follows:

- Long practice sessions u0010
- Insufficient rest u0015
- Excess muscle tension u0020
- Poor posture u0025
- Muscle fatigue u0030
- Sudden increase in playing u0035
- Repertoire scheduling u0040
- Stress u0045
- Lack of fitness u0050
- Insufficient warm-up u0055

The focus of the earlier versions of the Musicians' Clinics of Canada from 1990 to 1996 were ergonomic interventions such as posture, tension, force, support, duration, repetition, technique, recovery, strength, fitness, and size. These concepts are common in occupational and sports medicine however do not on their own explain the extremely high injury rates and extent of impairment and disability of performing artists.

In 1996 the clinic expanded to include assessment of psychophysiology and explored techniques to reduce the effects of chronic stress following ABCDEFG paradigm:

- ALIGNMENT u0060
- BREATHING u0065
- COORDINATION u0070
- DIET u0075
- EXERCISE u0080
- FOCUS u0085
- GOALS u0090

The following elements were added as quantitative measurement technology was developed and evidence-based interventions were refined for clinical practice. A detailed review of each of these methods is beyond the scope of this chapter⁵⁰ but briefly are summarized as follows:

Surface Electromyography measures electrical signals generated by neuromuscular recruitment of muscles with wireless sensors to assess fatigue, power spectrum, and power output during musical performance. This allows the modification of ergonomic factors that relate to excessive force, duration, repetition, and technique. u0095

Motion Analysis examines postural alignment and dynamic movements during musical performance u0100

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objectively measuring factors that may create excessive biomechanical loads on anatomically vulnerable structures.

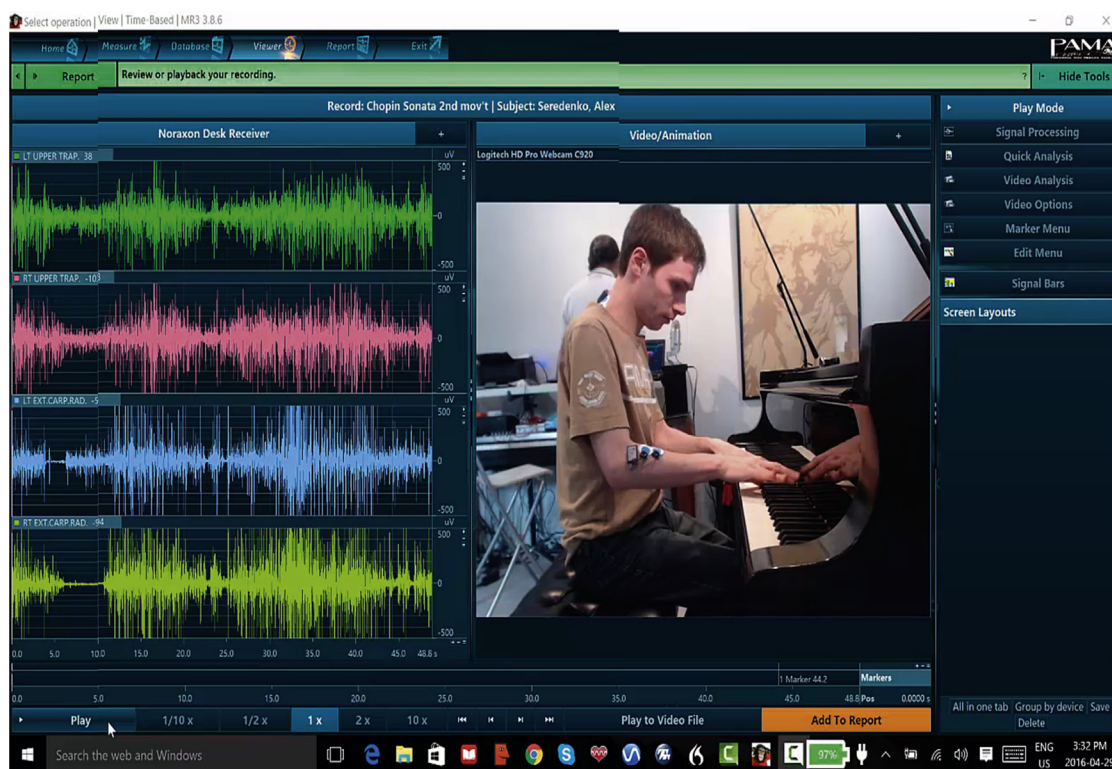
- u0105 **Audio/video Feedback** is crucial during the process of synchronizing the musical performance to muscle and movement data recorded in real time and available for playback analysis.
- u0110 **Heart Rate Variability (HRV) Analysis** before, during, and after musical performance can examine the balance of the sympathetic and parasympathetic nervous system.
- u0115 **Neurofeedback Analysis** measures the frequency of brain waves from very low to high frequencies to tune the mind–body connection into the zone of calm focus.
- u0120 **Psychotherapy Techniques** such as mindfulness based stress reduction (MBSR), CBT, and psychodynamic therapy (PT) form the building blocks to down-regulate the effects of chronic stress related to performance and the artistic lifestyle.
- u0125 **Acupuncture Techniques** can deactivate trigger points that are created by excessive stimulation from the

sympathetic nervous system and ergonomic biomechanical imbalances.

Medications can be prescribed to modify or regulate neurotransmitter and hormonal regulation problems created by chronic stress.

Specific psychophysiological and ergonomic parameters can be measured with state-of-the-art biofeedback technology to allow the performing artist and clinician to collaborate in a problem-solving methodology. By seeing and feeling how these objective measurements relate to performance health problems, awareness of risk factors such as alignment, breathing, and coordination create possibilities for restoration of autonomic regulation and homeostasis. Lifestyle modifications related to diet, exercise, focus, and goals are integral to reverse the effects of biological aging and to increase multisystem resilience outcomes. In 2015 the creation of the APELab allows an N-of-1 strategy⁵¹ to evaluate performance-related health problems and interventions that increase an individual's resilience.

The following case example illustrates the integrative approach to management and prevention:



f0010

Chopin Piano Sonata No. 2B flat minor second movement sEMG video/audio analysis APELab MC2.

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p0260 Alex "the Gr88!" Seredenko, concert pianist graduate of the Artist Diploma Program Glenn Gould School, was referred at age 21 in 2008 to MC2 for playing-related pain in the neck, back, and upper extremities. He was born in Moscow, started playing piano at age 3, and settled in North Toronto. He has been under intense family pressure to make it and live up to the legacy of the great Russian pianists. Quantitative analysis of neuromuscular function utilizing sEMG techniques showed dramatic fatigue response in the left greater than right forearms. Psychological assessment was consistent with a diagnosis of musician performance anxiety with major depression and posttraumatic stress disorder (PTSD).

p0265 The initial treatment plan included a noninflammatory diet, moderate aerobic exercise, learning multimodal stress reduction techniques, enhanced restorative sleep, mindfulness-based cognitive psychotherapy, and the medication pregabalin 75 mg at bedtime. Further medications were added to control the pain and depressive symptoms: nabilone 0.5 mg at bedtime and duloxetine 30 mg in the morning with an increase in pregabalin to 150 mg at bedtime.

p0270 A psychodynamic approach to rewrite the trauma narrative of ACEs emphasizing interpersonal boundaries, safe attachments, and trauma desensitization techniques was used. A nonjudgmental harm reduction approach to substance use of alcohol, tetrahydrocannabinol (THC), stimulants, and opiates was taken. Psychotherapy sessions addressed multiple stressors including financial instability, relationship breakups, and music competition anxiety. In depth, reflections on the life of Glenn Gould and an exploration of the history of great Russian pianists were undertaken to address the intense peer competition and parental pressure to succeed. Very strict monitoring of practice routine behavior using an iPad app revealed a cumulative piano performance load approximately 22,000 h.

p0275 With control of the PRMD, MPA, and major depressive disorder/PTSD symptoms, he was able to win the Canadian Chopin competition and prestigious Rebanks Scholarship at the Glenn Gould School with numerous international competitions lined up. Follow-up treatment included monthly sessions in APELab to prevent relapse, create resilience under performance pressure, and taper the medications as necessary. Diversification of career goals was necessary due to the scarcity of funding and performance opportunities for young Canadian performing artists.⁵²

[AU1]

p0280 In 2009 the Dean of the Glenn Gould School at the Royal Conservatory in Toronto made a request to create the "Performance Awareness" course, which is

mandatory for all Performance Diploma and Artist Diploma students. Basic mechanisms of performance-related stress on health are covered in detail followed by interactive demonstrations of techniques to measure and reduce specific risk factors related to performance related injury and illness. The application of targeted psychophysiological interventions is formulated and evaluated with objective outcomes for each student. Long-term outcomes of the course are being evaluated. Moreover, further educational collaboration with the National Youth Orchestra of Canada and Toronto Summer Music Festival is ongoing during the summer months to continue the effort of injury prevention on a national basis. University Faculties of Music are now starting similar courses to address this urgent need.

Other organizations interested in performing arts medicine began working with PAMA with an international initiative called PAMAForte with the following goals:

- Promoting the highest quality of care to all performing artists and bringing to that care an appreciation of the special needs of performing artists. u0135
- Developing educational programs designed to enhance the understanding and prevention of medical problems related to the performing arts. u0140
- Promoting communication among all those involved in the healthcare and well-being of performing artists. u0145
- Fostering research into the etiology, prevention, treatment, and rehabilitation of medical problems of performing artists. u0150

Progress thus far includes the following: international leadership and collaboration, social media development and sharing, development of more regional meetings, highlighting the annual symposium with the Aspen Music Festival and School, partnerships with the International Association of Dance Medicine and Science, American College of Sports Medicine, National Association of Schools of Music, Music Teachers National Association, National Athletic Trainers Association, and others. This culminated in the first International Congress in Performing Arts Medicine in New York City in 2016. A Task Force on Psychological Health published a series of State of the Art Reviews that are available on the PAMA website at artsmed.org.⁵³ p0310

This chapter on the psychophysiological approach to musicians' health problems provides strong evidence for clinicians and music educators to implement (1) primary prevention strategies to educate musicians and the music industry about psychophysiological health risks and implement mandatory stress reduction interventions; (2) secondary prevention strategies to create p0315

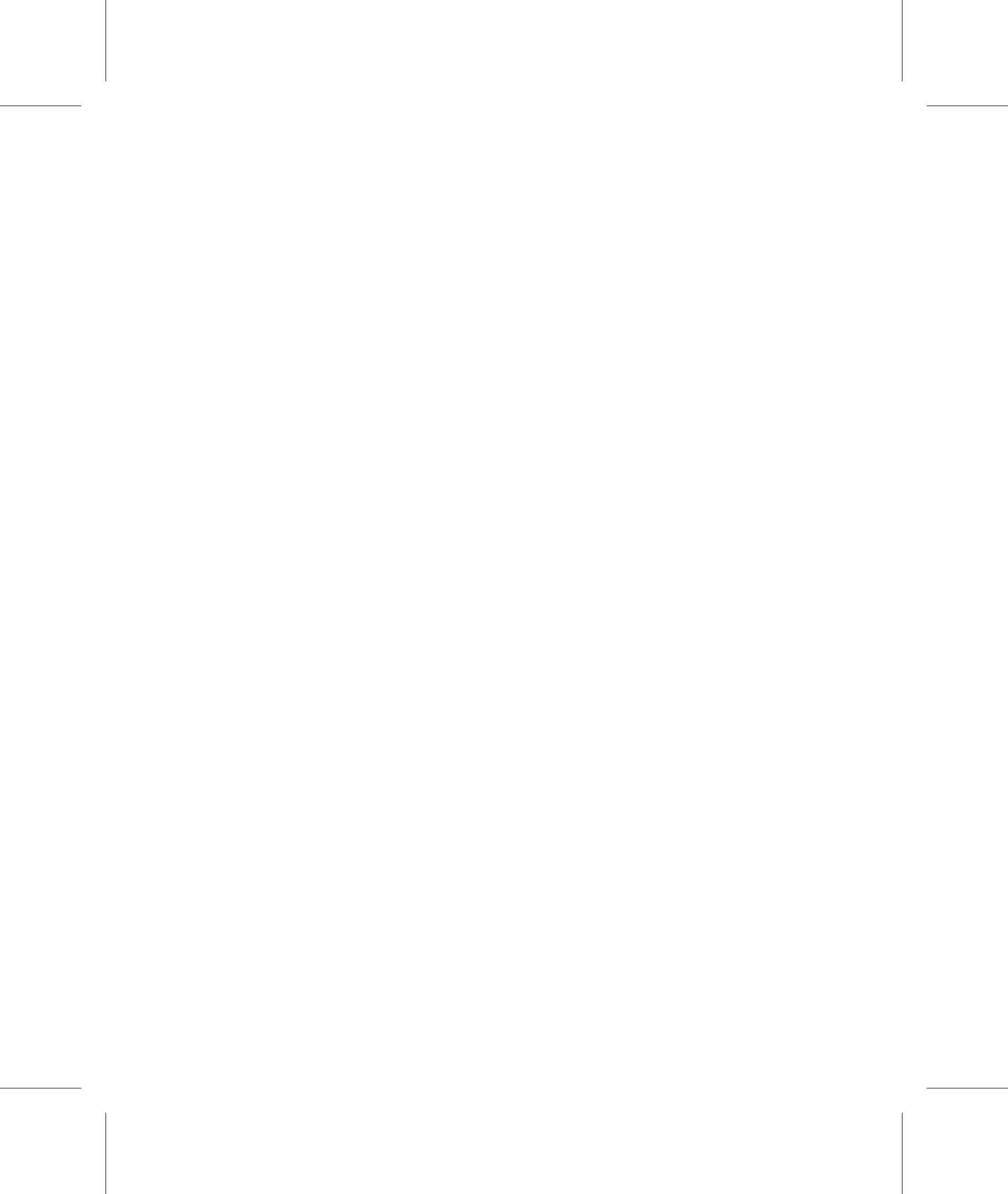
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systems for early detection such as screening for psychophysiological health problems among musicians, especially those at risk; and (3) tertiary prevention strategies to provide access to effective and efficient treatment of psychophysiological health problems among musicians. The collective contributions by authors of this book will further elucidate issues of key importance and provide more relevant evidence to effect change and to protect the psychophysiological health of musicians.

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Non-Print Items**Abstract**

This chapter will review scientific evidence essential for treatment and prevention programs for musicians' health. This body of evidence can now be utilized to create a psychophysiological approach for treatment in musician rehabilitation and prevention utilizing quantitative measurement technology. Medical problems of performing artists require specialized clinical and educational interventions targeted at populations exposed to highly stressful activities and environments. Since 1986 the Musicians' Clinics of Canada has treated over 10,000 musicians with playing-related musculoskeletal disorders (PRMD), performance anxiety (MPA), depression (MDD), nerve entrapments, and various stress-related medical conditions. Specific psychophysiological and ergonomic parameters can be measured with state-of-the-art biofeedback technology to allow the performing artist and clinician to collaborate in a problem-solving methodology. A case example illustrates the integrative approach to management and prevention. This approach to musicians' health problems provides strong evidence for clinicians and music educators to implement (1) primary prevention strategies to educate musicians and the music industry about psychophysiological health risks and implement mandatory stress reduction interventions; (2) secondary prevention strategies to create systems for early detection such as screening for psychophysiological health problems among musicians, especially those at risk; and (3) tertiary prevention strategies to provide access to effective and efficient treatment of psychophysiological health problems among musicians.

Keywords:

Biofeedback; Ergonomics; Musicians' health; Prevention; Psychophysiology; Rehabilitation; Treatment.