Holistic Health and the Prevention of Performance-Related Musculoskeletal Disorders in Orchestral String Musicians

by

F. Lynn Kuo

A thesis submitted in conformity with the requirements for the degree of Doctor of Musical Arts
Faculty of Music Graduate Department
University of Toronto

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Abstract

Professional orchestral string musicians represent a population at risk for performance-related musculoskeletal disorders (PRMD). Research literature suggests the influence of stress in the incidence of work-related and performance-related musculoskeletal disorders. The purpose of this study was to qualitatively investigate the role of holistic health (physical, mental, emotional, spiritual, and social) and stress management in the prevention of PRMDs in professional orchestral string musicians. Five musicians representing different instruments, genders, and PRMD histories were recruited and sorted from a single professional orchestra in Canada. This study combined quantitative data—in the form of basic demographic information and a Health and Well-being Assessment—with qualitative interview data. This combined data provided a focused, in-depth view of typical instances in the professional orchestral string population. The musicians reported a variety of occupational and non-occupational risk factors, as well as a range of intrinsic risk factors. They also reported a variety of PRMD prevention strategies and lifestyle behaviours. The musicians in this study provide evidence that stress may play a mediating role in PRMDs and that the management of biomechanical and psychosocial stressors through holistic health practices may positively influence the incidence, severity, and treatment of PRMDs in orchestral string musicians. This dissertation recommends that increased awareness and education in holistic health practices be encouraged for the purpose of improved PRMD prevention in professional orchestral string musicians.
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Chapter One: Introduction

Introduction
Performing musicians form a relatively under-represented and only recently acknowledged population in the occupational health literature (Morse et al., 2000; Ro, 2006). Musicians, aptly compared with athletes, are frequently required to perform under pressure, dedicating long periods of focused physical and mental training that require repetitive motions and acute concentration. Regular, structured practice and training often culminate in performance under extreme conditions (e.g., public performances, evaluations, and competitions), which are often perceived as stress inducing. A considerable body of research exists in sports medicine and occupational health literature that studies the nature of stressors and work-related injuries that athletes and other workers experience in their occupations.

Performing arts medicine is, in comparison, a relatively new but quickly growing area of research. The literature on performance-related injuries (PRI) has demonstrated that injury risk (Ro, 2006) and injury prevalence are high among musicians (Fishbein, Middlestadt, Ottati, Straus, & Ellis, 1988; Heinzle, 2001; Zaza, 1998). String instrumentalists have been shown to be particularly at risk (Middlestadt & Fishbein, 1989; Ro, 2006). Current trends in literature acknowledge the role of stress on PRIs (Dietrich, Abbott, Gartner-Schmidt, & Rosen, 2008; Ro, 2006; Yoshie, Kazutoshi, & Ohtsuki, 2008), as well as holistic approaches in the prevention (Chesky, Dawson, & Manchester, 2006), etiologic investigation (Hagglund & Jacobs, 1996), assessment and treatment (Guittill & Golem, 2008; Quentzel & Loewy, 2010a) of musicians’ PRIs.
The research literature on performance-related musculoskeletal disorders (PRMD) has primarily focused on epidemiological data of a quantitative nature, while qualitative information on musicians’ PRIs has been relatively scarce. As will be discussed in Chapter Two: Literature Review, there are few studies that qualitatively address musicians’ PRMDs through the investigation of the lived experience of professional orchestral string musicians. To this researcher’s knowledge, there are also no studies that qualitatively discuss PRMD prevention under the framework of holistic health and stress management. It is thus the aim of this study to gain further understanding of the needs and experiences of professional orchestral string musicians through their rich, in-depth narrative accounts, and to holistically portray the complex, multi-factorial roles of integrative health and well-being practices (i.e., physical, mental, emotional, spiritual, and social) and stress management on PRMD prevention.

Chapter Overview

The sections in Chapter One will be presented as follows:

- Definition of PRMD
- Index of Abbreviations
- Statement of Problem
- Rationale for Research
- Purpose of Research
- Benefits of Research
- Limitations and Delimitations
- Qualifications
- Structure of Dissertation

Definition of PRMD

Performance-related injuries (PRI) have been variably classified and labeled in the literature as
overuse syndrome (Hunter & Fry, 1986), overuse injuries (Dawson, 2006), repetitive traumas (Akel & Düger, 2007), performance-related injuries (Burkholder & Brandfonbrener, 2004), musculoskeletal injuries (Robinson, Zander, & BC Research, 2002), and the more recent term neuromusculoskeletal injuries (Rardin, 2007).

Generally categorized under three main categories, musicians’ PRIs consist of musculotendinous overuse, nerve entrapment/thoracic outlet syndromes, and motor dysfunctions (Akel & Düger, 2007). PRIs are predominantly musculoskeletal in nature and often in the upper-extremities (Burkholder & Brandfonbrener, 2004; Ro, 2006). PRIs may also include playing-related problems such as hearing loss and neurological disorders (e.g., Dupuytren’s contracture and focal dystonia). For the purposes of this research, only performance-related musculoskeletal disorders (PRMD) will be addressed, excluding injuries that are not specifically defined as musculoskeletal in nature. This dissertation will assume the definition for PRMDs set by Kenny, Cormack, and Martin (2009):

…any pain, weakness, numbness, tingling, loss of dexterity, loss of flexibility, or diagnosed injury or any other symptoms that interfere with your ability to play your instrument… at the level to which you are accustomed. This definition does not include mild short-lived aches or pains. (p. 26)

Index of Abbreviations

**PRI**: performance-related injury

**PRMD**: performance-related musculoskeletal disorder

**MSD**: musculoskeletal disorder

**RSI**: repetitive strain injury

**WRMD**: work-related musculoskeletal disorder
**Statement of Problem**

As discussed in Chapter Two: Literature Review, there has been relatively little qualitative discussion of PRMDs involving the in-depth investigation of professional orchestral string musicians. The epidemiology of musicians’ PRMDs is well documented, providing mainly quantitative and focused investigation on the subject of musicians’ health. Qualitative data investigating the in-depth nature of experiences, behaviours, and perspectives of musicians on PRMDs are relatively scarce in the literature, being represented by such researchers as Guptill (2010); Guptill and Golem (2008); Hagglund and Jacobs (1996); Park, Guptill, and Sumsion (2007); and Zaza, Charles, and Muszynski (1998).

In 2008, Guptill conducted a review of 131 papers in the musicians’ health literature between the years of 1998 and 2005, basing her criteria on the World Health Organization’s *International Classification of Functioning, Disability, and Health* (ICF). She concluded that the domain body structure and function was well addressed in the literature while the areas of environmental factors (e.g., environment, prevailing social attitudes, support and relationships), personal factors (e.g., lifestyle, coping styles, overall character and behaviour), and the domain of participation (i.e., involvement in the life situation of musicians) were under-represented. Guptill (2008) stated that these gaps in the literature have led to insufficiencies in effective and evidence-based health care for musicians. Acknowledging these insufficiencies, it is also noted that no study exists that addresses PRMD prevention under the framework of holistic (physical, mental, emotional, spiritual, social) health and stress management.

**Rationale for Research**

The rationale for this research is explained according to three main areas, namely (a) to focus investigation on professional orchestral string musicians, (b) to assume a holistic approach in the
assessment and prevention of PRMDs, and (c) to undertake a qualitative research method.

Focus on professional orchestral string musicians.

Research has demonstrated that orchestral musicians are a population particularly at risk for PRMDs (Fishbein et al., 1988; Heinzle, 2001; Ro, 2006). In particular, string instrumentalists have been noted for their high PRMD risk and prevalence (Middlestadt & Fishbein, 1989; Ro, 2006). It is thus the focus of this study to investigate the specific needs, opinions, and experiences of professional orchestral string musicians. It has been noted in previous literature (Guptill, 2010), that there is a general reluctance among musicians to openly discuss their PRMDs out of fear of professional and social consequences. This study thus provides an opportunity for musicians to candidly and anonymously discuss their PRMD experiences.

Holistic approach.

Performing arts health researchers have advocated for the necessity of a holistic approach in the assessment and prevention of musicians’ health issues through emphasizing wellness and personal responsibility for healthy behaviours (Chesky et al., 2006; Quentzel & Loewy, 2010a; Quentzel & Loewy, 2010b; Watson, 2009). This integrative philosophy, i.e., a ‘bio-psycho-social model,’ is assumed at the Louis Armstrong Center for Music and Medicine in the Beth Israel Medical Center in New York City where clients are comprehensively assessed for their medical, psychiatric, and musical background information (Quentzel & Loewy, 2010b). As Ray (2004) states: “This new approach to health says loudly and clearly that the causes, development, and outcomes of an illness are determined by the interaction of psychological, social, and cultural factors with biochemistry and physiology” (p. 29). This holistic approach provides the philosophy on which this study is based: to comprehensively investigate the integrated elements of the musician’s body, mind, emotion, and spirit. Through a qualitative and integrative
approach, it is the aim of this study to avoid the isolation of physical symptoms, biomechanical factors, psychological factors, emotional factors, and spiritual human experience, which is often the case with reductive quantitative studies.

**Qualitative approach.**

Due to its relative scarcity in the research literature, a qualitative approach is assumed for this study, particularly as it has been noted that there is a limited understanding among healthcare professionals of the specific needs and lived experiences of musicians (Park et al., 2007). This study aims to provide rich, in-depth accounts of insiders’ perspectives in order to provide insightful information with which healthcare and music professionals may devise effective diagnosis, treatment, and prevention strategies. The value of a qualitative approach is aptly summarized by Guptill and Golem (2008) who state that: “Perhaps the most valuable contributions from the literature on musicians’ playing-related injuries are the anecdotes from seasoned practitioners about how to approach effective care” (p. 310).

**Purpose of Research**

The purpose of this study was to (a) present a qualitative investigation of typical instances in a sample professional orchestral string population regarding PRMD prevention, holistic health, and stress management; (b) holistically portray the complex, multi-factorial roles of holistic health and stress management on PRMD prevention; (c) gain further understanding of the behaviours, opinions, and experiences of professional orchestral string musicians through their rich, in-depth narrative accounts; and (d) give voice to a marginalized population traditionally reluctant to discuss PRMDs.

The study attempts to gather and discuss data under the framework of the following questions:

- What role does holistic health and well-being play in stress management for professional
orchestral string musicians?

- How does stress management influence PRMD occurrence, treatment, and prevention in professional orchestral string musicians?
- What are the behaviours, attitudes, and opinions of professional orchestral string musicians regarding holistic health and PRMD incidence, treatment, and prevention?

**Benefits of Research**

It is hoped that the findings of this study will (a) provide musicians with an opportunity to voice their personal experiences and opinions on PRMDs without fear of professional or social consequence; (b) provide an insightful portrayal of insiders’ perspectives of the complex factors surrounding musicians and PRMDs in order to (c) increase knowledge and provide better understanding of orchestral string musicians’ lived experiences and opinions on PRMDs, holistic health and stress management; and (d) provide music professionals, students, teachers, orchestra management, and health care practitioners with insightful information with which to devise effective PRMD treatment and prevention plans, orchestra management policies, and teaching strategies.

**Limitations and Delimitations**

This research study focused on a subset of musicians, i.e., a group of selected professional orchestral string instrumentalists. It was the aim of this study to qualitatively investigate the backgrounds, opinions, and lived experiences of this selected population sample. It was not the intent of this research to derive evidence-based conclusions from a large sample size or to find correlations between holistic health lifestyle behaviours, stress management, and PRMD prevention that may be generalized to the larger music population. Rather, this study served as a presentation of rich qualitative data on professional orchestral string musicians collected and presented from the perspective of a fellow professional orchestral musician and concert violinist.
Due to the qualitative nature of this study, researcher bias and subjectivity are acknowledged, as they are commonly accepted to be inherent in this method of research. In addition, despite efforts to ensure cross-representation in the population sample, self-identification and self-selection of interview candidates played a mediating role in the study’s findings.

**Qualifications**

As a full-time professional concert violinist and orchestral musician, I have had personal experience with PRMDs, first-hand experience of the music occupation’s stressors, and have closely observed fellow musicians’ experiences with PRMDs. From this perspective, I was able to provide an insider’s point of view for this research study, which otherwise might not have been available to health care professionals or occupational health workers.

My own experience with PRMDs was not unlike those described in the case studies, and due to my first-hand experience with the subject matter and the conversational nature of the methodological approach, trust and sense of familiarity were important factors in the study’s data collection process. My inherent understanding of the case studies’ experiences provided the interview participants with a peer-to-peer based trust and understanding.

Being integrated with the music profession also enabled me to efficiently facilitate the recruitment of suitable candidates for the research study. My knowledge of musicians’ habits, attitudes, behaviours, and occupational practices also allowed me to effectively communicate with the study population, as well as solicit and interpret their described experiences.

**Structure of Dissertation**

The dissertation is structured in six chapters. This Chapter One: Introduction has provided an
introduction and general overview of the research study. Chapter Two reviews related research literature discussing the background of PRMDs in the music occupation, the role of stress on PRMDs, and its relationship to holistic health and well-being (physical, mental, emotional, spiritual, and social). Chapter Three describes the methodology used to undertake the research. Chapter Four presents the findings of the five case studies while Chapter Five presents a discussion of the study findings. Chapter Six presents the study’s conclusions and recommendations.
Chapter Two: Literature Review

To provide a background for this research study, the literature review in Chapter Two gives a brief overview of the history and development of the performing arts health literature. This chapter also reviews the literature concerning stress and its relationship to work-related and performance-related musculoskeletal disorders. Following this is a discussion of literature on holistic health and well-being, its relationship to PRMD prevention, related methodologies summary.

History and Survey of PRMD Literature

Performing arts health exists as a relatively new branch of medicine for which systematic, scholarly investigation began in the 1980’s (Brusky, 2009; Dommerholt, 2009; Guptill, 2010; Park et al., 2007; Rardin, 2007). The modern investigation of performing artists’ medical problems was largely prompted by the public accounts of concert pianists Leon Fleisher (b. 1928) and Gary Graffman (b. 1928) and their experiences with focal dystonia (Brusky, 2009). In 1986, the first volume of the journal Medical Problems of Performing Arts (MPPA) was published presenting research on the subject of performing arts health (Brusky, 2009; Guptill, 2008). Since then, other peer-reviewed publications that have also featured research on this subject have included Music and Medicine, Psychology of Music, and non-music related journals such as Applied Psychophysiology and Biofeedback; Canadian Medical Association Journal; Health Education; Journal of Individual Difference; Journal of Occupational Medicine; Medical Science Monitor; and Work: A Journal of Prevention, Assessment and Rehabilitation.

The performing arts health literature has also included textbook, resource guide, and internet-published contributions on PRMD prevention (Andrews, 2005; Bishop, 1991; Grindea 1995;
Horvath, 2009; Jameson, 2004; Paull & Harrison, 1997; Robinson, Zander, & BC Research, 2002; Rosset i Llobet & Odam, 2007). Specific instrumentalist categories have been addressed which have included percussionists (Workman, 2006), bass players (Kertz, 2005), brass players (Lewis, 2005), and singers (Maran, 2005). Related topics of discussion have also included the role of nutrition in the prevention and treatment of PRMDs (Pirtle & Fallon, 2006).

**Epidemiology.**

In the rapidly growing body of performing arts health literature, the epidemiology of performance-related injuries is well documented. Epidemiological studies on PRMDs have described their nature (Fishbein et al., 1988), incidence (Hunter & Fry, 1986), prevalence (Abréu-Ramos & Micheo, 2007; Chesky, Devroop, & Ford, 2002; Fishbein et al., 1988; Thrasher & Chesky, 2001; Zaza, 1998), etiology (Davies & Mangion, 2002; Fjellman-Wiklund, Brulin, & Sundelin, 2003; Hagglund & Jacobs, 1996; Ro, 2006; Wu, 2007; Yoshimura, Fjellman-Wiklund, Paul, Aerts, & Chesky, 2008; Zaza & Farewell, 1997), as well as management and prevention (Rardin, 2007).

Research studies have also focused epidemiological investigation on specific musician populations such as percussionists (Sandell, Frykman, Chesky, & Fjellman-Wiklund, 2009), double reed players (Thrasher & Chesky, 2001), bassoonists (Brusky, 2009), string players (Middlestadt & Fishbein, 1989), flautists (Spence, 2001), keyboard players (Yoshimura et al., 2008), brass players (Chesky et al., 2002), guitarists (Fjellman-Wiklund & Chesky, 2006), music teachers (Fjellman-Wiklund et al., 2003; Yoshimura et al., 2008), singers (Dietrich et al., 2008), and student musicians (Akel & Düger, 2007; Burkholder & Brandfonbrener, 2004; Guptill, Zaza, & Paul, 2000).
Research has demonstrated that the prevalence of PRMDs in musicians is high (Abréu-Ramos & Micheo, 2007; Fishbein et al., 1988; Heinzle, 2001; Morse, Ro, Cherniack, & Pelletier, 2000; Zaza, 1988). Fishbein et al.’s (1988) landmark survey of 2212 members of the International Conference of Symphony and Opera Musicians (ICSOM) found that 76% of musicians experienced a medical problem severe enough to disrupt performance. A systematic review of 24 studies revealed that between 39% and 87% of adult musicians have PRMDs (Zaza, 1998). A pilot population study of 954 musicians concluded that playing a musical instrument ranks second only to computer use in terms of population exposure to musculoskeletal injury risk (Morse et al., 2000). In a survey of 230 orchestral musicians, two-thirds reported experiencing an injury severe enough to cause work stoppage for over a week (Heinzle, 2001). A 2006 study of PRMD risk factors in 255 professional performing musicians from the music unions of San Francisco and Hawaii concluded that orchestral musicians were especially at risk for musculoskeletal symptoms, and particularly of the upper-extremity variety (Ro, 2006). This study further concluded that upper string instrumentalists had higher exposures to physical risk factors to the upper-extremities and had a higher prevalence of musculoskeletal symptoms (Ro, 2006).

A general consensus in the literature acknowledges that females (Abréu-Ramos & Micheo, 2007; Brusky, 2009; Dietrich et al., 2008; Heinzle, 2001; Middlestadt & Fishbein, 1989; Wu, 2007) and upper-string players (Middlestadt & Fishbein, 1989; Rardin, 2007; Ro, 2006; Wu, 2007) appear to be particularly at risk for PRMDs. From these statistics, it is clear that musicians represent a population highly at risk for PRMDs, which can negatively affect work performance and productivity.
Etiology.

Etiological studies have discussed PRMD risk factors in performing musicians (Davies & Mangion, 2002; Fjellman-Wiklund et al., 2003; Hagglund & Jacobs, 1996; Ro, 2006; Wu, 2007; Yoshimura et al., 2008; Zaza & Farewell, 1997), and have included investigations on the effect of stress in singers (Dietrich et al., 2008) and on pianists (Yoshie, Kudo, & Tatsuyuki, 2008). Other variables studied have included personality factors (Allread, 2000; Levy, Lounsbury, & Kent, 2009) as well as psychosocial risk factors in student musicians (Akel & Düger, 2007).

PRMD risk factors.

Numerous PRMD risk factors have been variously classified in the literature. Extrinsic PRMD risk factors may be categorized as occupational or non-occupational. Occupational risk factors that have been identified in research and anecdotal literature have included environmental aspects such as temperature, equipment (layout and configuration), layout and size of space (Horvath, 2009), and lighting (Abréu-Ramos & Micheo, 2007; Horvath, 2009; Wu, 2007). Physical demands may include instrument type (Abréu-Ramos & Micheo, 2007; Wu, 2007), non-neutral body postures (Jameson, 2004; Punnett & Wegman, 2004), vibration (Punnett & Wegman, 2004), rapid work pace (Punnett & Wegman, 2004), repetitive motion (Punnett & Wegman, 2004), forceful exertions (Punnett & Wegman, 2004), playing duration and insufficient recovery time (Horvath, 2009; Jameson, 2004; Ro, 2006; Wu, 2007), mechanical pressure concentrations (Ro, 2006), and cold (Ro, 2006).

Non-occupational risk factors that have been identified in the research and anecdotal literature include domestic stress (Andrews, 2005; Horvath, 2009) as well as intrinsic individual factors such as gender (Abréu-Ramos & Micheo, 2007; Wu, 2007), years of playing experience (Wu,
2007), age (Abréu-Ramos & Micheo, 2007; Akel & Düger 2007), fitness level/conditioning (Abréu-Ramos & Micheo, 2007; Horvath, 2009; Robinson et al., 2002), physical health condition (e.g., disease, pregnancy, etc.; Jameson, 2004), negative thought patterns, (Jameson, 2004), personality factors (Allread, 2000; Levy et al., 2009), and physical characteristics (e.g., body size/build, joint laxity; Horvath, 2009). Other variables that have also been reported anecdotally as PRMD risk factors include chemical (e.g., toxic environmental chemicals, drinking water), pharmacological (e.g., drugs and alcohol), and nutritional stressors (e.g., poor diet; Jameson, 2004).

Ro (2006), in her study of PRMD risk factors in musicians, categorized PRMD risk factors under two broad categories: biomechanical and psychosocial. Biomechanical risk factors are physically related aspects such as music-related ergonomic adjustments, repetition, and the frequency, duration, and nature of rest breaks. Psychosocial risk factors are psychological and social aspects that include factors such as audition strain, social support, physical exertions, and psychological job demands (Ro, 2006).

Psychosocial factors that have also been identified by researchers and anecdotal reports include, but are not limited to, decision latitude (Akel & Düger, 2007; Horvath, 2009; Ro, 2006) – which is defined as the degree to which a person has control over the application and use of their skills on the job, job demand (Akel & Düger, 2007; Horvath, 2009), coworker support (Ro, 2006), stressful play/practice patterns (Horvath, 2009; Ro, 2006), balancing multiple professional roles (Mäkirintala, 2008), facing high levels of competition (Mäkirintala, 2008), auditions (Ro, 2006; Schmidt, 2004) and competitions (Schmidt, 2004), lower income (Morse et al., 2000; Wu, 2007), lack of stability (Mäkirintala, 2008), and music performance anxiety (Ro, 2006; Yoshie et al.,
Stress: A background

The role of (mental) stress in occupationally related injuries has been discussed in the research literature. The following sections give a background on stress and its presence in the research literature on WRMDs and PRMDs. This dissertation will assume the definition of stress proposed by Seaward (2008) in his book *Managing Stress: Principles and Strategies for Health and Well-being*: “the inability to cope with a perceived (real or imagined) threat to one’s mental, physical, emotional, and spiritual well-being which results in a series of physiological responses and adaptations” (p. 6).

**Stress and work-related musculoskeletal disorders (WRMDs).**

Research literature has investigated the role of mental stress and psychosocial factors on work-related musculoskeletal disorders in occupational activities such as computer mouse tasks (Visser, De Looze, De Graaff, & van Dieën, 2004), typing tasks (McLean & Urquhart, 2002; Rietveld, van Beest, & Kamphuis, 2007), and in dentists (Palliser, Firth, Feyer, & Paulin, 2005), transit operators (Rugulies & Krause, 2005), and telecommunications systems design engineers (Wiholm & Arnetz, 2006). The hypothesis that stress is correlated to performance-related injury (PRI) is well known and supported (Lehmann, Sloboda, & Woody, 2007; Ro, 2006).

Psychological stress has been shown to affect musculoskeletal function and to be a possible mediating factor in PRMDs. Visser et al. (2004) reported that mental pressure resulted in substantial increases in EMG (electromyography) readings in upper-extremity muscles in a study of ten test subjects engaging in computer mouse tasks. Rietveld et al. (2007), in their study on repetitive strain injury (RSI) in 20 academic researchers and 20 control test subjects, stated that excess muscle exertion when under stress may mediate a person’s risk for RSI. Rugulies and
Krause (2005) concluded in their study on 1974 transit vehicle operators that psychosocial factors such as low job satisfaction and low job control are examples of the multifactorial aspects that contribute to work-related low back and neck injuries.

**Theories on stress’ effect on musculoskeletal disorders.**


Healthcare providers in the chiropractic profession also propose possible explanations on stress’ effect on MSDs. Timothy Jameson (2004), a chiropractor who treats musicians with RSI, explains that stressors, whether physical, chemical, or emotional, create strain on the nervous system. Continued exposure to these stressors may lead to spinal subluxations (spinal misalignments) that exert stress on the nervous system. This in turn affects the function of organs and/or muscles. Jameson (2004) further states that prolonged stress on the nervous system is a precursor to disability and disease.

Chiropractor Elizabeth Andrews (2005) describes a less direct pathway by which mental stress
may increase PRMD incidence in musicians. According to Andrews (2005), mental stress may lead to negative and unclear thinking, causing the musician to hold back in the execution of difficult passages. This in turn may be accompanied by worry and stress, which may affect physiological functions of the body such as digestion. Poor digestion results in the inefficient assimilation of nutrients as well as the accumulation of toxicity in the body. The resulting chemical stress on the body results in inefficient removal of waste products in the muscle fibers, leading to muscle starvation. As the muscles decline in function, they more easily succumb to fatigue. This in turn may cause the musician frustration and disappointment as they begin to struggle with decreased functioning and performance. Mental distress may cause the musician to expend additional effort and force to compensate. By exceeding the body’s physical limits in this manner, the musician is exposed to increased risk for further injury, which can lead to a downward spiral of increased injury and stress (Andrews, 2005).

Reports on RSI in the anecdotal literature have acknowledged the connection between the body and mind (mind/body connection), suggesting that all illnesses have a mental (and/or emotional) component (Pascarelli & Quilter, 1994; Ruegg, 1999; Sarno, 2007). Though debated in the medical literature, author and medical doctor John E. Sarno (2007) stated that the body unconsciously produces physical symptoms of pain or disease in substitution for the outward expression of repressed emotions. Ruegg (1999), and Pascarelli and Quilter (1994) have suggested that the body produces physical symptoms as a self-protective mechanism that stimulates the person to re-evaluate their environment, work habits, emotional, psychological, and spiritual conditions. In reference to musicians, Watson (2009) explained that the physical manifestation of stress (somatization) may result in the experience of pain or other physical symptoms such as fatigue or headaches.
Stressors in the music occupation.

As previously outlined, PRMD risk factors are broadly classified under two large categories: biomechanical and psychosocial (Ro, 2006). These biomechanical and psychosocial risk factors have the potential to be perceived as stressors that pose a threat, “real or imagined” (Seaward, 2008, p. 6). According to the theories on stress, these perceived stressors may mediate PRMD risk. As described earlier, biomechanical risk factors, which are potential sources of physical stress in musicians, have been widely documented in the literature.

Psychosocial risk factors, which pertain to psychological and social factors, present stress of a mental/emotional/social nature. Psychosocial risk factors in the music occupation have been confirmed through the use of Robert Karasek’s Job Content Questionnaire (JCQ; Akel & Düger, 2007; Ro, 2006), a self-administered instrument used to assess psychological and social characteristics of jobs (Karasek et al., 1998). Akel and Düger (2007) in their study of 90 student musicians in Turkey confirmed that these musicians (violists, cellists, and pianists) were exposed to psychosocial stress. Particularly significant psychosocial factors in this group were job demand, physical exertion, and physical load (Akel & Düger, 2007). Akel and Düger (2007) also stated that exposure to psychosocial stress increases over time in a similar way to musculoskeletal stress. Ro’s 2006 study on 255 professional musicians from two music unions in the United States found that musicians, in comparison with other types of workers, were exposed to higher levels of physical and psychosocial PRMD risk factors (Ro, 2006). Her study also found that the level of JCQ strain was high in the music occupation compared to that of the United States population. In Ro’s (2006) study, musicians were exposed to lower decision authority, decision latitude, coworker support, supervisor support, and social support. It also found that musicians were exposed to higher psychological demands, greater risk of job
insecurity, and physical exertion. As stated by Akel and Düger (2007), and Taylor (1997), in his dissertation on biofeedback and cognitive therapy for stress management in musicians, performance pressure is characteristic of the occupation and is a uniquely inherent source of psychosocial stress in the daily lives of musicians.

Decision latitude, a scale on Karasek’s *Job Content Questionnaire* (JCQ; Karasek et al., 1998) is another factor of consideration in the orchestral occupation. Decision latitude is the degree to which a person has control over the application and use of their skills on the job. It is frequently evaluated along with psychological demand and low social support to evaluate job strain (Karasek et al., 1998). Rugulies and Krause (2005) define job strain as the combination of high psychological demand and low job control. The combination of job strain (high demands + low control) with low social support is known as *iso-strain* (Rugulies & Krause, 2005).

Orchestral musicians, by nature of the occupation, are at a higher risk for both job strain and iso-strain. Orchestral musicians have relatively low control over artistic and other work-related factors due to being subject to the direction of management, music directors, and section leaders (Akel & Düger, 2007; Horvath, 2009; Mäkirintala, 2008). Orchestral musicians are also subject to high psychological demand (e.g., performance pressure and performance anxiety) as well as low coworker support (Ro, 2006). An orchestra is constructed with a hierarchical structure of a music director, section leaders, and section players; in this regard, orchestras are analogous to the hierarchical structures of other occupations. As stress researcher Robert Sapolsky stated in the video *Stress: Portrait of a Killer* (Stanford University, National Geographic, & Heminway, 2008), those in lower social hierarchical ranking are observed to be more at risk for negative physiological effects of stress. In terms of low decision latitude, Theorell et al. (1993)
demonstrated in a laboratory-conducted pain experiment that participants who reported low
decision latitude in their everyday job situation were less able to raise their pain threshold during
acute stress. Theorell et al. (2002) also stated that those who exhibit long-residing feelings of low
decision latitude often demonstrate an increased sensitivity to pain.

In addition to low decision latitude, other psychosocial stressors that have been reported in the
orchestral occupation include insufficient preparation and/or harsh self-judgment (Horvath,
2009; James, 2000), demanding conductors (Horvath, 2009; James, 2000), work politics (e.g.,
rank and seating), social relationships with colleagues (Mäkirintala, 2008), incompatible stand
partner (James, 2000; Mäkirintala, 2008), freelance and in-orchestra competition (Mäkirintala,
2008), and financial concerns (James, 2000; Mäkirintala, 2008; Morse et al., 2000; Romeo,
2007; Wu, 2007).

**Stress and PRMD-risk in musicians.**

Consistent with literature on work-related musculoskeletal disorders (WRMDs) in other
occupations, research literature has acknowledged the role of stress on PRMDs in the music
occupation. Middlestadt and Fishbein’s (1988) large-scale study of 2212 orchestral musicians
reported that those who experienced higher than average stress levels also reported the highest
prevalence (71%) of musculoskeletal injuries. Ro’s (2006) study of professional musicians
revealed that orchestral musicians were exposed to greater amounts of psychosocial risk factors
(compared with non-orchestral musicians), and demonstrated a higher prevalence of
musculoskeletal symptoms. In their study of 160 patients at a vocal clinic, Dietrich et al. (2008)
found a significant association between stress, depression, and muscle tension dysphonia, a voice
disorder for which a number of potential contributing factors (including stress) exist. Dietrich et
al. (2008) also stated that stress and vocal problems likely have a bi-directional relationship with
one reinforcing the other. Yoshie et al. (2008) were the first to demonstrate in a study of 12 amateur pianists in arpeggio performance that there was a relationship between psychological stress and muscle activity in musicians. They demonstrated that music performance anxiety resulted in heightened EMG activity in the arm and shoulder muscles as well as co-contraction of antagonist muscles in the forearm and upper arm. They further concluded that this response could contribute to the overall risk of PRMDs (Yoshie et al., 2008).

Ro (2006) summarizes the zeitgeist of the stress theory stating that occupational stress may have both direct and indirect effects on the individual. She states that psychosocial stressors, in addition to biomechanical stressors, have a contributory or multiplicative effect on overall strain, which contribute to PRMDs. The results of her study indicated that it was the combination and interaction of psychosocial and biomechanical factors from musical and non-musical sources that were associated with PRMD symptom severity. These collective findings indicate that the etiology and prevention of musicians’ PRMDs are complex and multifactorial.

**Holistic Health and Well-being, Stress Management, and PRMD Prevention**

Performance injury experts such as Andrews (2005), Horvath (2009), Jameson (2004), and Robinson et al. (2002) have indicated from clinical experience and in anecdotal literature the importance of both stress management and a holistic approach to PRMD prevention. Despite the high levels of psychosocial and biomechanical risk factors in the music occupation, and the high incidence of PRMDs in musicians, there is a poor awareness among musicians of the importance of stress management, injury prevention, and healthy behaviours (Ginsborg et al., 2009; Romeo, 2007; Schmidt, 2004). Musicians often neglect to respect recommended rest periods after an injury diagnosis (Park et al., 2007; Romeo, 2007), which may be due in part to psychosocial pressures such as financial concerns or lack of health insurance benefits (Romeo, 2007).
Musicians’ health experts have acknowledged the need for increased education on healthy behaviours for musicians (Chesky et al., 2006; Ginsborg, Kreutz, Thomas, & Williamon, 2009). As stated in an article by Chesky et al. (2006), the Health Promotion in Schools of Music (HPSM) project, a collaborative effort by the University of North Texas System and Performing Arts Medical Association (PAMA), recommends Prevention Education and Intervention in music schools. The HPSM project acknowledges the need for a holistic approach to musicians’ health issues that emphasizes “wellness and personal responsibility” (Chesky et al. 2006, p. 142).

Chiropractor Elizabeth Andrews (2005), in her book *Muscle Management for Musicians*, recommended that musicians aim for “optimum health” and optimal functioning of the “whole body machine” (p. 70). Ginsborg et al. (2009) similarly suggest that musicians need to adopt healthier lifestyles to include the areas of health responsibility, physical fitness, and spiritual growth. These recommendations suggest the relevance and importance of a holistic strategy for PRMD prevention in musicians.

In conjunction with a holistic strategy for PRMD prevention is an equally holistic approach to assessment. Park et al. (2007), in their qualitative investigation of why music students pursue music despite injury risk, concluded that there is a need for a holistic and client-centered approach “to ensure that consideration is given to all aspects of the musicians’ lives” (p. 95). Resource centres that apply a holistic approach to artists’ well-being and assessment include the Artists’ Health Centre in Toronto and the Louis Armstrong Center for Music and Medicine in New York. Toronto’s Artists’ Health Centre provides a team of healthcare practitioners dedicated to serving artists by “providing a holistic approach to health within an evidence-based framework” (Al and Malka Green Artists' Health Centre, n.d.). The Louis Armstrong Center for
Music and Medicine in New York City specializes in an integrative and comprehensive approach to client care that approaches the assessment and treatment of musicians from a medical, as well as psychological and musical, perspective. This integrated bio-psycho-musical approach, which acknowledges mind, body, emotion, and spirit, considers the musician as a whole “[j]ust as a symphony produces music that far exceeds merely a sum of the parts” (Quentzel & Loewy, 2010a, p. 118).

The concept of holism, in its application to musicians, has been discussed with varying definitions and applications in a small body of literature. Rardin (2007), in her ten-week injury prevention intervention program on high school music students, referred to the somatic education/postural awareness methods of Alexander Technique and Feldenkrais as holistic strategies for PRMD prevention. Mäkirintala (2008) conducted an inter-disciplinary, qualitative study on the effects of a holistically oriented intervention program targeting music students’ well-being and peak performance. Khalsa, Shorter, Cope, Wyshak, and Sklar (2009) studied yoga as a “holistic system of mind-body practices for mental and physical health” (p. 279).

Specific discussion on holistic approaches and PRMDs in academic literature is generally scarce and was confirmed by a literature review conducted by Guptill in 2008. In her review of 131 papers in the musicians’ health literature between the years of 1998 and 2005, Guptill concluded that according to the World Health Organization’s International Classification of Functioning, Disability and Health (ICF), the areas of environmental factors, personal factors, and domain of participation are underrepresented in the literature. Environmental factors include type of instrument, social and psychosocial environment, support and relationships, surrounding attitudes, and natural and human-made changes to environment. Personal factors include gender,
lifestyle, habits, coping styles, social background, education, professional experience, overall behaviour/character, and psychological assets. The domain of participation refers to involvement in a life situation, i.e., the involvement in the life situation of musicians. Guptill (2008) concluded that this gap in the literature has led to insufficiencies in effective and evidence-based health care for musicians.

**Holistic Health and Musicians.**

The following sections give an overview of holistic health: its definition, its multi-faceted application to musicians’ PRMDs, as well as a discussion of its components, namely physical, mental, emotional, social, and spiritual health. This chapter also discusses other variables that are part of an integrative assessment of PRMDs, i.e., personality factors that include perfectionism, Type A Behaviour Pattern, and stress-coping styles.

**Definition of holistic health and well-being.**

Based on definitions by Danna and Griffin (1999), Diener (2009), Seaward (2008), and the World Health Organization (1948), this paper will define holistic health and well-being as:

- the quality of an individual’s state, assessed as a whole and reflecting the integration, depth, and balance of physical health, emotional health, mental health, social health, spiritual health, as well as the subjective perceptions of life satisfaction, happiness, and positive affect.

In this study, the concept of holism will be applied to the assessment, treatment, and prevention strategies for PRMDs in musicians. For simplicity, the terms ‘holistic health,’ ‘holistic well-being,’ and ‘holistic health and well-being’ may be used interchangeably.
Musicians and a holistic healthy lifestyle.

Health and well-being in musicians tend not to be a priority for most developing and professional musicians, as suggested by a study comparing the health-promoting behaviours in music students and other tested populations (Kreutz, Ginsborg, & Williamon, 2008). Musicians are exposed to hard work from a young age but are often unaware of healthy practice disciplines and of the importance of developing muscle endurance to prevent musculoskeletal disorders (Akel & Düger, 2007). Wu (2007) similarly concluded that a lack of preventive behaviour, (e.g., taking breaks), was a potential PRMD risk factor in professional instrumentalists. As previously mentioned, Ginsborg et al. (2009) suggest that musicians need to adopt healthier lifestyles to include the areas of health responsibility, physical fitness, and spiritual growth.

Yoga – a holistic practice.

Khalsa et al. (2009) suggested that a yoga lifestyle incorporating mind and body elements appears to be ideally suited for treating or preventing physical and psychological symptoms in musicians. The practice of yoga incorporates breathing techniques, physical postures (intended to increase strength and flexibility), as well as the practice of meditation. Meditation is the controlled focusing and shifting of attention on a desired object of choice while letting go of conditioned mental activity and reactions (Kristeller, 2007). Traditionally practiced for spiritual benefits, meditation has long been a part of many religious practices, and has also been successfully used in stress management (Carrington, 2007). Yoga, as a health promoting, mind-body holistic practice, has often been used effectively for stress management and musculoskeletal disorders. Decades before Khalsa et al.’s (2009) study, concert violinist Yehudi Menuhin (1916-1999) recognized the benefits of yoga and pursued studies with BKS Iyengar in the 1950’s. Through the regular study and practice of Iyengar’s yoga postures, Menuhin
achieved a complete disappearance of his chronic, severe muscular pain (Busia, 2005; Horvath, 2009).

Khalsa and Cope (2006) investigated the effects of a yoga lifestyle intervention on a sample of young professional musicians participating in the Tanglewood Music Festival. Though the study did not result in a reduction of PRMD symptoms in the study’s population and time frame, they stated that the practice of yoga did result in improved mood and reduced performance anxiety. In Khalsa et al.’s 2009 study, they also did not find meaningful results on PRMDs in their small study population, though it was noted that a possible limitation in their study was the initial low baseline level of PRMDs reported in the musicians. This likely created a ‘floor effect,’ which precluded any significant post-study results (Khalsa et al., 2009).

**Physical health and well-being.**

General health benefits of physical fitness are well known to affect cardiovascular health, outlook, mood, and sleep quality (Watson, 2009). Holth, Werpen, Zwart, and Hagen (2008) reported in their large-scale population study that physical activity could reduce the incidence of musculoskeletal complaints 11 years later. Taylor and Wasley (2004), in their book *Musical Excellence: Strategies and Techniques to Enhance Performance*, state that physically fit people may demonstrate an ameliorated physiological response to stress, known as the cross-stressor hypothesis. This physiological improvement, which can be the result of both chronic and acute exercise, comes in the form of a reduced cardiovascular and neuroendocrine response to physical and psychological stressors, the reduction of anxiety (either from predisposition or learned response pattern), and the reduction of musculoskeletal problems (Taylor & Wasley, 2004).
Related to physical health are nutritional, pharmacological, and chemical stressors. Health professionals and researchers such as chiropractor Elizabeth Andrews (2005), chiropractor Timothy James (2000), diet/health lecturer and clarinetist Kathryne Pirtle (2006), and neuroscientist and educator Alan H. D. Watson (2009) endorse a nutritional approach to PRMD prevention. These recommendations include ensuring adequate nutritional intake (Andrews, 2005) through the optimal digestion and absorption of nutritionally dense foods (Pirtle & Fallon, 2006). Other recommendations also include the reduction of nutritional stressors such as nutritional deficiencies (Jameson, 2000), pharmacological stressors (e.g., prescription and recreational drugs, alcohol, nicotine; Watson, 2009), and chemical stressors (e.g., poor quality air and water, environmental toxins; Jameson, 2000). Robinson et al. (2002) supported these recommendations in their guide to PRIs in musicians and dancers stating that the combination of poor diet and psychological stress in performers may contribute to the negative effects of their physical demands.

Mental/emotional health and well-being.

Mental health, a component of holistic health, is defined by the World Health Organization (2010) as:

…a state of well-being in which an individual realizes his or her own abilities, can cope with the normal stresses of life, can work productively and is able to make a contribution to his or her community. In this positive sense, mental health is the foundation for individual well-being and the effective functioning of a community. (Mental health section, para. 2)

Mental health has also been defined in close relationship to emotional health. According to *The American Heritage Medical Dictionary*, mental health is defined as “a state of emotional and
psychological well-being in which an individual is able to use his or her cognitive and emotional capabilities, function in society, and meet the ordinary demands of everyday life” (“Mental health,” 2007, para. 1).

Mental health, according to a questionnaire study conducted by Romeo in 2007, is an issue of considerable concern for a large number of professional orchestral musicians. Romeo (2007) polled 932 professional orchestral players in 10 world-class orchestras in the United States. Her study revealed that 63% of those surveyed experienced depression severe enough to disrupt playing. Violinists in particular appeared to be a susceptible group, with 93% of the surveyed violinists experiencing depression on a regular basis (Romeo, 2007). Acknowledging a relationship between mental/emotional well-being and PRMDs, performance injury expert Alice Brandfonbrener (cited in Horvath, 2009) stated that: “Depression not only makes people more injury-prone, but it also increases with pain and if not recognized, tends to prolong illnesses, injuries, and musculoskeletal pain syndromes” (p. 26).

**Flow and subjective well-being.**

As a possible contributing factor in musicians’ health, the experience of flow may be discussed in relation to subjective well-being. Fritz and Avsec (2007) stated in their study of the experience of flow and subjective well-being in 84 music students that both music practice and music performance are activities in which musicians can frequently become immersed and can serve as a source for flow experience. Csikszentmihalyi (1990) describes the experience of flow as the feeling of optimal experience while being completely engaged and immersed in a controlled activity (“Flow: Being happy”, n.d.). The state of flow is characterized by a sense of ecstasy, serenity, and separation from self-consciousness (Csikszentmihalyi, 1996). The results of their study conclude that the experience of flow is a significant predictor of subjective well-being,
particularly to its emotional aspects. As stated by Fritz and Avsec (2007), dimensions of flow experience may predict the presence of positive emotions and the absence of negative emotions. Csikszentmihalyi (1990) also described flow to be “intimately connected” with religion, suggesting a spiritual element (p. 76). The experience of flow in artists, in particular in musicians, has been extensively observed and studied.

Despite these suggestions of the positive influence of flow on subjective well-being, Guptill (2010), in her study of professional orchestral musicians, found that flow was reported to have a negative influence on musicians’ health and injury risk. The musicians in Guptill’s study did report flow experience to be a “powerful and enjoyable experience” (Guptill, 2010, p. 142), however they also reported feeling a dissociation with both body and time experience, which led to overplaying and inadequate rest breaks. As Wu (2007) stated, overplaying and inadequate rest breaks are contributing risk factors to PRMDs, which, as Guptill’s (2010) study suggests, may be contributed to by the experience of flow.

**Social health and well-being.**

The quality of social health and well-being via interpersonal relationships may also play a role in holistic health and in PRMDs. In a qualitative study conducted on 27 professional musicians and three healthcare professionals studying the meaning of PRMDs to Classical musicians, Zaza, Charles, and Muszynski (1998) reported that a lack of collegial support was detrimental to the subjective experience of musicians’ PRMDs. They stated that injured musicians deemed social support to be important for gaining a sense of validation (Zaza et al., 1998).

According to Shelly Taylor’s tend and befriend theory (cited in Gurung, 2010), females in particular seek social support in times of stress (*befriending*). As Taylor explains, this behaviour
serves to counteract the effects of the fight-or-flight stress response, through the calming role of the female hormone oxytocin (Gurung, 2010). Ray (2004), in his review of social and behavioural factors on health, illness, and death, affirmed the importance of social support on health, naming it as a category of stress-coping skills.

These findings indicate that poor social health and well-being may contribute to elevated stress levels, which in previous research findings (Dietrich et al., 2008; Middlestadt & Fishbein, 1988; Ro, 2006; Yoshie et al., 2008) have been associated with increased PRMD risk in musicians. As Taylor (cited in Gurung, 2010) and Ray (2004) state, social support provides a means of stress coping, which according to the stress theory may serve to reduce overall stress that may contribute to elevated PRMD risk.

**Spiritual health and well-being.**

Despite the relative scarcity in the literature regarding the role of spirituality on health and well-being, there is a growing interest and acceptance of this component of holistic health (Ray, 2004). Most evidence describing any positive link has been mainly anecdotal (Morris, 1998), however, the research literature is growing. Levin and Vanderpool, and Plante and Sherman (as cited in Edmonson et al., 2005) determined that religion and spirituality have an overall beneficial effect on health. Graham, Furr, Flowers, and Burke (2001) found that spirituality was positively associated with successful stress coping. In a 2005 study conducted on 52 young adult women, spirituality was found to have a positive effect on both psychological and physical health (Edmonson et al., 2005). Using the *Spirituality Well-being Scale* and the *Existential and Religious Well-being Subscales*, their research suggested an association between spirituality and perceived stress and subjective well-being. In addition, there was a prediction of fewer physical health symptoms, an association with lower mean heart rate, decreased heart rate reactivity, and
reduced systolic blood pressure (Edmonson et al., 2005).

According to Seaward (2008), spiritual well-being may be described as “the maturation of higher consciousness through strong nurturing relationships with both the self and others; the development of a strong personal value system; and a meaningful purpose in life” (p. 26). Schmidt (2004), in her dissertation on selected personalities and stress symptoms, stated that Classical musicians, compared with members of other occupations, have cultivated a long-established identity with their occupation by the early stages of adulthood. As Pruett (1991) stated, since most musicians begin their musical training in early childhood, musicians are more likely to experience a major personal conflict of a spiritual or emotional nature at an early age, often at puberty. These statements suggest that optimal spiritual health and well-being may be an important stress-coping mechanism, as was also proposed by Ray (2004), who listed spirituality as a category of stress-coping skills.

**Stress personality types.**

As stated by Guptill (2008), a holistic approach to PRMD prevention includes the acknowledgement of personality factors. Both anecdotal and research literature have discussed personality factors in relationship to stress and psychosomatic-related illness (Allread, 2000; Mäkarintala, 2008; Sarno, 1998; Schmidt, 2004; Seaward, 2008; Taylor, 1997).

In an investigation of personality and MSD risk factors on 182 workers in a warehouse distribution centre, Allread (2000) concluded that in physically demanding occupations, personality types moderate the complex relationship between psychosocial, personal, non-work-related factors, and injury risk. In a study conducted on stress-induced muscular effort, repetitive strain injury, and computer usage, Rietveld et al. (2007) observed that the personality factors
neuroticism and alexithymia had a possible correlation to injury risk. Neuroticism (also known as high trait anxiety) is defined as the propensity towards anxiety and pessimism (Rietveld et al., 2007), and having the tendency to react to stress with negative emotions. Alexithymia is defined as having a deficiency in emotion regulation (Rietveld et al., 2007) and the inability to express and describe emotions (Alexithymia, 2009). In their findings on twelve amateur pianists, Yoshie et al. (2008) observed that those with high trait anxiety exhibited more sensitivity to stress-induced physiological and behavioural changes than those exhibiting lower trait anxiety.

Levy et al. (2009) found similar findings in their study on marching band musicians and the Big Five personality traits (neuroticism, extraversion, conscientiousness, openness, and agreeableness). Their findings support previous literature that states that poor emotion regulation in response to stress can lead to excess muscle tension. They further stated that this extra muscle tension could cause less coordinated movement leading to increased injury risk (Levy et al., 2009).

**Perfectionism.**

Taylor’s (1997) dissertation on the role of biofeedback and cognitive therapy in combating stress in musicians discussed perfectionism as a subset of obsessive-compulsive personality, an identifiable personality type in musicians. As Taylor (1997) stated, perfectionism may lead musicians to practice long hours, and subsequently, to experience a fight-or-flight stress response. According to Taylor (1997), music is “a perfectionistic profession” (p. 28) and, as a source of frequent stress, may lead to increased muscle tension. Though Taylor (1997) did not attempt to scientifically prove the proposed relationship between perfectionism and PRMDs, Hagglund and Jacobs (1996), in their survey of 45 music students, did report that 72% of their respondents cited self-induced pressure as a stressor that worsened their injuries. Wu (2007)
conducted a systematic review of PRMD risk factors in professional instrumentalists and, consistent with Hagglund and Jacobs’ (1996) findings, concluded that self-pressure, long hours, and over-practicing appeared to be potential risk factors for musculoskeletal conditions. Yoshie et al. (2008) were the first to scientifically demonstrate this relationship between psychological stress, the fight-or-flight response, and an increased PRMD risk by finding EMG evidence that psychological stress resulted in muscle stiffness during arpeggio performance in pianists.

Perfectionism, as explained by Klibert, Langhinrichsen-Rohling, and Saito (2005), may have adaptive or maladaptive constructs. Perfectionism is considered adaptive when it produces positive, motivating, and constructive results in the individual. Perfectionism is considered maladaptive when it produces negative and counter-productive results in the individual. Adaptive or maladaptive constructs are observed in the areas that affect mental/emotional health, that is, self-esteem, perceived self-control, achievement motivation, depression, anxiety, suicidal proneness, shame, guilt, and procrastination (Klibert et al., 2005).

*Self-oriented vs. socially prescribed perfectionism.*

Klibert et al. (2005) compared two categories of perfectionism: self-oriented and socially prescribed. Self-oriented perfectionism is the engagement in “severe judgment of one's own performance and the prevention of mistakes” (Langendörfer et al., 2006, p. 162). Socially prescribed perfectionism is the feeling of being subject to critical evaluation from external sources and feeling pressure to be perfect (Klibert et al., 2005). Klibert et al. (2005) observed in their study of 475 university students that the research participants who displayed high levels of both socially prescribed perfectionism and self-oriented perfectionism demonstrated higher reports of depression, suicide proneness, anxiety, shame, and guilt.
Klibert et al. (2005) state that an intrinsically motivated person may thrive as a self-oriented perfectionist. However, when confronted with socially prescribed perfectionism, even in the presence of self-oriented perfectionism, mental/emotional stress may arise in the form of disappointment, guilt, and shame. A study which involved 122 musicians from six German orchestras reported that socially prescribed perfectionism correlated with worry in rehearsal, lack of confidence, and cognitive performance anxiety (Langendörfer et al., 2006). Socially prescribed perfectionism is considered the best predictor of worrying before a rehearsal, meaning that rehearsals are social situations of appraisal in which musicians perform in the presence of their colleagues (Langendörfer et al., 2006). Langendörfer et al. (2006) also found a correlation between demanding opus (i.e., repertoire) and physical symptoms of stress.

Prevailing attitudes in the industry such as “you are as good as your next performance” (Mäkarintala, 2008, p. 9) and ‘every gig is an audition’ contribute to the performance pressure that musicians face in the occupation. As Mäkarintala (2008) stated, a musician may equate their achievements or perceived level of performance with their self-esteem. As Hagglund and Jacobs (1996), Taylor (1997), and Yoshie et al. (2008) suggest, the level of perfectionism required in the music profession, particularly if it is socially prescribed, may contribute to psychological tension. As Klibert et al. (2005) state, this may include feelings of depression, which Brandfonbrener (cited in Horvath, 2009) claimed to have negative effects on PRMD risk.

**Type A behaviour pattern (TABP).**

Type A Behaviour Pattern (TABP) is another example of a personality type that may serve as a contributing factor to increased stress response (Sarno, 1998; Seaward, 2008). Type A Behaviour Pattern (TABP) is characterized by competitiveness and drive (Sarno, 1998; Seaward, 2008; Taylor, 1997), hostility (Sarno, 1998; Seaward, 2008), the desire for recognition, self-imposed
time pressure, simultaneous involvement in more than one activity or task (polyphasia) (Seaward, 2008), and intense, sustained motivation or workaholism (Sarno, 1998).

Andrews (2005) stated that this behaviour, which is characterized by increased mental tension and physiological disorders (e.g., cardiovascular issues) may also increase susceptibility to PRMDs by way of increased levels of stress-induced muscle tension. Sarno’s (1998) Tension Myositis Syndrome theory, though still considered a debatable theory in the scientific research literature, states that a relationship exists between the mind/body and the incidence of neural and musculoskeletal issues. According to this theory, TABP may thus have psychosomatic implications that are relevant to PRMDs in musicians.

**Stress-coping.**

Related to the discussion of stress and personality factors is the subject of stress-coping styles. As stated by Ray (2004), “Stress/allosstatic load is experienced when there is an inadequate match between an individual’s coping skills and the environmental demands that the individual believes these skills must confront” (p. 32). How one copes with stress may have implications on a musician’s health, as suggested by a study on subjective health complaints, stress, and coping in 35 members of the Bergen Philharmonic Orchestra (Halleland, Harris, Sønes, Murison, & Ursin, 2009). As Halleland et al. (2009) state, according to the Utrecht Coping List, stress-coping may be measured by evaluating seven styles that fall into two categories: instrumental coping and emotion-focused coping strategies. Instrumental coping strategies are those that are based on active problem solving and are generally considered more effective than emotion-focused coping strategies (Halleland et al., 2009). Emotion-focused coping strategies include seeking social support (help, support, and understanding from others), expression of feelings (expressed emotions and anger towards the stressor), palliative reactions (seeking distractions and other
activities such as alcohol, food, or drug consumption to reduce tension), and passive avoidance (passively waiting for outcome). Though Halleland et al. (2009) acknowledged previous literature that reported a high number of musculoskeletal complaints in musicians, their study participants did not reveal a higher level of musculoskeletal complaints as compared with their reference population. In light of these findings, Halleland et al. (2009) claimed that a possible explanation was the “healthy worker” effect (p. 61); that is, those suffering from debilitating PRMD symptoms were no longer working in the study’s orchestra population. Given the study’s small sample size (35 musicians), it was also difficult to generalize their conclusions to other orchestral musicians.

Related Methodologies

It is apparent from the preceding discussion of the numerous, inter-related variables affecting PRMDs that the etiologic investigation of musicians’ PRMDs is a complex one, and has up to the present, been approached from numerous perspectives. A qualitative investigation on this topic would serve the benefit of providing a comprehensive and integrative discussion of these numerous factors. The resulting data would serve to supplement the literature’s quantitative studies, which though provide insightful information on musicians’ PRMDs, are often exclusory and reductive in their approach. The following section reviews selected research studies that have employed qualitative methodologies related to this study and to the discussion of PRMDs in musicians.

Hagglund and Jacobs (1996) conducted a survey study on a population of 300 music students from Boston University investigating their physical and mental practices. Out of 45 respondents, 19 participated in a subsequent interview. Acknowledging the relationship between mental stress and physical health, the purpose of this study was to provide descriptive information on the
general physical and mental habits of student musicians and to uncover any associations between their daily activities or habits and PRMD incidence. Despite the survey’s low response rate and small sample size, their results proved insightful and succeeded in providing musician-specific data for the education and use of health professionals. Their findings emphasized, among other things, the importance of physical fitness for body maintenance and overall PRMD prevention, the individuality of musicians, the relevance of multiple treatment modalities, and the general lack of understanding among healthcare professionals of the specific needs of musicians. The authors reported that a surprising number of respondents reported preferring the treatment of Alexander Technique and Feldenkrais professionals in addressing their PRMD symptoms and that this perhaps emphasized the lack of music-specific and relevant knowledge of healthcare professionals.

Despite the validity issues that arose from this study’s small and self-selected sample population, Hagglund and Jacob’s (1996) study did provide evidence warranting further investigation and education on PRMD prevention and treatment in both the medical and music community. Perhaps one of the most revealing findings concerning stress and PRMDs came from a study participant who reported a significant association between his/her tendonitis symptoms and the incidence of life stress. It is noted that this study’s population consisted of music students. As such, a similar study conducted on current professional musicians would be insightful, particularly with the assumption that current music professionals may likely consist of music graduates from approximately the time of this study (15 years ago). Given that Hagglund and Jacobs prefaced their study by acknowledging the general role of stress on physical symptoms, it is interesting to note that the findings in their study’s population did not demonstrate a significant impact of stress on physical symptoms. It must be considered, however, that this
study did not include in its discussion the variable of stress-coping mechanisms, which in theory may have exerted a mediating role in the presence of physical symptoms.

Zaza et al. (1998) were perhaps one of the first groups of researchers to provide a purely qualitative study investigating professional musicians’ experiences and opinions on PRMDs. In this study, 27 Classical instrumentalists (string, woodwinds, brass, keyboard professionals, and university students) along with three health care professionals were individually interviewed on the subjective meaning and definition of PRMDs. This study adopted a case study approach, which included health professionals as a means to ensure increased validity through data triangulation. Through semi-structured interviews, data was collected on the musicians’ perceptions, experiences, and behaviours regarding PRMDs. An emerging theme of overall suffering was reported from which it was concluded that PRMDs pose a threat to the identity of the musicians. Of relevance to this topic were fear, lack of control, and social support. Particularly interesting was the statement that the musicians’ suffering was increased in the absence of validation from peers, which suggests a bi-directional relationship between PRMDs and social health.

The benefit of Zaza et al.’s (1998) study was in providing professional musicians the opportunity to provide their own rich descriptions of their definitions and experiences of PRMDs. Like Hagglund and Jacobs’ (1996) study, the rich data resulting from this study provided insightful background information on musicians for the enlightenment of healthcare professionals. It is noted however that it was not in the scope of Zaza et al.’s (1998) study to discuss prevention strategies. Rather, theirs was a study that aimed to gather personal accounts of experiences and opinions of PRMDs.
Three other similarly qualitative studies by Park et al. (2007), Guptill and Golem (2008), and Guptill (2010) investigated the lived experiences of musicians with PRMDs. Park et al. (2007) collected rich, in-depth data on nine music students from an Ontario post-secondary music institution. The purpose of their study was to investigate why music students choose to pursue music despite PRMD risk, and was executed using a naturalistic approach with focus group discussions. The study’s objectives were to understand the lived experience of a sample of university students and to provide the study participants an opportunity to present themselves as ‘experts’ and share their personal accounts. A strength of the study was that it was conducted by researchers who had music performance backgrounds and thus provided a knowledgeable perspective and insider’s understanding of the profession. A limitation of the study, however, was the small sample size, which though characteristic of qualitative studies, precluded generalization of their findings to larger populations. The researchers also stated that though their study was an open-ended collection of rich experiences and opinions, the study did not include in their discussion the areas of emotional or psychological stress.

Guptill and Golem (2008) conducted a narrative case study of a North American graduate music student with a PRMD. Similar to the philosophy used at the Louis Armstrong Center for Music and Medicine as described by Quentzel and Loewy (2010a), a comprehensive, qualitative approach was chosen in an effort to “listen to and respect the musician’s story” (Guptill & Golem, 2008, p. 309), as well as to present the quality and nature of the musician’s experience. As previously mentioned, this type of qualitative approach revealing rich, in-depth data on musicians’ PRMDs is relatively scarce in the research literature. Guptill and Golem’s (2008) study attempted to address the apparent lack of understanding from healthcare professionals of
the physical and emotional experiences of injured musicians.

An objective of their study was to provide a narrative context from which healthcare providers could better comprehend and relate to the experiences of musicians. With this information, it was hoped that healthcare providers could better provide effective treatment through a holistic assessment and treatment. Guptill and Golem (2008) emphasized the importance of respecting and listening to the musician’s story and experiences. They stated that: “Perhaps the most valuable contributions from the literature on musicians’ playing-related injuries are the anecdotes from seasoned practitioners about how to approach effective care” (Guptill & Golem, 2008, p. 310).

Guptill, in her 2010 dissertation, investigated 10 professional Ontario musicians, expanding the investigation to include music teachers, freelance musicians, and orchestral musicians. Using interviews and focus groups, Guptill’s (2010) methodology was enhanced with the use of journal entries, as well as references to biographies, art, and literature. These additional resources were used in an attempt to provide contextual understanding of the lived experience of professional musicians.

Guptill’s (2010) study findings indicated that health care services for musicians were either inadequate or not easily accessible, and that increased education on PRMDs was needed. As was the case with the previously mentioned studies, the findings from this qualitative study may not necessarily be generalized to the greater population due to small sample size. However, the detailed information revealing the quality and nature of the musicians’ experiences nevertheless provided rich and insightful data with which professionals could use to devise better healthcare
policies, health promotion strategies, and assessment/treatment protocols.

As discussed earlier, an interesting finding in Guptill’s study was the report of flow experience as having a detrimental influence in musicians’ health. The musicians reported a desire to avoid the experience of flow, feeling that it posed an injury risk. These findings are in contrast to the statements made by Csikszentmihalyi (1990), and Fritz and Avsec (2007), who associated flow experience with subjective well-being and positive spiritual and emotional experiences.

Summary

The previously mentioned studies feature the investigation of predominantly student musician populations (except for the example of Guptill’s 2010 study). Guptill’s (2010) study was the first to examine a professional musician population, which consisted of a cross-section of orchestral and freelance musicians, as well as music teachers. Despite the detailed, open-ended investigation of PRMDs, there was a lack of significant discussion on stress management and mental/emotional/spiritual health factors. It is the intent of this research study to focus its investigation specifically on professional orchestral string musicians, i.e., their lived experience with PRMDs under the framework of prevention through stress management and holistic health behaviours.
Chapter Three: Methodology

This chapter identifies the study’s participants and procedure, which includes the description of the recruitment process, the administered Health and Well-being Assessments, and interview protocol.

Participants

Five professional orchestral string musicians from a major Canadian orchestra participated in the research study: three violinists, one violist, and one cellist. These musicians consisted of one male and five females between the ages of 39 and 54. Participants were selected from a single orchestra in order to ensure uniformity of exposure to workplace risk factors.

Six musicians were originally recruited for the interview, with one musician withdrawing their data out of privacy concerns. The interview participants displayed varying attitudes regarding the sharing of their personal accounts: from open willingness to concerns over privacy and compromising professional reputation. To ensure privacy, participant names were removed and replaced with case study numbers, e.g., Case Study #1/ Musician #1. To further guarantee anonymity, specific instruments were removed as it was determined to bear little relevance to the study’s findings.

Procedure

This study utilized a case-study/interview approach, which provided qualitative data on the recruited participants drawn from the professional orchestral string musician population.

A mixed methods (Denscombe, 1998), three-step approach was implemented:

1. Recruitment:

A preliminary, introductory letter and brief questionnaire were administered and distributed
online via QuestionPro™ (url: http://www.questionpro.com) by the principal researcher to a sub-
set of musicians within a single major professional orchestra in Canada. In order to maintain a
homogeneous research population, the questionnaire was distributed to the orchestra’s 34 string
players only. (See Appendix A – Brief Preliminary Questionnaire). This brief questionnaire
gathered preliminary quantitative data on the population sub-set’s current or past PRMD history,
as well as sorted out potential and willing interview candidates.

The musicians reporting PRMD history were asked to self-identify in one of three categories.
Category 1 (Currently displaying PRMD symptoms and proactive with maintenance and/or
prevention) denoted musicians consciously pursuing modalities, strategies, and behaviours
targeted to address PRMD symptoms. Category 2 (Currently displaying PRMD symptoms and
not proactive with maintenance and prevention) denoted musicians not consciously pursuing
modalities, strategies, and behaviours that were targeted to address PRMDs. This category did
not exclude musicians who (unknowingly) incorporated health-promoting behaviours that are
considered PRMD treatment and prevention strategies. Category 3 (No longer displaying PRMD
symptoms and achieving successful maintenance and/or prevention) referred to musicians who
reported an absence (for one year or more) of any PRMD symptoms severe enough to disrupt
playing.

Following the results of the sorting questionnaire, six candidates were selected to reflect varying
profiles of gender, age, instrument, and PRMD history, (including those with no PRMD history),
as examples of typical instances (Denscombe, 2007) in the orchestral string population. Two
musicians with no PRMD history and four musicians reporting little to no PRMD symptoms and
achieving successful maintenance participated in the interviews. Prior to the interviews,
participants were e-mailed an electronic copy of the recruitment letter and consent form. (See Appendix B – Recruitment Letter and Consent Form).

2. **Health and Well-being Assessment:**

Prior to the interview, participants were requested to complete a brief *Health and Well-being Assessment*, which was administered online via QuestionPro™ (url: http://www.questionpro.com). (See Appendix D – *Health and Well-being Assessment*). This *Health and Well-being Assessment* consisted of a 16-question health and well-being scale of assessment created and adapted from six scales measuring general health (David Goldberg's *General Health Questionnaire* GHQ-12, 1978) and *EuroQol Health Status Visual Analogue Scale* EQ-5D VAS, 1990), mental health (*Warwick-Edinburgh Mental Well-being Scale* WEMWBS, 2006), emotional health (*Positive And Negative Affect Scale* PANAS; Watson & Clark, 1994), subjective well-being (*WHO Well-being Index* WHO-5, 1998), and life satisfaction (*Satisfaction with Life Scale* SWLS; Diener, Emmons, Larsen, & Griffin, 1985).

3. **Interview:**

The case study musicians participated in private, semi-structured interviews for which they signed a consent form. A hard copy of both the recruitment letter and consent form was given to each participant for their records. A verbal statement reassuring protection of privacy as well as the option to withdraw or withhold information without penalty was reinforced at the interview.

The interview consisted of two sections (See Appendix C – Interview Guide). Part I consisted of background information in the form of a health and well-being assessment score (administered online via QuestionPro™ (url: http://www.questionpro.com) as well as demographic data (e.g.,
To assist in the assessment of PRMD history, an adaptation of Kenny, Cormack, and Martin’s (2009) variables for measuring PRMDs was used. This scale assessed frequency and severity on a 10-point Likert scale (0 = never, 10 = daily), as well as duration of symptoms (in hours or days). This data was collected only as needed or as it arose during the course of the interviews. Part II of the interview consisted of a semi-structured interview format in which the participants were asked to share their thoughts, opinions, and behavioural practices regarding PRMD-prevention and holistic health and well-being. (See Appendix C – Interview Guide).

Relevant audio data and written notes were transcribed for analysis. Case study summaries and facts were then crosschecked by the interviewees for clarification and accuracy of interpretation.

The case study participants were rated on their health and well-being status (Poor, Fair, Good, Excellent) according to the score tabulated from their completed Health and Well-being Assessment. Sixteen questions, rated by the interview candidates (1 = Poor, 6 = Excellent) were scored according to the following scale: 16 – 35 = Poor, 36 – 55 = Fair, 56 – 75 = Good, 76 – 96 = Excellent. 16 = Worst imaginable health/well-being, 96 = Best imaginable health/well-being.

This research procedure was approved by of the Office of Research Ethics at the University of Toronto. (See Appendix D – Ethics Approval).
Chapter Four: Results

This chapter provides a summary of the collected data as well as the details of the five case study musicians.

Interview Data Summary

Out of 34 string musicians, 25 musicians responded to the preliminary survey that polled PRMD history (73.5% response rate). Of the 25 responses, 19 (76%) replied having a PRMD history, and 6 (24%) reported having no PRMD history. Table 1 summarizes the response results from the Brief Preliminary Questionnaire.

Table 1 Orchestra Strings and PRMD History

<table>
<thead>
<tr>
<th></th>
<th>Violin (18)</th>
<th>Viola (6)</th>
<th>Cello (6)</th>
<th>Double Bass (4)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PRMD History</td>
<td>55.6% (10)</td>
<td>83.3% (5)</td>
<td>50% (3)</td>
<td>25% (1)</td>
</tr>
<tr>
<td>No PRMD History</td>
<td>27.8% (5)</td>
<td>16.7% (1)</td>
<td>0% (0)</td>
<td>0% (0)</td>
</tr>
<tr>
<td>No response</td>
<td>16.6% (3)</td>
<td>0% (0)</td>
<td>50% (3)</td>
<td>75% (3)</td>
</tr>
</tbody>
</table>

Of the 19 musicians who reported having PRMD history, three failed to complete the questionnaire in its entirety.

Nine musicians self-identified in Category 1 (Currently displaying PRMD symptoms and proactive with maintenance and/or prevention), one musician self-identified in Category 2 (Currently displaying PRMD symptoms and not proactive with maintenance and prevention), and six musicians self-identified in Category 3 (No longer displaying PRMD symptoms and achieving successful maintenance and/or prevention). Six musicians reported no PRMD history (Category 4).
Background Data

The musicians’ years of training ranged from 12 to 18 years. Years of professional experience ranged from 18 to 30 years. Three of the five musicians were solely performing musicians. The musicians’ playing activities ranged from 100% orchestra to 60% orchestra/20% personal/20% leisure. The amount of time playing per week varied, ranging from 15 to 40 hours per week, with the average range being 19.6 to 32.8 hours per week. As mentioned, two of the five musicians engaged in professional activities outside of performing: one musician engaged in occasional teaching, another devoted 50% of her professional time to teaching and 50% of her time to playing.

Health and Well-being Assessment

All five musicians ranged from Good to Excellent on the Health and Well-being Assessment. Scores ranged from 62 (Good) to 87 (Excellent) on a scale of 6 = Worst imaginable to 96 = Best imaginable.

PRMD Histories

All musicians experienced at least one minor incident with PRMD symptoms significant enough to disrupt their playing. Two musicians (#1, 4) reported no significant PRMD history, two musicians (#2, #3) experienced years of chronic symptoms, and one (#5) suffered an acute injury, which developed into chronic symptoms aggravated by playing. Table 2 lists a summary of the case study profiles.
<table>
<thead>
<tr>
<th></th>
<th>Musician #1</th>
<th>Musician #2</th>
<th>Musician #3</th>
<th>Musician #4</th>
<th>Musician #5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td>Female</td>
<td>Female</td>
<td>Female</td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>42</td>
<td>54</td>
<td>44</td>
<td>39</td>
<td>52</td>
</tr>
<tr>
<td><strong>Health &amp; Wellbeing</strong></td>
<td>Excellent (87)</td>
<td>Good (84)</td>
<td>Good (62)</td>
<td>Good (67)</td>
<td>Excellent (76)</td>
</tr>
<tr>
<td><strong>PRMD History</strong></td>
<td>NO</td>
<td>YES</td>
<td>YES</td>
<td>NO</td>
<td>Acute/YES</td>
</tr>
<tr>
<td><strong>PRMD Symptoms</strong></td>
<td>None</td>
<td>Neck discomfort, Upper thoracic back: tension, fatigue, pain</td>
<td>None</td>
<td>None</td>
<td>Acute injury: swelling in finger joint, limited wrist &amp; finger mobility</td>
</tr>
<tr>
<td><strong>Yrs of training</strong></td>
<td>14 years</td>
<td>12 years</td>
<td>20 years</td>
<td>17 years</td>
<td>18 years</td>
</tr>
<tr>
<td><strong>Profil experi.</strong></td>
<td>18 years</td>
<td>30 years</td>
<td>19 years</td>
<td>18 years</td>
<td>26 years</td>
</tr>
<tr>
<td><strong>Playing activ.</strong></td>
<td>60% Orch., 20% Personal, 20% Leisure/Other</td>
<td>80% Orchestra, 5% Freelance</td>
<td>100% Orchestra</td>
<td>95% Orch.</td>
<td>80% Orchestra</td>
</tr>
<tr>
<td><strong>Other profil activ.</strong></td>
<td>50% Teaching, 50% Playing</td>
<td>None</td>
<td>None</td>
<td>Occasional teaching</td>
<td>None</td>
</tr>
<tr>
<td><strong>Playing schedule</strong></td>
<td>15-30 hrs/wk</td>
<td>25-30 hrs/wk</td>
<td>17-32 hrs/wk, Summer: Ohio to sporadic</td>
<td>24-40 hrs/wk, Summer 3-4 hrs/wk</td>
<td>17-32 hrs/wk</td>
</tr>
<tr>
<td><strong>Pract. schedule</strong></td>
<td>1½ hrs/day when not disrupted by work sched.</td>
<td>Typically does not practice</td>
<td>1-2 hrs/day, Only practices unfamiliar repertoire</td>
<td>4½ hrs/day or 1½ hrs/day</td>
<td>Irregular to regular, depending on schedule</td>
</tr>
<tr>
<td><strong>Pract. routine</strong></td>
<td>Regular routine technique, repertoire</td>
<td>Learns repertoire on site in lieu of private practice</td>
<td>Efficient practice, minimizes repetition</td>
<td>Slow warm-up on instrument</td>
<td>Warmup away from instrument, technical warmup</td>
</tr>
</tbody>
</table>
**Practice Schedules and Routines**

The musicians varied in their practice routines from no regular routine, to minimal practice, to a regular one to two hours per day. They reported different practice strategies: incorporating regular technical exercises and repertoire study, starting with slow warm-ups, minimizing practice (of work repertoire) and repetition, warming up away from the instrument, and avoiding practice and learning repertoire on-site only. The musicians who had no history with PRMDs (#1, 4) reported a similar practice regimen, which consisted of a regular instrumental warm-up. Musician #1 engaged in regular, daily practice consisting of technique, followed by repertoire. Musician #4 incorporated slow warm-up routines before both playing and practicing.

The musicians with a history of PRMDs (#2, 3, 5) all made a conscious effort to reduce their hours of practice and playing time. The most significant reason cited for this was to reduce the risk of muscle strain and/or aggravation of their symptoms. This strategy appeared to be a reactionary measure prompted by their development of PRMD symptoms. By comparison, the musicians who had no PRMD history did not report a need to reduce their play/practice hours.

Of the injured musicians, Musician #2 did not practice and elected instead to conserve muscular stamina for rehearsals and performance. Musician #3 also did not practice, unless the repertoire was unfamiliar. She endeavoured to practice with a minimum of repetition and only up to the point of feeling mentally confident, i.e., avoiding ‘over-practicing’. Musician #5 reported an irregular practice routine, but incorporated a regular warm-up routine away from the instrument. She also ensured a day a week to rest.

**Case Studies**

The following sections present the five case studies in further detail. Each musician’s narrative is
supplemented with results from their Health & Well-being Assessments.

**Case study #1.**

Musician #1, female, aged 42, has had no significant PRMD history and has never experienced work stoppage due to PRMD symptoms. She had 18 years of professional playing experience and engages in a typical work schedule that consists of 50% playing and 50% teaching. When playing, her typical schedule is between 15-30 hours a week. Her teaching schedule includes a minimum of 12-14 students a week.

Musician #1’s musical training consisted of 14 years of an intense daily practice routine, which consisted of four hours per day, and 6-10 hours a day during the summers. She likened her formative training to the intense training of an athlete’s. During her studies, which began at the age of seven and continued up to post-secondary training, she reported intense pressure from her parents and music teacher to become a successful musician.

Her practice regimen was consistent from the age of seven and continued after her formative training well into her adulthood and professional life. Her current practice routine, when not disrupted by a busy work schedule, regularly consists of an hour and a half of daily practice, beginning with technique (scales and arpeggios), followed by concerto repertoire. Despite pressure from her parents to become an accomplished musician, she described herself as quiet and unambitious. She reported becoming increasingly quiet and unhappy during her childhood years, attributing it to the pressures of her musical training. Despite the pressure to succeed in her early development, Musician #1 is happy with her chosen career, calling music her “job and calling.”
Health and Well-being Assessment Results.

Musician #1 scored 87 on the Health & Well-being Assessment (Excellent). (Worst imaginable = 16, Best imaginable = 96). She revealed a generally high level of health and well-being in all areas of physical, mental, emotional, social health. Table 3 reveals the results the assessment.
Table 3 Case Study #1: Health and Well-being Assessment

1 = At no time, 2 = Some of the time, 3 = Less than half of the time, 4 = More than half of the time, 5 = Most of the time, 6 = All of the time.

| 1. I feel good and am in the best imaginable health. | 6 |
| 2. I have no pain or discomfort. | 6 |
| 3. I am not anxious or depressed. | 6 |
| 4. I am calm and relaxed. | 4 |
| 5. I am cheerful and in good spirits. | 5 |
| 6. I feel active, vigorous, and energetic. | 4 |
| 7. I typically wake up feeling fresh and rested. | 6 |
| 8. I feel capable, useful, and able to accomplish tasks. | 6 |
| 9. I cope well with change, problems, and unexpected events. | 4 |
| 10. I am able to make up my own mind easily. | 6 |
| 11. I feel confident and good about myself. | 6 |
| 12. I accept myself for both my strengths and weaknesses. | 6 |
| 13. I feel highly satisfied with my life. | 5 |
| 14. My life is filled with things and activities that keep me occupied, and are meaningful and interesting to me. | 5 |
| 15. I have a social network of quality relationships. | 6 |
| 16. I feel optimistic about the future. | 6 |
**PRMD history.**

Musician #1 has had no significant PRMD history except for an isolated incident in her early twenties. While attending a summer training institution, PRMD symptoms occurred after she substantially increased the duration of her practice sessions. She began to experience shooting pain in her left arm, the severity of which she described as 5 on a scale of 1 to 10. Symptoms lasted for three weeks, during which she self-treated by bathing the affected area daily in warm water.

**PRMD prevention practices and strategies.**

Though Musician #1 does not participate in any activities or behaviours with the intent of preventing PRMD symptoms, she engages in regular physical activity in the form of swimming. She describes her instrumental technique as playing with a “loose” left-hand, relaxed shoulders, and what she refers to as a “lazy” left-hand, and “no pressure.”

**Reported stressors.**

Musician #1 cited several occupational stressors. Of concern to her was the lack of recognition, respect, and power she receives as an individual player in the orchestra. She also reported work politics to be a source of strain and social tension, in particular, the areas of orchestra seating and informal ranking. Freelance competition as well as fear of peer judgment were also sources of strain. Outside of the occupation, she reported family life and caregiving as sources of non-occupational stress.

**Stress personality.**

Musician #1 described herself as typically calm and infrequently stressed. She reports experiencing emotional stress approximately five days a month. When she is emotionally upset
or loses her temper, which she estimated to be 8 on a severity scale of 1 to 10, she typically resolves the emotion within in one to two hours.

As part of her personal belief system, she practices love and respect towards others and does not believe in anger: “Love God with all your self. Love your neighbours.” Using this philosophy, she quickly resolves interpersonal conflicts and neutralizes strong emotional reactions: “Being angry is wrong.”

**Stress management techniques.**

Among her stress management techniques, Musician #1 listed spiritual faith, social support, and psychotherapy as part of her life. Musician #1 emphasized the important role of spiritual faith in her management of stress and in her outlook on life: “It’s very important for one to have faith.” Having discovered spirituality after a traumatic experience in her adolescence, she relies on spiritual faith to cope with challenging situations in her life. She practices regular prayer and attends church weekly as part of her spiritual rituals. She also reported that her general philosophy was: “Practice hard and pray hard. The rest is up to God.”

Musician #1 is able to separate herself emotionally and spiritually from daily stressors and work pressures that include workplace tension and politics. She is able to alter her perception and assessment of challenges and stressful situations in both her work and domestic life, likening them to “dog bites,” viewing them as temporary or minor setbacks. Musician #1 also reported receiving social and emotional support from her spouse, whom she cited as a companion in her faith. She also actively pursues psychotherapy to maintain her mental health.

In the isolated incident of PRMD symptoms in her twenties, Musician #1 reported the use of
prayer and spiritual faith in overcoming the setback in her playing:

That year when my left hand [felt] like.. it’s going.. it’s in pain every time I’d start Brahms.

I’d pray a lot. I’d pray a lot. … You see, when you have faith, you don’t take things that come your way as permanent problem[s].

Despite a history of forced training and practicing, Musician #1 described music as her “job and calling” indicating a level of job satisfaction and a sense of purpose in life.

**Opinions and observations.**

Based on her own professional experience, Musician #1 believes that playing-induced muscular fatigue, aches, and pains are an unavoidable experience in the music occupation. She also believes that musicians up to the age of their early thirties should have the physical capability to remain strong and injury-free, but expects the process of aging to naturally decrease muscle strength and performance stamina.

After spending a significant portion of her life in intensive musical training, she believes that some musicians may be susceptible to PRMDs due to insufficient stamina training in their developmental years. She believes that a musician who is unaccustomed to long hours of practicing and playing may be unable to sustain the demands of a professional playing schedule.

Musician #1 also acknowledges the role of stress in PRMDs, that stress causes one to breathe in a shallow manner, which causes muscles to tense, leading to possible injury. She also made the observation that busy musicians “playing all the time” are more likely to get injured. On the subject of personality factors and their possible effect on PRMDs, she has observed a young student who, displaying perfectionist tendencies, played with considerable tension and complained of pain.
Case study #2.

Musician #2 is female, 54 years of age, and has experienced years of PRMD symptoms in the form of muscle fatigue and weakness in the left arm, neck discomfort, as well as muscle tension, fatigue, and pain in the upper thoracic back. In her mid-forties, she began to experience loss of control in the left fourth (ring) finger. She experienced a period of work stoppage that lasted eight weeks.

She has had 12 years of training and 30 years of professional playing experience. Her typical playing schedule consists of 95% orchestral playing and 5% freelance work, which amounts to a total of 25-30 hours a week. Musician #2 describes her practice routine to be minimal, typically saving muscular stamina for work and performances. She chooses to learn repertoire at the work site in favour of private practicing.

Health and Well-being Assessment results.

Musician #2 scored 64 (Good) on the Health & Well-being Assessment. (Worst imaginable = 16, Best imaginable = 96). She reported an overall positive self-evaluation of her health and well-being, with the notable exceptions that she often experiences pain or discomfort and occasionally does not feel rested after sleep, lacking vigour and energy. Table 4 reveals the results of the assessment.
Table 4 Case Study #2: Health and Well-being Assessment

1 = At no time, 2 = Some of the time, 3 = Less than half of the time, 4 = More than half of the time, 5 = Most of the time, 6 = All of the time

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. I feel good and am in the best imaginable health.</td>
<td>4</td>
</tr>
<tr>
<td>2. I have no pain or discomfort.</td>
<td>2</td>
</tr>
<tr>
<td>3. I am not anxious or depressed.</td>
<td>5</td>
</tr>
<tr>
<td>4. I am calm and relaxed.</td>
<td>4</td>
</tr>
<tr>
<td>5. I am cheerful and in good spirits.</td>
<td>4</td>
</tr>
<tr>
<td>6. I feel active, vigorous, and energetic.</td>
<td>3</td>
</tr>
<tr>
<td>7. I typically wake up feeling fresh and rested.</td>
<td>3</td>
</tr>
<tr>
<td>8. I feel capable, useful, and able to accomplish tasks.</td>
<td>4</td>
</tr>
<tr>
<td>9. I cope well with change, problems, and unexpected events.</td>
<td>4</td>
</tr>
<tr>
<td>10. I am able to make up my own mind easily.</td>
<td>5</td>
</tr>
<tr>
<td>11. I feel confident and good about myself.</td>
<td>4</td>
</tr>
<tr>
<td>12. I accept myself for both my strengths and weaknesses.</td>
<td>4</td>
</tr>
<tr>
<td>13. I feel highly satisfied with my life.</td>
<td>4</td>
</tr>
<tr>
<td>14. My life is filled with things and activities that keep me occupied, and are meaningful and interesting to me.</td>
<td>4</td>
</tr>
<tr>
<td>15. I have a social network of quality relationships.</td>
<td>5</td>
</tr>
<tr>
<td>16. I feel optimistic about the future.</td>
<td>5</td>
</tr>
</tbody>
</table>
**PRMD history.**

Musician #2 has experienced seven years of chronic daily PRMD symptoms that she reported to be at a mild severity level (3 on a scale of 1 to 10). She continues to experience muscle fatigue in the upper thoracic back caused by postural and repetitive strain. She moderates the severity of these symptoms by regular stretching. She has also experienced other symptoms that include muscle fatigue and weakness in the entire left arm, which developed into tendonitis. In her mid-forties, she also began to experience loss of fine motor control in the left fourth (ring) finger.

In response to a rapid increase in her symptoms, which she attributed to severe emotional strain in her family life, she discontinued playing for six weeks to recover from her symptoms. Four of these weeks were paid leave. During this period, she sought professional healthcare in the form of physiotherapy, massage, Active Release Therapy, and acupuncture. She began to re-train, gradually increasing her muscle stamina (playing ten minutes at a time). Two weeks after returning to work, she suffered a relapse in symptoms, having discovered that she had begun to play at full capacity prematurely. She withdrew herself from an additional two weeks of work at the end of the work season.

**Prevention and maintenance techniques and strategies.**

Musician #2 is pro-active in the management of her PRMD symptoms through the regular use of various physical, biomechanical, and psychosomatic strategies. She seeks professional healthcare, which includes visits with a general practitioner as well as regular treatments in physiotherapy, Active Release Therapy, acupuncture, and massage. She maintains a level of physical fitness, engaging in Pilates, walking, and Tai Chi. She also incorporates regular stretching before, during, and immediately after playing in order to reduce back muscle fatigue.
To reduce the risk of muscle strain and to ensure adequate rest and recovery, she minimizes her time spent playing through the strategic scheduling of her freelance schedule, e.g., avoiding ‘triple service’ workdays. She also engages in a self-care routine that includes post-performance icing.

On a biomechanical level, she has made adjustments to her technique and playing style, which include playing lightly with less muscular effort (particularly in the absence of acute performance pressure), altering fingerings on the instrument, and applying less left-hand pressure on the fingerboard.

Musician #2 has also adopted psychosomatic strategies to address her general health and PRMD symptoms. She has engaged in professional counseling and stress management techniques that have included breath awareness, meditation, cognitive therapy, and Tai Chi.

**Occupational and non-occupational stressors.**

Musician #2 describes several occupational and non-occupational stressors. She listed occupational biomechanical stressors that included physical strain from carrying her instrument, repetitive strain from playing, and physically demanding repertoire. She reported psychosocial stressors that included seating within the section and relation to colleagues (workplace tension), work politics, financial situation (balancing the need for income with the need for rest/recovery), balancing a freelance schedule, and managing general workload. Musician #2 also reported being affected by non-occupational stressors that included family illness and death.

**Stress and PRMDs.**

In Musician #2’s experience, emotional and mental stress was a significant trigger of PRMD
symptoms. As she dealt with the illness and subsequent passing of a close family member, she experienced a rapid decline in her health in response to the emotional strain. Playing a busy work schedule, she described having insufficient time for self-care. She felt that the severe emotional stress made her increasingly vulnerable to her existing PRMD symptoms.

Six months into dealing with the family illness, she “hit a wall” and experienced rapidly declining health, which consisted of a cold, bronchitis, and then an infected salivary gland:

So it was the stress of that, got sick, and didn’t take care of myself well enough. Because just being normally sick, if I hadn’t had the stress, I probably would have recovered quickly from the illness. It probably wouldn’t have been as severe.

She continued to work despite feeling ill, with her condition being aggravated by particularly challenging repertoire:

Quite truly, it was not possible to play. And with my immune system, and trying to play it, I started to feel a weakness in my arm, and that was the start of my journey. …All these things happened like a domino effect, and I was out.

The extended period of strain initiated PRMD symptoms: “Then my arm started to go…And then being weakened, and not taking a rest, and then just trying to plow through…the arm couldn’t take it.”

Due to a busy work schedule, she was unable to engage in the necessary self-care to manage her stress levels and deteriorating health. Working past her physical and mental capacity, she experienced an increase in her PRMD symptoms, which consisted of severe arm muscle fatigue. The symptoms eventually progressed into tendonitis forcing her to cease playing for two months.
She summarized the effect of the stress on her PRMD symptoms: “… I think it [the stress] probably didn’t cause my injury, but it caused me to be so down in my immune system that it enabled the injury to happen.”

She also reported that experiencing PRMD symptoms also created additional mental and emotional stress. Her inability to play contributed to mental anguish and panic attacks. She also experienced anxiety and self-doubt in her ability to return to playing, as well as anticipated symptom triggers and pain. This in itself led to additional anxiety creating a vicious cycle. She fielded queries from colleagues, the strain of which she reported caused her additional stress.

Musician #2 also reported financial strain to be a contributor to her stress levels. She reported that in order to minimize financial loss during her injury, she placed pressure on herself to accelerate recovery and return to work. She also stated that instead of taking summers as an opportunity to rest from playing, she feels obligated to continue freelance work due to her need for financial income.

**Stress personality and stress management techniques.**

Musician #2 describes herself as a “worrier,” and describes “taking on the stress of others.” She describes a tendency to catastrophize and takes prescription medication to control anxiety. She observes that mental and emotional stressors tend to amplify her PRMD symptoms, which she reports to diminish and/or disappear when she applies cognitive-based stress management techniques that are intended to increase mindfulness and decrease anxiety.

Musician #2 has been proactive in learning and applying cognitive therapy techniques as well as
other stress-coping strategies (e.g., meditation techniques, breath awareness, body scans, and mindfulness, i.e., “being in the moment”). She reports that receiving counseling in combination with mindfulness techniques has provided the greatest positive results in her PRMD symptoms.

**Opinions and observations.**

In Musician #2’s opinion and experience, occupational and non-occupational stress both play a significant role in PRMD occurrence. She believes that the relationship between PRMDs and stress is a cyclical one, and personally advocates for a holistic strategy in PRMD prevention. Musician #2 observes that more women than men report PRMD symptoms and tend to be more pro-active about treatment and prevention. She also observes that more male musicians tend to ignore PRMD symptoms and other health issues. She also observes an increased occurrence of PRMDs in younger musicians, believing it to be attributed to increased competition in the job market. Musician #2 lists several reasons why she believes the orchestra job market has changed and has become more competitive: a changing economy, an increased musician-to-job ratio (due to musicians staying in jobs longer), and more stringent tenure policies in orchestras. She also observes a general tendency among some musicians to ignore or to remain silent about their PRMD symptoms.

**Case study #3.**

Musician #3 is a 44 year old female who has experienced approximately eight years of recurring PRMD symptoms, which have included bilateral forearm numbness, muscle weakness, tendonitis, loss of control, stamina, and strength. She has experienced periods of work stoppage that have ranged from four to six weeks in duration.
Musician #3 has had 20 years of training, and 19 years of professional playing experience, which consists of 100% orchestral playing. Her typical playing schedule ranges between 17-32 hours per week. In the summer, she engages in little to no playing. Musician #3 typically practices one to two hours per week, usually practicing unfamiliar repertoire only until the point of feeling confident and comfortable. She has trained herself to practice efficiently and consciously minimizes repetition in order to conserve muscle endurance and avoid repetitive strain.

*Health and Well-being Assessment results.*

Musician #3 scored 62 (Good) on the Health & Well-being Assessment. (Worst imaginable = 16, Best imaginable = 96). Despite a moderately high level of reported health and well-being, Musician #3 rated her subjective well-being as being poor. She also reported experiencing pain or discomfort and a general dissatisfaction with her life. Despite these self-assessments, she reported an ability to cope well to change, an absence of anxiety or depression, a quality social network, meaningful activities in her life, and a sense of optimism about the future. Table 5 reveals the results of the assessment.
Table 5 Case Study #3: Health and Well-being Assessment

1 = At no time, 2 = Some of the time, 3 = Less than half of the time, 4 = More than half of the time, 5 = Most of the time, 6 = All of the time

<table>
<thead>
<tr>
<th>Statement</th>
<th>Score</th>
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<tr>
<td>1. I feel good and am in the best imaginable health.</td>
<td>1</td>
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<td>2. I have no pain or discomfort.</td>
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<td>3. I am not anxious or depressed.</td>
<td>5</td>
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<td>4. I am calm and relaxed.</td>
<td>4</td>
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<td>5. I am cheerful and in good spirits.</td>
<td>4</td>
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<tr>
<td>6. I feel active, vigorous, and energetic.</td>
<td>4</td>
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<tr>
<td>7. I typically wake up feeling fresh and rested.</td>
<td>4</td>
</tr>
<tr>
<td>8. I feel capable, useful, and able to accomplish tasks.</td>
<td>4</td>
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<tr>
<td>9. I cope well with change, problems, and unexpected events.</td>
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<tr>
<td>10. I am able to make up my own mind easily.</td>
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<td>11. I feel confident and good about myself.</td>
<td>4</td>
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<tr>
<td>12. I accept myself for both my strengths and weaknesses.</td>
<td>4</td>
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<tr>
<td>13. I feel highly satisfied with my life.</td>
<td>2</td>
</tr>
<tr>
<td>14. My life is filled with things and activities that keep me occupied, and are meaningful and interesting to me.</td>
<td>5</td>
</tr>
<tr>
<td>15. I have a social network of quality relationships.</td>
<td>5</td>
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<tr>
<td>16. I feel optimistic about the future.</td>
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**PRMD history.**

Musician #3 experienced severe symptoms that included numbness, muscle weakness, tendonitis, as well as loss of control, stamina, and strength in both right and left upper extremities. Ten years previous, recurring symptoms of muscle weakness prompted her first incidence of work stoppage, which lasted four weeks. During the gradual process of returning to playing, she continued to experience muscle fatigue as well as a loss of dexterity, which was predominantly in the left arm: “…couldn’t hold the instrument up without extreme fatigue, on the left side… trying to move fingers was like trying to move them through mud.” Six years later, she experienced occasional symptoms of recurring muscle fatigue and weakness, which she described to be a 4 on a frequency scale of 1 to 10. The level of severity ranged between 3 and 9 on a scale of 1 to 10. Two years later, she experienced tendonitis symptoms that prompted six weeks of work stoppage. She described a repeating pattern of going to work and dropping out due to debilitating symptoms.

**Prevention and maintenance techniques and strategies.**

Musician #3 has now achieved successful management of her PRMD symptoms that was the result of identifying and addressing biomechanical issues (e.g., equipment, technique, and posture) as well as psychosocial issues (occupational and personal stress). She has been symptom free for two years.

Musician #3 described an ongoing journey experimenting with multiple treatments, therapies, and approaches. She sought out practitioners in physiotherapy, chiropractic, acupuncture,
massage therapy, laser therapy, and Bowen therapy. Of the professional healthcare modalities, Musician #3 experienced the greatest results with acupuncture. She also pursued somatic education through studying Alexander Technique.

She described her physical fitness activities as including stretching, swimming, and cycling. She began to increase her body awareness, respect her physical limits, and ensured adequate rest and recovery by strategically arranging her work schedule. Electing to work a partial schedule or subbing out of work in response to physical discomfort, she was able to prevent PRMD symptoms from developing. She also reduced playing time by utilizing efficient practice techniques such as minimizing repetition while practicing. Further strategies included incorporating breathing techniques as well as improved nutrition (e.g., reduction of salt intake and alcohol).

Musician #3 engaged in biomechanical strategies that included the adjustment of her playing technique. She experimented with different technical and postural adjustments such as altering her left thumb position and vibrating in different hand positions. She also eliminated excess muscle tension by learning how to release tension in the neck: “… over the years, I learned how to relax when I play, or if I couldn’t be completely relaxed during certain parts, how to release after the difficult passage or the passage I worried about.” She also experimented with ergonomic adjustments to equipment such as using different chin rests and shoulder rests.

1 Bowen Therapy is a complementary, gentle, and holistically-oriented healing modality developed in the twentieth century used for correcting structural and functional systems as well as achieving homeostasis (“History of”, n.d; “How Bowen Therapy works”, n.d.; “What is Bowen Therapy?”, n.d.)
Psychotherapy also proved to be beneficial to Musician #3 as she was able to address personal and relationship issues that had contributed to mental/emotional/spiritual stress: “I was in therapy for years. … The therapist helped tremendously. Just understanding that a lot of it was emotionally based helped in understanding.” In addition to psychotherapy, Musician #3 incorporated stress management techniques through the modification of her cognitive and behavioural responses to stressors. She achieved this by consciously identifying her stress triggers and managing her emotional responses and thought patterns.

**Stress and PRMDs.**

Musician #3 strongly feels that the connection between the mind and body represents the largest contributing factor in her experience with PRMDs:

> It’s hugely important. The mind/body connection was, without a doubt, the biggest factor in what was going on with me, to be honest…. I know now that whatever’s happening with me physically… it’s always because there’s emotional stress going on as well. Without a doubt.

Musician #3 encountered opinions from healthcare professionals and colleagues that suggested she was at fault for her PRMD symptoms. She was told that she needed to re-learn and revise her playing technique. Despite these diagnoses, she felt that her PRMD symptoms were not because of improper technique, but largely due to emotional stress:

> It wasn’t necessarily because I was playing the [instrument] incorrectly or because I didn’t practice enough, or because that it was my fault. I was told at one point that I was playing the [instrument] incorrectly and that could be why I was getting injured. But that wasn’t the case.
She observed that her emotional health, which was greatly affected during periods of high stress, had a very key affect on her nervous system. Dealing with emotional stress proved to be more debilitating than the actual PRMD symptoms. She observed that when her “nervous system is functioning well”, she experiences more of a sense of calm and emotional well-being, and that she is less prone to PRMD symptoms. She also reported a cyclical relationship between her PRMD symptoms and mental and emotional stress.

**Occupational Stress.**

Musician #3 reported experiencing job stress, which was largely induced by feelings of low self-efficacy. The challenge of difficult repertoire created worry and self-doubt in her technical ability, which contributed to feelings of vulnerability and of being at fault. She identified this mental/emotional stress as a key factor in the development of her PRMD symptoms:

I was already very, very tensed and stressed out so I played with my body in a really fight-or-flight mode all the time. So my body never relaxed. …But I was stressed in my head, so my body, and therefore my muscles were always... bound. My neck was like a vice, worried about every shift, worried about this passage coming up, panic when I saw all the black. ‘I don’t know how to play it.’…‘How do I do it?’

After the onset of PRMD symptoms, her inability to play at maximum capacity caused her emotional strain, which she described as being a “handicap”:

…I didn’t want to be put in the position of not being able to do what I had set out to do…. It’s a catch 22. The stress of sitting there, of not being able to play what you’re supposed to play makes the injury or the problem worse. So I was trying to avoid being stressed… I didn’t want to feel like I couldn’t do it because it made everything worse. It was starting to become an emotional handicap. The emotional part of not being able to play was starting to
In addition to feeling frustration, she also felt guilt over subbing out of portions of the work schedule, the impact of which she felt affected her colleagues and section seating: “I didn’t want to be in the position where I was sitting in orchestra and actually couldn’t do the job. … It’s not fair. You’re letting down the team.”

Musician #3 also identified the psychological and emotional struggle involved with having to continually self-assess her ability to play/go to work. She internally struggled between her personal need to respect her injured condition and recovery period and her professional responsibilities to her job and colleagues:

Sometimes having to stop playing when the whole orchestra is playing…to sit there and not play when you’re in the middle of this massive [group of] people playing, it’s hugely distressing. … It doesn’t feel right… But you can’t just get up and walk out. The [performance] is going on… … Being in that situation was hugely stressful… in tears…practically sitting there, in orchestra. … ‘I shouldn’t be here, but I’m trying to be here.’

While struggling with PRMD symptoms, she described social interaction at work to be emotionally straining, due to the desire to avoid discussion with colleagues:

It’s very distressing and very upsetting because not only are you injured, but everybody’s watching you… Everybody’s asking if you’re okay…Your struggle becomes an open book because everyone’s seeing you show up, drop out, show up, drop out. That’s stressful.

She also described feelings of frustration due to interaction with colleagues who did not fully
understand the nature of her symptoms:

The muscle weakness I felt different from pain. … Not too many people get that until they’ve experienced ‘You have no energy in your arms, like you’ve run out of gas’… For some reason, that was more important to me, for them to know that… because for me, the weakness was way more debilitating than pain symptoms.

**Non-occupational stress.**

Musician #3 experienced non-occupational stress in the form of personal relationships. She identified a negative personal relationship as a strong contributing factor to emotional stress and her PRMD symptoms. She claimed that resolving this relationship stress resulted in great improvements in her PRMD symptoms.

**Stress personality and stress management techniques.**

Musician #3 claimed that she was “uptight” in the job, highly self-critical, (“beat myself up”), and maintained a high level of physical tension while playing. As she began to conclude that negative mental/emotional stress was a major contributing factor to her PRMD symptoms, she began to learn how to manage self-induced stress that was a result of her self-evaluation at work.

Over several years, she learned to identify stressors and manage her reactions to them. She is currently able to use cognitive strategies that enable her to reduce mental distress. She also reported great benefits from psychotherapy, increasing her awareness of negative self-talk, and adopting an attitude of equanimity and self-acceptance. She claimed that by developing an attitude of self-compassion, she was able to let go of perfectionism on the job and to release feelings of upset and self-criticism. She now alters her perception of making mistakes (reframing) as a way to minimize self-generated criticisms, consequences, and negative
emotions: “not the end of the world.”

Musician #3 also states that through increased self-awareness, she is able to better identify and understand stress triggers in her life, and how to manage and let go of her negative reactions to them. By practicing self-acceptance and eliminating self-criticism, she claims she has become more comfortable and confident with herself and her colleagues.

Opinions and observations.

Musician #3 strongly advocates for a holistic approach to PRMD prevention. She believes that there is no single-pronged solution or prevention technique against PRMDs. After a challenging and ongoing journey trying numerous therapies and prevention strategies, she states that she is “not looking for a Magic Bullet anymore.”

She describes that as an injured musician, it is overwhelming at the initial outset of debilitating symptoms: having to first understand the nature of one’s condition, its contributing factors, evaluating one’s lifestyle and behaviours, determining from the numerous therapies and prevention strategies which approach might be suitable to the individual. She acknowledges that each person has his or her own individual physical make-up, characteristics, degree of resilience, and mental state. Though she recommends professional treatments such as psychotherapy, massage, and acupuncture, as well as other complementary modalities, she acknowledges that healthcare professionals may only be able to offer a limited insight into an individual’s needs.

She thus advocates that musicians actively seek out individually appropriate strategies, i.e., the most effective treatments and prevention behaviours: “Everyone has to find their own cocktail, their own combination of practices and therapies so that they find out what will best work for
Musician #3 also observed that colleagues generally remain quiet about their PRMD symptoms. She speculated that musicians may be afraid to display any sign of weakness and fear being discriminated against by contractors who depend on healthy, reliable musicians.

Case study #4.

Musician #4 is male, 39 years of age, who has no significant PRMD history nor has missed work due to a PRMD. He did however report an isolated incident in which he suffered only negligible symptoms, which he rated as 1.5 on a severity scale of 1 to 10. He reported that these mild symptoms typically occur just once or twice a year and last no more than several days.

Musician #4 has had 17 years of training, and 18 years of professional playing experience. Ninety-five per cent of his playing activities are dedicated to orchestral playing while 5% is dedicated to leisure playing. In addition to performing, he engages in a small amount of occasional teaching. A typical workweek amounts to between 24 and 35 hours per week, occasionally up to 40 hours. In the summer season, he typically plays three to four hours per week, gradually increasing his playing time as the beginning of the season approaches.

Outside of work hours, Musician #4 typically practices between four to five hours per week, or approximately one to two hours per day. At each practice session, he typically begins with a slow warm-up on the instrument.

Musician #4 is aware of the risk of PRMDs and incorporates preventative measures that include light physical exercise and warming-up before playing. He also practices body awareness by
making technical and postural adjustments at the first sign of discomfort.

**Health and Well-being Assessment results.**

Musician #4 scored 67 (Good) on the Health & Well-being Assessment. (Worst imaginable = 16, Best imaginable = 96). Table 6 reveals the results of the assessment, which reveal a uniformly moderate to excellent score in all areas of assessed well-being.
Table 6 Case Study #4: Health and Well-being Assessment

1 = At no time, 2 = Some of the time, 3 = Less than half of the time, 4 = More than half of the time, 5 = Most of the time, 6 = All of the time

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<td>2. I have no pain or discomfort.</td>
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<td>3. I am not anxious or depressed.</td>
<td>4</td>
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<td>16. I feel optimistic about the future.</td>
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Prevention and maintenance techniques and strategies.

Musician #4 identifies two main strategies in preventing PRMD symptoms: physical fitness as well as biomechanical and postural adjustments. His physical fitness regime consists of regular upper-body weight training using light weights. He is aware of his body while playing and makes small adjustments in both posture and technique at the first sign of discomfort: “If I’m doing too much of this, too much of this… drop my left shoulder, go a little easier…whatever, I adjust.”

Occupational stressors.

Musician #4 described several sources of stress in the orchestral occupation that included physically and mentally demanding repertoire, demanding conductors, and incompatible stand partners: “The close interaction with various colleagues can raise or lower the stress level. It’s the stress of your colleagues, the stress of the repertoire.” Musician #4 described an incident in which he played alongside an incompatible colleague. He reported that this experience manifested in an unusual occurrence of physical discomfort in his right arm—the arm closest in proximity to his stand partner. Both he and the colleague acknowledged and observed these unusual symptoms. As a result, he is convinced of the relationship between stress and physical tension: “The stress creates tension in the body. I believe that completely. …Yes, there is a relationship. Definitely.”

Job satisfaction.

Musician #4 reports a high level of job satisfaction, describing a connection and passion for his chosen occupation: “There’s nothing else I can imagine doing. I’m not the best there is but I am passionate about it.” Despite being affected by stressors in the orchestral occupation such as perceived exertion (e.g., playing demanding repertoire) and dealing with difficult coworkers, Musician #4 displays a high level of person-environment fit in his job: “Well, I do get worked
about it but the fact that I do enjoy what I do helps to level it out. …helps to balance things out.”

**Stress management.**

Musician #4 reports being able to effectively cope with the stressors of the orchestral occupation. Engaging in social interaction with colleagues after work provides him the opportunity to vent frustration and/or express any negative feelings: “Something annoys you and within a couple of minutes, you let it go. It’s the 10 minutes…. after work with a colleague… Then it’s over with.” Musician #4 also uses humour and comic relief to relieve workplace tension and reduce stress. He also reported mentally and emotionally benefiting from psychotherapy. With these behaviours and strategies, Musician #4 appears to efficiently deal with the stressors of the job despite factors such as perceived exertion (e.g., playing demanding repertoire) and dealing with difficult coworkers.

**Flow experience.**

As mentioned, Musician #4 appears to display job satisfaction as an orchestral musician and reports having flow experiences from music. He derives a high level of satisfaction and enjoyment from music, both in its creation and in active listening. He described a particularly sacred experience of flow during the act of listening to music:

I don’t consider myself a particularly spiritual person in any sense of the word, but well except for music, maybe. … Quite often I will go home and one of the last things I do before I go to bed will be to listen to some favourite piece. … And I find that just sitting there with the headphones on, by myself… I think I would refer to that as something spiritual. That’s part of the reason why we’ve worked so hard for all these years. When it all just works, it’s a great thing. It is spiritual.
Well, I don’t want to get… not maudlin… or sentimental… but for a long time, it’s the only constant in my life. I don’t want to say it’s the *only* thing I have, but it’s just such a huge part of my life. And…. we slog through a lot of crap, musically speaking, and it’s nice if you’ve been playing some piece of garbage or something, or you had a bad [performance], and it’s nice to go home and, sort of, for me, clear my head and listen to a great recording of a great piece of music.

**Opinions and Observations.**

Aware of PRMD occurrence among his colleagues, Musician #4 believes in the benefit of a proper and preventative warm-up on the instrument, a routine of which he ensures regularly before work. He has observed that the musicians who appear more prone to PRMDs are often female and/or “busy.” He speculates that male gender and genetic physical make-up may have been protective factors in his situation. He has also noticed colleagues who are indifferent, discontent, or who perceive themselves to be mismatched to their job/position according to talent or merit.

**Case study #5.**

Musician #5, female, aged 52, experienced an acute injury in the hand, which after continual playing, developed into chronic symptoms. She has had approximately 18 years of training and 26 years of professional playing experience. Her professional playing activities amount to 80% orchestral playing and 20% other types of playing. Her playing schedule, which varies according to her professional demands, amounts to between 17 and 32 hours per week with a typical week totaling 28 hours per week (or approximately 4 hours per day). In the summer, she reduces her playing to a minimal amount and takes the opportunity to rest.
Her practice schedule outside of work hours is irregular and varies according to her changing professional schedule. She practices when necessary, according to the demands of her work, and when more time allows, fits in a more comprehensive routine, which includes a warm-up of technical exercises. Before playing, Musician #5 warms up away from the instrument, often incorporating a cardiovascular warm-up (e.g., brisk walking/running) to increase circulation. She also uses hand putty to simulate instrument technique, using it to warm up and strengthen the left hand. When her schedule permits, she also ensures one day a week to rest.

Her approach to PRMD treatment and prevention focuses on body-specific care, treatment, education, and maintenance. She advocates physical maintenance, adequate rest, somatic education, and enlisting the care and support of an established team of healthcare practitioners.

**Health and Well-being Assessment results.**

Musician #5 scored 76 (Excellent) on the Health & Well-being Assessment. (Worst imaginable = 16, Best imaginable = 96). Table 7 reveals the results of the assessment, which reveal an overall high level of health and well-being.
Table 7 Case Study #5: *Health and Well-being Assessment*

1 = *At no time*, 2 = *Some of the time*, 3 = *Less than half of the time*, 4 = *More than half of the time*, 5 = *Most of the time*, 6 = *All of the time*

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<td>5</td>
<td>I am cheerful and in good spirits.</td>
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<tr>
<td>6</td>
<td>I feel active, vigorous, and energetic.</td>
<td>4</td>
</tr>
<tr>
<td>7</td>
<td>I typically wake up feeling fresh and rested.</td>
<td>3</td>
</tr>
<tr>
<td>8</td>
<td>I feel capable, useful, and able to accomplish tasks.</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>I cope well with change, problems, and unexpected events.</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>I am able to make up my own mind easily.</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>I feel confident and good about myself.</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>I accept myself for both my strengths and weaknesses.</td>
<td>6</td>
</tr>
<tr>
<td>13</td>
<td>I feel highly satisfied with my life.</td>
<td>5</td>
</tr>
<tr>
<td>14</td>
<td>My life is filled with things and activities that keep me occupied, and are meaningful and interesting to me.</td>
<td>6</td>
</tr>
<tr>
<td>15</td>
<td>I have a social network of quality relationships.</td>
<td>5</td>
</tr>
<tr>
<td>16</td>
<td>I feel optimistic about the future.</td>
<td>5</td>
</tr>
</tbody>
</table>
**Acute injury.**

On the day after a sudden fall, Musician #5 began to experience swelling in the finger joint after playing two services (a total of six hours of playing). Diagnosed as a soft-tissue injury, she experienced debilitating symptoms that compromised her finger and wrist mobility. The forecasted recovery period of one year was prolonged due to continued playing, which aggravated the injured area.

Musician #5 is aware of instrument-specific asymmetrical muscle development and reported playing-related symptoms that include general stiffness and pain. She attributes these symptoms to joint laxity. Her intermittent symptoms are moderate in severity (rated 4/5 out of 10) and, though previously experienced occasionally (rated 5 on a frequency scale of 1 to 10), are currently experienced on a frequent to daily basis (frequency: 8 out of 10).

After three months of persistent symptoms, Musician #5 reports that her injury is now being treated as a chronic injury. A year and half after the initial injury, she continues to monitor load bearing on the compromised finger. Occasional setbacks in her recovery have led to work stoppage, both emergency and preventative. Work stoppage (sick days) has occurred for periods that have lasted between one to two services (three hours per service) up to several weeks at a time. She has observed that these injury setbacks occurred particularly after neglecting her self-care routine.

**Prevention and maintenance techniques.**

Musician #5 employs predominantly physical strategies in her prevention and maintenance behaviours. She currently incorporates regular treatments from professional healthcare
professionals in the form of physiotherapy, chiropractic, Active Release Therapy, massage therapy, and osteopathy. She has also engaged in physical fitness training and education through the study of Pilates. After four years of Pilates training, she reassessed its appropriateness and effectiveness due to persisting symptoms, which she believes to be attributed to joint laxity.

Musician #5 engages in a regular post-work self-care routine involving contrast bathing (cold-hot-cold treatment). She also ensures adequate rest and recovery by strategically scheduling her freelance work and electing to take sick days to maximize her recovery time and/or prevent symptom aggravation. Schedule permitting, she ensures one day each week for muscle rest and recovery, stating however that it is often a challenge to refrain from playing. As a preventative measure, she also avoids extracurricular activity (e.g., prolonged computer use) that requires common muscle groups used for playing.

Musician #5 has pursued somatic education and has sought to improve the general use of her body through physiotherapy conditioning classes. She reported that six months of biweekly physiotherapy conditioning classes yielded the most positive results in her symptoms. Musician #5 also avoids over-exertion while playing and respects her body limits (“taking it easy”).

**Stress and PRMDs.**

Musician #5 believes that stress has a damaging effect on a pre-existing PRMD. She claims that when one is faced with sudden injury, a significant source of stress is in the search for a suitable healthcare practitioner:

> I believe that having to look for a healthcare practitioner when one becomes injured adds to the stress of having an injury. If you have a team already in place, then you get a head start on dealing with an acute injury. You have a better chance of getting in to be seen...
immediately, and you are seen by someone who is already familiar with you and your body.

Much like injured athletes, she also states that PRMD symptoms can cause mental and emotional stress in musicians: “Injury is a very scary thing. … It’s very frustrating to play less than 100%. It’s hugely frustrating, on many levels. And we don’t deal with that at all.”

She also described the internal struggle that is the result of determining one’s readiness to return to work. She described that the “trial-and-error” experience was mentally straining and that it was “an uncomfortable place to be.”

**Opinions and observations.**

Musician #5 believes in the importance of establishing a support system that is in place before the occurrence of an injury. Having observed other musicians in an emotionally vulnerable state when injured, she believes that a musician’s objectivity may be compromised and that it is not an ideal time to search for suitable and compatible healthcare practitioners. She believes that a musician’s support team should ideally consist of a pre-assembled team of various healthcare practitioners, as well as any other resources, that may help in reducing mental or physical strain that could contribute to existing PRMD symptoms. She cited the example of hiring childcare support in order to help alleviate childcare duties, create increased practice time, and better meet the demands of a busy work schedule.

She stated that establishing and cultivating a relationship with healthcare professionals would be of benefit to musicians in the event of an unexpected occurrence of injury symptoms. She pointed out that this is particularly important in the event of an acute injury, when treatment
within the first 24 hours can greatly optimize chances for speedy recovery.

Musician #5 also advocates for consulting with different healthcare practitioners that reflect different disciplines, in order to ensure a broad, holistic approach to one’s health. Having experienced that each healthcare practitioner has their own particular strength and develops their own approach, she believes that by ensuring a broad range of treatments, a musician is better positioned to gain an enriched perspective of their situation and to receive better overall care.

Musician #5 also spoke of the importance of suitability and compatibility of the practitioners to the musician, that the effectiveness and appropriateness of the treatment, as well as personality compatibility were important factors. She believes that it is important for a musician to seek out practitioners who are pro-active about self-education and who practice using a broad, holistic knowledge. By pre-establishing a personally customized support team of healthcare professionals, she believes that a musician can help reduce stress, ensure better muscle management, increase free time, and receive prompt treatment by professionals already familiar with the musician’s profile.

She also believes in the importance of self-care, that maintenance is 90% of a successful PRMD prevention strategy. She spoke of the importance of seeking regular professional care (e.g., weekly massages) and practicing self-maintenance strategies on a routine basis. As a result of neglect of her own self-maintenance, she was forced to stop working due to an increase in severity and frequency of her PRMD symptoms (i.e., muscle and joint stiffness).

Musician #5 also makes an effort to enforce adequate rest and recovery by taking a weekly day
of rest. Despite feeling a desire to practice, she believes in the importance of taking a day to rest and recover in order to ensure long-term muscle endurance. As a contracted orchestral player with benefits, she takes advantage of sick days to help prevent the aggravation of PRMD symptoms. She acknowledges that for a freelance musician, this is more difficult to achieve without the benefit of paid sick days.

Musician #5 advocates for musician’s health education as an important PRMD prevention strategy: “Education is important.” As an example, she recommends for musicians to become aware of extra-curricular activities that may contribute to PRMD risk (i.e., using muscle groups common to playing an instrument).

Musician #5 also expressed the desire for better social support for injured musicians and has noticed a deficiency in emotional and psychological support in the arts industry. As in professional sports, she points out that it is mentally and emotionally challenging for a musician to be unable to play at their optimal level and to be unable to work due to an injury: “It’s very frustrating to play less than 100%. It’s hugely frustrating, on many levels. And we don’t deal with that at all.”

She expressed frustration over the disparity between the arts and sports industries stating that musicians need to receive the same kind of support that professional athletes get during their injuries and recovery processes. From her own personal experience, she states that a musician may struggle internally with wanting to return to playing and also wanting to achieve complete recovery. She stated that a musician might also receive little guidance and/or psychological support in the process of work re-entry. She herself relied on the process of trial and error in her
return to playing, which she claimed was “an uncomfortable place to be.”

Musician #5 has observed that, during the course of her career, she has noticed progress in musicians’ awareness and openness to discuss PRMDs. She has observed that in the past, musicians have traditionally feared revealing their injury symptoms out of fear of being discriminated against by music administrators and personnel managers. She observes that among music administrators, there is often a lower level of understanding and support for injured musicians. She observes that orchestra administrators are often motivated to protect the needs of the organization, which may not be in the best interest of the injured musician. She claims that the administration often seeks to ensure reliable, successful performances while the musicians desire safe, full recoveries and career longevity.

In contrast to the past, Musician #5 acknowledges a growth in awareness and self-maintenance practices among musicians:

For people to be stretching on a break, or after a [performance] is huge. Because for a long time, you didn’t want anyone to know that you were injured, or needing extra support, because then they wouldn’t hire you. This is a significant shift, and it’s taken 25 years.

Musician #5 wishes for increased awareness of PRMDs in order to increase social support for injured musicians, to remove the social stigma attached to PRMDs, and to encourage open communication among musicians about PRMDs and their prevention. She also feels that by encouraging openness about PRMDs, a healthier atmosphere will develop which can further promote PRMD prevention and maintenance: “It’s not showing that you’re weak or ‘one of the guys.’ It’s a much healthier atmosphere—because a healthier atmosphere really promotes
health.”
Chapter Five: Discussion

This chapter discusses the results of the case study interviews: the emerging themes, typical behaviours and strategies used in PRMD prevention, as well as the general opinions and observations on PRMDs. These findings are discussed in relation to the occupational and performing arts health literature as surveyed in Chapter Two. This chapter will also discuss strengths, limitations, and significance of the study. The following sections first discuss findings and emerging themes that are of relevance to PRMD prevention, stress management, and holistic health behaviours in musicians.

Stress and PRMDs

Stress appeared to exert an influence on PRMD symptoms in several of the musicians. These musicians experienced various relationships with occupational and non-occupational stressors, which affected their subjective experiences to varying degrees.

Musician #2 experienced a rapid decline in both her health and in her pre-existing PRMD symptoms in response to the stress of a family illness/death. As a self-described “worrier,” she also experienced occupational stress from financial concerns and balancing a work/life schedule. Financial strain is an acknowledged concern among musicians (Mäkirintala, 2008; Morse et al., 2000; Wu, 2007) as is the balancing of work and personal commitments (Mäkirintala, 2008).

Musician #3, like Musician #2 also reported that a combination of emotional stress in her personal life and mental stress in her work life (anxiety and self-pressure) contributed to the severity of her PRMD symptoms. An interpersonal relationship was a significant source of Musician #3’s stress outside of work, the resolution of which she claimed had a profound impact.
on her mental health and PRMD symptoms. At work, she reported struggling with anxiety and panic, feeling that she could not keep up with the technical standards required of the job. As Mäkirintala (2008) stated: “Musicians’ self-esteem is highly dependent on their perceived performance skill, which in turn raises demands for technical perfection” (p. 8). Musician #3 appeared to have experienced a combination of performance anxiety, performance pressure, and socially prescribed perfectionism. Klibert et al. (2005) discussed the psychological significance of socially prescribed perfectionism (to be discussed further in a later section), claiming it to have an effect on anxiety, shame, and self-pressure. Wu’s (2007) findings further claimed that self-pressure is an associated risk factor with PRMD symptoms.

Musician #3 additionally reported lack of coworker support and understanding as a stressor that affected her PRMD experience. Ro’s (2006) findings support this, citing lack of coworker support to be among psychosocial factors that affect PRMDs in professional musicians.

Musician #2 and #3’s lived experiences appear to be consistent with the theory that negative stress plays a contributing role in musculoskeletal disorders (Horvath, 2009; Ro, 2006; Sandell et al., 2009; Wiholm & Arnetz, 2006; Yoshie et al., 2008). As Yoshie et al. (2008) demonstrated in their study on pianists, psychological stress caused antagonist muscles in the forearms to co-contract, leading to an increased risk for PRMDs. Both Musicians #2 and #3 experienced symptoms that are consistent with Yoshie et al.’s (2008) findings; their symptoms also included muscle tension and fatigue that occurred in the upper extremities.

Musician #4, who did not have PRMD symptoms, reported that demanding conductors, demanding repertoire, and incompatible stand partners were sources of psychosocial stress in the
orchestral occupation. Horvath (2009) discussed these occupational stressors having listed demanding conductors and repertoire as sources of strain for orchestral musicians. Mäkirintala (2008) also explained that “problems with a stand partner” is one of the “best predictors of ill health” (p. 8). Though Musician #4 did not report these stressors as posing a chronic threat to his playing ability, he did experience an isolated incident of arm pain that correlated with stand partner tension. This seemingly psychomatic and isolated correlation between psychosocial tension and physical symptoms appears to be supported by the theory that occupational psychosocial stressors may influence PRMD symptoms (Horvath, 2009; Mäkirintala, 2008; Ro, 2006; Sandell et al., 2009; Yoshie et al., 2008).

Musician #5, who originally suffered an acute injury, did not report any effect of stress on her PRMD symptoms, though explained that psychosocial strain arose during her recovery process. Returning to playing proved to be an emotionally straining process of trial and error, resulting in feelings of uncertainty and frustration. Lack of support and understanding from management was also an issue of concern.

Prevention and education were important issues for Musician #5 who, like Musician #2 and #3, actively pursued professional healthcare and practiced self-care regimens. Though she did not acknowledge stress to worsen her symptoms, she believed it was important to assemble a team of healthcare practitioners in order to preemptively reduce stress and emotional overwhelm at the first sign of a PRMD occurrence.

Musician #1, who also did not have a PRMD history, reported several occupational stressors that included lack of artistic control and political power, work politics, social relationships with
colleagues, freelance and in-orchestra competition, and fear of judgment from colleagues. Within a symphony orchestra, social tension, lack of artistic integrity, and the sense of anonymity within a larger group have all been reported as sources of stress in musicians (Mäkirintala, 2008). Musician #1’s fear of judgment from colleagues relates to Musician #3’s performance-based anxiety and experience with socially prescribed perfectionism. Mäkirintala (2008) explains that by working in a competitive occupation that demands technical perfection, a musician’s self-esteem may be affected by anxiety over the perceived judgment of one’s playing ability. Like Musician #4, Musician #1 did not report any of these stressors to have a contributory effect to PRMD symptoms. The absence of symptoms may suggest a beneficial interaction of intrinsic protective factors and healthy behaviours, as was suggested by Allread (2000). Allread (2000) concluded that injury risk is dependent on a complex relationship between numerous variables that include psychosocial, personal, and non-work related factors.

Case Study #1

Of particular interest in this study was the description of Case Study #1 who did not have any significant PRMD history. Musician #1 reported a lifelong history of arduous training, extrinsically motivated daily practice, and exposure to occupational risk factors (i.e., low decision latitude; Theorell et al., 1993; and performance pressure; Ro, 2006). According to commonly acknowledged risk factors listed in research literature, she exhibited predisposing PRMD risk factors that included female gender (Abréu-Ramos & Micheo, 2007; Brusky, 2009; Dietrich et al., 2008; Heinzle, 2001; Middlestadt & Fishbein, 1989; Wu, 2007), playing a string instrument (Middlestadt & Fishbein, 1989), and long hours of playing and over-practicing (Wu, 2007). As mentioned earlier, she also reported strain from acknowledged psychosocial risk factors on the job. Despite being exposed to these risk factors, she reported no significant history with PRMDs.
Based on the description of her typical behaviours and practices, one can speculate on the factors that may have contributed to her successful avoidance of PRMDs: the combination of stress management (spiritual practice and psychotherapy), a relaxed playing style (loose left hand technique), and regular physical exercise. Playing technique and physical fitness will be addressed in a later section; however the immediately following sections first discuss spirituality as a mediating factor in stress management and PRMD prevention.

**Spirituality.**

Musician #1 reported spiritual well-being as a central theme in her life, using philosophies based on her spiritual faith as a significant method of reducing stress and tension. She reported attending church regularly, and as Seaward (1998) explains, the routine practice of special activities or “the practice of sacred rituals” (p. 1) is a means to cultivate spiritual well-being, to remind oneself of a connection to a greater source.

Musician #1 also reported having a strong personal belief system in which she did not believe in anger and practiced love and respect towards others. She endeavoured to quickly resolve negative emotions as well as interpersonal conflict believing that: “Being angry is wrong.” Seaward (1998) discusses how repeated perceptions of fear and anger may obstruct the flow of “life force” (para. 10) necessary for physical health and spiritual growth. He discusses the importance of nurturing the human spirit, its ability to produce a sense of calm, and to effect coping strategies against life’s daily stresses. With these spiritually based coping strategies, she demonstrated an awareness and control over her emotions. Rietveld et al. (2007), in their study of stress-induced muscle effort and repetitive strain injury, suggest that the successful regulation of one’s emotions may provide PRMD prevention benefit. Their study found that poor emotion
regulation (alexithymia) was a possible risk factor for repetitive strain injury.

Though her spiritual practices were not consciously applied for the purpose of PRMD prevention, Musician #1, who reported religious faith as a significant lifestyle behaviour, had no PRMD history. This was also in spite of a number of pre-disposing PRMD risk factors. These findings can be at least partly explained by findings by Edmonson et al. (2005) who reported spirituality to have a possible beneficial effect on health. Musician #1’s absence of PRMD symptoms in correlation with the management of stress in her life are also supported by literature that states that spiritual faith is an important means of stress-coping (Gurung, 2010; Seaward, 2008) and that a correlation exists between negative stress and elevated PRMD risk (Middlestadt & Fishbein, 1988; Ro, 2006; Yoshie et al., 2008).

**Job satisfaction.**

Musician #1 also reported being satisfied with her occupation, citing music as her “job and calling.” As cited in Levy et al. (2009), Holland’s person-environment fit theory states that a person who is naturally drawn to, persists, and derives satisfaction from their chosen occupation or environment may experience less occupational and psychosocial strain than a person who is not well-suited to their occupation or environment. A person ill-suited to their occupation may experience or perceive greater amounts of occupational stress, which according to Allread (2000), may compromise health and increase injury risk in a physically demanding occupation. Holland’s theory (Levy et al., 2009) and Allread’s (2000) findings may thus serve to explain Musician #1’s job satisfaction as being a contributing factor in her absence of PRMD symptoms.

**Case Study #4: Flow Experience**

Musician #4, like Musician #1, also had no PRMD history and also reported job satisfaction. His description of his work as a musician suggested a sense of purpose, deep connection, and a high
level of satisfaction with his occupation—all considered elements of spiritual well-being according to the definition by Seaward (1998). Musician #4 likened the experience of optimal music making to a spiritual experience, describing what Csikszentmihalyi (1990) called the experience of flow, i.e., the feeling of optimal experience while being completely engaged and immersed in a controlled activity (“Flow: Being happy,” n.d.).

Flow experiences from music and high job satisfaction suggest elevated emotional and perhaps spiritual well-being. As part of the holistic definition of health, these may have been positive contributing factors to Musician #4’s overall health, serving as part of an interaction of healthy lifestyle behaviours. As Chesky et al. (2006) and Ginsborg et al. (2009) emphasize, overall wellness and healthier lifestyles are important in the prevention of PRMDs. These areas include health responsibility, physical fitness, as well as spiritual growth. Applying Seaward’s (2008) definition of spiritual well-being, having a passion for one’s occupation may likely add a positively contributing element to a musician’s overall wellness, thus fortifying a musician’s successful PRMD prevention.

Musician #4’s positive description of flow experience contrasts however with Guptill’s (2010) study findings, which found that flow experience was reported to be a detriment to health. In her study, the musicians felt that the experience of getting ‘lost’ in the act of music-making led to overplaying, and was thus a risk to their health. Musician #4’s description of flow experience did not impact his playing, however, nor did it present a risk for developing PRMD symptoms. This was perhaps due the fact that he did not cite flow experience to be derived from playing but rather from the active listening of music.
Occupational Risk Factors

The following sections discuss the occupational risk factors, both biomechanical and psychosocial, that were discussed in the interviews. These discussions are organized according to the emerging themes that were reported to have a correlation with PRMD symptoms and prevention.

**Biomechanical risk factors.**

The musicians reported biomechanical risk factors that have been frequently discussed in the literature. These included physically demanding repertoire (Horvath, 2009), repetition (Punnett & Wegman, 2004), being unable to determine rest breaks (Ro, 2009), tense play/practice patterns (Ro, 2006), and carrying heavy instrument cases (Horvath, 2009). In the orchestral occupation, lack of decision latitude largely influences repertoire choice, repetition, and rest breaks. The musicians were at least able to address tense play/practice patterns by examining posture, ergonomic set-up, and more efficient instrument and practice technique. These strategies will be discussed further in a later section.

**Psychosocial risk factors.**

Occupational psychosocial risk factors reported by the musicians in this study included demanding repertoire and conductors, low coworker support/understanding, financial concerns, balancing work/life schedule, stand partner tension, and low decision latitude. The following sections discuss in further detail the recurring themes discussed by the musicians: performance pressure and low decision latitude.

**Performance pressure.**

Performance pressure was a significant occupational stressor reported in different forms by three
of the musicians in this study. As mentioned, Musician #1 experienced psychological strain fearing the negative judgment of colleagues. Musician #3 reported feeling pressure to keep up with demanding repertoire and struggled with self-criticism of her playing. Musician #4 listed demanding repertoire and demanding conductors as sources of performance pressure.

Performance pressure is a central characteristic of the music occupation, which serves to contribute to the inherently high level of psychosocial strain experienced by musicians (Akel & Düger, 2007; Taylor, 1997). High psychological demand in the forms of performance pressure and performance anxiety can result from public performances (e.g., recitals, concerts, orchestral solos), and official evaluations (e.g., auditions; Ro, 2006). Performance pressure can also come from unofficial sources such as silent peer judgments from colleagues, stand partners, conductors, personnel managers, and even audience feedback (e.g., applause, reviews, and audience turnout). Orchestral musicians in particular face regular evaluation on the job, which can be self-generated—as demonstrated in Case Study #3—or externally oriented. The results from this study support the findings from Ro’s (2006) study, which demonstrated that performance pressure is a source of considerable strain for professional musicians (experienced by Musicians #1, #3, and #4). This study also suggests that performance pressure may also be a contributing factor in PRMD risk (as was reported by Musicians #2 and #3).

**Low decision latitude.**

Low decision latitude was also a commonly cited occupational stressor. Consistent with previous findings in literature (Mäkirintala, 2008), Musician #1 reported having a low level of control over orchestra seating, ranking, and work politics, the social implications of which created psychosocial tension. She also perceived a lack of recognition, respect, and power as an individual within the larger orchestra population.
Musician #4 cited sources of occupational stress to be demanding repertoire (the selection of which orchestral musicians have no artistic control) and being under the demands of the conductor (who determines repetition, intensity, and duration of playing in rehearsals and in performance) as sources of occupational strain. Demanding repertoire (Horvath, 2009) as well as demanding conductors (Horvath, 2009; James, 2000) have been cited in literature to be both sources of strain and risk factors for PRMDs.

Musician #3 experienced low decision latitude being unable to determine the frequency and timing of her rest breaks while keeping up with the rest of the orchestra in her injured condition. Low decision latitude, in this case, had physiological rather than psychosocial implications, as it proved difficult for Musician #3 to stop playing in the middle of a rehearsal or performance. As discussed in Chapter Two, low decision latitude (Mäkirintala, 2008; Ro, 2006), along with its related psychosocial stressors of demanding conductor (Horvath, 2009; James, 2000) and repertoire (Horvath, 2009) have been identified in the orchestral occupation as having an influence on PRMDs.

The musicians who reported no PRMD history (Musicians #1 and #4) also felt affected by low decision latitude but did not report any negative effects on their playing ability. This contrast in findings (as compared to Musician #3’s experience) suggests that a complex interaction of other factors interacted to determine their PRMD risk, and that further study is required to better understand what factors may serve to counteract the negative effects of low decision latitude on PRMD risk.
Socially prescribed perfectionism.

Socially prescribed perfectionism has been correlated with worry in rehearsal, lack of confidence, and cognitive performance anxiety (Langendörfer et al., 2006). Langendörfer et al. (2006) also found a correlation between demanding repertoire and physical symptoms of stress, which was experienced by Musician #3. Inadequate preparation, high occupational standards (Horvath, 2009), and self-pressure (Wu, 2007) are all inherently linked to socially prescribed perfectionism and have also been confirmed as PRMD risk factors for orchestral musicians. Musician #3’s mental stress and PRMD symptoms were partially attributed to perfectionism and harsh self-judgment, and were successfully moderated through stress management techniques.

Musician #1 also described socially prescribed perfectionism as a stressor in her life. She reported fearing silent critical evaluation from colleagues. Unlike Musician #3, however, she did not report this performance pressure to have a negative effect on her playing. Comparing the different physiological responses to stress of Musicians #1 and #3, it is apparent that the individuality of each musician’s stress personality contributes to the complexity of PRMD risk and prevention.

Social support.

Social support emerged as an important factor in both the musicians with and without PRMD histories. Musician #5, who suffered an acute injury, felt frustration and lack of support from orchestra management, claiming that the recovery process was emotionally challenging. Musician #3, who demonstrated a classic example of iso-strain, experienced low coworker support in combination with high psychological job demands and low control. She reported that a lack of understanding of her symptoms from colleagues caused her emotional distress, and that
this was one of several factors that contributed to her PRMD symptoms. Zaza et al. (1998) gathered similar reports in their study finding that musicians’ suffering increased in the absence of validation from peers.

In the musicians without PRMDs, social support was reported to be beneficial in coping with stress. Musician #4 benefited from sharing his work frustrations with colleagues, who presumably showed collegial support. According to the Utrecht Coping List (Gurung, 2010; Halleland et al., 2009), the expression of one’s feelings is considered a stress-coping mechanism. Musician #1 listed social support from her spouse as a supplement to her inner resources. Gurung (2010) cites Taylor’s tend and befriend theory, which states that social support (observed particularly in females) is a behaviour that is exhibited during times of stress.

**Non-Occupational Risk Factors**

The case study musicians reported non-occupational risk factors that included health problems and the stress of domestic life, which are also identified in literature as contributing PRMD risk factors (Jameson, 2000). Musician #3, who claimed that stress greatly contributed to her PRMD symptoms, reported that a significant source of emotional stress in her life was due to a personal relationship. She claimed that psychotherapy provided the greatest benefit to her general well-being and helped alleviate her PRMD symptoms. Musician #5 reported that illness in the family led to a “domino effect” of stress, declining health, and served to exacerbate her PRMD symptoms. These examples provide descriptive evidence that emotional stress from non-occupational sources are correlated with PRMD symptoms, as was suggested by previous findings that pertained to perceived stress and muscle tension dysphonia in singers (Dietrich et al., 2008). Musician #2 and #5 also acknowledged that an additional contributing factor to their PRMD symptoms was joint laxity, which has also been acknowledged in literature (Horvath,
Selected personality factors.

Personality factors that appeared to be correlated with PRMDs included trait anxiety and perfectionism. Type A Behaviour, which was discussed in Chapter Two as a likely behavioural trait in the Classical music occupation (Taylor, 1997), was neither reported nor observed in the musicians in this study. Trait anxiety, however, was reported in both Case Studies #2 and #3 and appeared to have a direct correlation with reported PRMD symptoms.

Musician #2 described herself as being prone to worry, anxiety, and catastrophizing. She reported years of PRMD symptoms and observed a strong relationship between her mental/emotional stress and PRMD symptoms. This finding is supported by Levy et al.’s (2009) study on marching musicians and the Big Five personality traits, which stated that poor emotion regulation in response to stress is correlated with higher incidence of performance-related injury. This is caused by way of excess muscle tension, which can cause less-coordinated movement and can lead to injury (Levy et al., 2009).

Though Musician #2 admitted to a range of PRMD risk factors that included physical factors (e.g., joint laxity, repetitive strain) and acute personal stress (e.g., loss of a family member), she claimed that the most significant improvement in her condition came from the application of stress management techniques. In response to acute family stress, she experienced a rapid decline in her health, which was followed by an increase in her PRMD symptoms. As Watson (2009) stated, chronic stress can contribute to compromised immune function, leading to greater risk for viral infections and other health complications. Musician #2’s account of a psychosomatic connection between stress and PRMDs is thus consistent with previous findings in the literature.
that state that: 1) workers who tend to adapt poorly to stress and experience negative emotions (neuroticism) may be more vulnerable to repetitive strain injury (Rietveld et al., 2007; Sarno, 1998) and 2) that musicians with high trait anxiety may experience pain more acutely (McGrady, 2007) and exhibit more sensitivity to stress-induced physiological and behavioural changes (Yoshie et al., 2008). Middlestadt and Fishbein (1988) also stated that in their study, musicians who reported an above-average level of stress also reported the highest prevalence of musculoskeletal injuries. Palliser et al. (2005) stated that high exposure to potentially stressful occupational and non-occupational stressors may contribute to the development of work-related musculoskeletal disorders, such as repetitive strain injury (Rietveld et al., 2007).

Musician #3 exhibited anxiety and socially prescribed perfectionism that was associated with self-pressure and job performance. Like Musician #2, she too reported the successful management of her PRMD symptoms through stress reduction techniques. Feelings of anxiety and low self-efficacy resulted as a response to insufficient preparation, challenging repertoire, and high performance standards. Combined with self-pressure, she claimed that a chronic fight-or-flight response led to PRMD symptoms in her neck and upper extremities. Emotional stress in her personal life added to the stress on the job, which consisted of feelings of guilt, perceived social pressure, and strained relations with colleagues. The combination of these stressors with intrinsic factors (i.e., gender, instrument, etc.) appeared to have contributed to her PRMD symptoms.

Hagglund and Jacobs (1996) provided similar findings in their study of physical and mental practices of music students. They stated that musicians may “worry about technique, repertoire, insufficient amount of preparation, inadequate performance, experience…” (p. 22). Most
significantly, they also reported that in their study, a musician experienced a “definite correlation” (p. 21) between tendonitis symptoms and their stress levels.

Musician #3 despite being told that her symptoms were due to improper playing technique, asserted that stress was the greatest contributing factor to her PRMD symptoms. She reported a direct causal relationship between stress and her PRMD symptoms and claimed that psychotherapy made a noticeably positive contribution in her condition.

Table 8 summarizes the stressors reported by the case study musicians.
<table>
<thead>
<tr>
<th>Occupational Stressors</th>
<th>Musician #1</th>
<th>Musician #2</th>
<th>Musician #3</th>
<th>Musician #4</th>
<th>Musician #5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Psychosocial</strong></td>
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<td>Low decision latitude</td>
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<td>Mental/emotional stress caused by PRMD symptoms</td>
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<td>Demanding conductor</td>
<td>Mental/emotional stress caused by PRMD symptoms</td>
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<td>Orch. seating, politics Competition</td>
<td>Orch. seating, politics</td>
<td>Psychosocial issues surrounding PRMDs (e.g., social interaction, social pressure)</td>
<td>Incompatible stand partner</td>
<td>Psychosocial issues surrounding PRMDs (e.g., pressure to return to work)</td>
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<td>Perceived judgment from colleagues</td>
<td>Financial challenges</td>
<td>Performance pressure leading to low self-efficacy</td>
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<td><strong>Biomechanical</strong></td>
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<td>Physically demanding repertoire</td>
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<td>Demanding repertoire</td>
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<td>Work/rest time management</td>
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<td>Repetitive strain from playing</td>
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<td>Physical strain of carrying instrument</td>
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<td><strong>Non-occupational stressors</strong></td>
<td></td>
<td>Family stress (illness, death)</td>
<td>Personal relationships</td>
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PRMD symptoms in themselves were reported to be a source of stress in the injured musicians (Case Studies #2, 3, and 5). These musicians reported feelings of worry, anxiety, self-doubt, guilt, or frustration over the debilitating nature of their PRMD symptoms. The mental and emotional stress resulted from different sources: Musician #2 felt self-doubt in her ability to return to full playing capacity, Musician #3 experienced doubt in her playing ability and guilt from feeling unreliable to her colleagues, and Musician #5 felt uncertainty and a lack of support during her recovery process. All three musicians experienced frustrations with their experiences with symptom relapse and work re-entry.

As explained in Maslow’s hierarchical needs (“Maslow's Hierarchy,” n.d.), musicians demonstrate the need to strive for excellence (self-actualization) and the need to achieve recognition and self-accomplishment (esteem; “Maslow's Hierarchy,” n.d.). These desires may fuel the internal pressures that drive a musician to continue playing through pain or disability. As McGrady (2007) stated, musicians like athletes, train to focus, concentrate, and perform under pressure and through pain in their active muscles. External pressures such as financial concerns, workplace pressure, as well as lack of peer support and understanding, may also contribute to a musician’s desire to play despite symptoms.

Halleland et al. (2009) explained that like professional athletes, musicians experience worry and concern over the impact of PRMDs on their playing ability. Musicians devote many years to specialized training and practice, often starting from a considerably younger age than workers of other occupations. They may experience emotional stress being forced to withdraw from playing, and may experience internal conflict in having to distinguish their playing ability from their
sense of identity and self-worth. Musicians with PRMD symptoms may require months or even years to rehabilitate and fully recovery from their injuries (Heinzle, 2001). As was the case with Musicians #2, 3, and 5, injury recovery processes can be slow and interrupted by periodic relapses.

Musician #3 reported self-induced pressure to continue playing through debilitating symptoms in the middle of a performance. Musician #5 described feeling pressure from orchestra management whom she felt to be more interested in protecting the integrity of the performances rather than the performers. As these musicians demonstrated, social pressure to return to work may be felt both implicitly and explicitly from colleagues and management, and may combine with a musician's intrinsic motivation to return to playing.

Musicians #2 and #3 suggested a cyclical effect between stress and their PRMD symptoms. As demonstrated by their experiences, psychosocial implications and mental/emotional stress arose, involving complex emotions of guilt, frustration, anxiety, and self-induced pressure. Stress was originally identified as a contributing factor in their symptoms, and thus appeared to be part of a self-perpetuating cycle. Considering that the stress also appeared to negatively influence their subjective experience of symptoms, it is logical that these musicians reported the greatest improvement in their symptoms through the management of their stress levels.

Musician #5 also stated that the emotional vulnerability that comes with struggling with a PRMD might also compromise a musician’s ability to objectively choose between various treatment modalities. Emotional vulnerability may also compromise the musician’s ability to evaluate the effectiveness and/or appropriateness of a practitioner’s treatment. This in turn may lead to
ineffective or inefficient pursuits towards PRMD recovery, which can prolong a musician’s struggle with symptoms and lead to increased distress.

As was demonstrated by Musicians #2 and #3, this study found PRMDs in themselves to have a negative impact on mental/emotional well-being. This finding is consistent with results from Zaza et al.’s (1998) study, which found that PRMDs pose a mental/emotional challenge to musicians and may threaten their sense of identity. Social strain also appeared to be part of a bi-directional relationship between PRMDs and social health. Specifically, lack of coworker support appeared to be both a contributor as well as a result of PRMDs.

**General Observations on PRMDs**

The case study musicians observed several characteristics and practices that they considered to be associated with greater PRMD incidence in orchestral musicians. Many of these observations are consistent with previous findings in research literature. These included female gender (Abréu-Ramos & Micheo, 2007; Heinan, 2008; Wu, 2007; Zaza, 1992), younger age (Abréu-Ramos & Micheo, 2007; Wu, 2007), increased stress and practicing due to competition (Heinzle, 2001), lack of adequate rest or ‘playing all the time’ (Wu, 2007), lack of adequate warm-up (Horvath, 2009), joint laxity (Horvath, 2009), and perfectionism (Hagglund & Jacobs, 2006; Taylor, 1997; Wu, 2007).

**Age and playing experience.**

Musician #2 observed that younger professional musicians often suffered from PRMDs, which she attributed to longer hours of practicing as a result of increased workforce competition. Musician #1, however, believed that it was older musicians who were more susceptible to PRMDs. Musician #1, who engaged in an intense practice regimen throughout her training and professional life believed that both youth and performance stamina training (i.e., long practice
hours during training years) are protective factors against PRMDs. She believed that muscle strength and performance stamina naturally decrease with the process of aging. She also believed that if a person were unaccustomed to long hours of practicing in their childhood, they would later have difficulty sustaining a professional playing schedule. She believed that playing-induced muscular fatigue, aches and pains are an unavoidable aspect of the occupation, but that musicians up to the age of their early thirties should have the physical capability to remain strong and injury-free. Evidence for some of these observations is found in the literature (Abréu-Ramos & Micheo, 2007; Wu, 2007), though the literature lacks a consensus on the effect of age on PRMDs.

Burkholder and Brandfonbrener (2004) stated that young age does not preclude injury symptoms in musicians, acknowledging that there are numerous other PRMD risk variables that may contribute to PRMD symptoms in student musicians (e.g., joint laxity, lack of muscle conditioning). Wu (2007) also found that younger musicians, due to fewer years of playing experience, exhibited higher prevalence of PRMDs. Abréu-Ramos and Micheo (2007) observed that both younger (22-29 years) and older (50-61 years) musicians were reported to have increased PRMD prevalence in professional symphony orchestra musicians, presumably due to increased hours of playing. Akel and Düger (2007) stated that PRMD risk and prevalence increased with age, at least in their student musician population. Ro (2006), however, did not find any statistically significant evidence attributing age and years of playing/professional experience to increased PRMD symptoms.

**Breathing and muscle tension.**

Musician #1’s opinions on PRMDs also included an acknowledgement of the importance of appropriate breathing, a lack of which she associated with muscle tension and increased PRMD
risk. Horvath (2009) confirms this observation stating that stress leads to superficial breathing, “affecting the oxygen supply to the muscles and nerves” (p. 42). Andrews (2005) also explains that holding the breath, due to unawareness, reflects inappropriate postural tension. She explains that breath awareness and tension reduction are correlated and that appropriate breathing is dependent on good posture, calm mental attitude, and absence of inappropriate tension.

**PRMDs and workplace silence.**

Musicians #2 and #5 also observed a general reluctance among musicians to reveal PRMD symptoms. They observed that musicians feared that their injuries would be perceived as a weakness and that they would be considered unreliable in what is a competitive profession. This observation is consistent with previous findings in interviews with professional instrumental musicians, what Guptill (2010) referred to as a “culture of silence” (p. 115).

**Gender.**

The musicians also observed gender to be a relevant factor in PRMDs. Musician #4 (a male musician) observed that more females suffered PRMDs. Musician #2 (a female musician) observed that women were also more likely than men to report PRMDs and to seek help. These statements are consistent with findings that suggest that women are more open to discuss their symptoms (Brandfonbrener, 2009) and/or that they may be more susceptible to PRMDs (Brandfonbrener, 2009; Wu, 2007). For comparison purposes, Table 9 summarizes the musicians’ opinions and observations on PRMDs in the orchestral occupation.
<table>
<thead>
<tr>
<th>Opinions &amp; Observations</th>
<th>Musician #1</th>
<th>Musician #2</th>
<th>Musician #3</th>
<th>Musician #4</th>
<th>Musician #5</th>
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<tbody>
<tr>
<td>Believes PRMD is unavoidable and incidence increases with age</td>
<td>Believes mental/emotional stress triggered PRMD symptoms</td>
<td>Believes mental/emotional stress triggered PRMD symptoms</td>
<td>Stress management can have positive effect on PRMDs</td>
<td>Acknowledges that stress has damaging effect on PRMDs</td>
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<tr>
<td>Observes that breathing patterns are affected by stress, lead to PRMDs</td>
<td>Observes gender differences e.g., willingness to report/treat symptoms</td>
<td>Advocates holistic PRMD prevention strategy</td>
<td>Advocates for holistic PRMD prevention strategy</td>
<td>Advocates for Healthcare team:</td>
<td></td>
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<tr>
<td>Insufficient rest &amp; recovery is a risk factor</td>
<td>Advocates holistic PRMD prevention strategy</td>
<td>Advocates for holistic PRMD prevention strategy</td>
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<tr>
<td>Perfectionist tendencies associated with tension and pain</td>
<td>Observes correlation between increased competition and increased PRMD occurrence</td>
<td>Busy musicians more at risk</td>
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<td>Rest and recovery</td>
<td>Self-care and maintenance</td>
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<td>Self-education</td>
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Strategies Used for PRMD Prevention and Treatment

The case study musicians consciously applied various strategies for PRMD prevention that included physical, mental, emotional, biomechanical, and nutritional practices. Among these strategies were commonly reported techniques: Feldenkrais, Alexander Technique, adjustments to equipment, posture, and playing technique, as well as self-care strategies such as icing, stretching, and rest (Hagglund & Jacobs, 1996; Horvath, 2009). Spiritual practices were not listed as consciously applied PRMD strategies but appeared to have played a stress-reducing and/or health-promoting role in Case Studies #1 and 4. The following sections discuss in further detail the various practices employed by the musicians in this study: biomechanical, technical, and ergonomic strategies, physical, mental/emotional, as well as time management strategies, nutritional health strategies, and an overall holistic approach.

Biomechanical/technical/ergonomic adjustments.

In an effort to address PRMD symptoms, several of the musicians reported making ergonomic and playing style adjustments, which are immediately accessible and commonly adopted strategies of injured musicians (Hagglund & Jacobs, 1996; Horvath, 2009). Though Musicians #2, 3, and 5 originally played through their symptoms, they along with Musician #4, became increasingly aware of their bodies and began to respect their physical limits. Adaptability in this regard appeared profitable to varying degrees for Musicians #2, 3, 4, and 5 who all reported making conscious adjustments. All musicians made efforts to reduce playing tension, minimize force, and reduce the risk of repetitive strain. Musician #3 became aware of and reduced excess tension in the neck in an effort to alleviate her symptoms of weakness in the forearms. Musician #4 made slight postural changes to ward off muscle fatigue. Musicians #1 and 2 reported using less left-hand pressure on the fingerboard (“loose”, “lazy”, “no pressure”). Musician #2 also reported altering fingerings to avoid straining already injured soft tissue. Musician #5 reported
avoiding over-exertion while playing and respecting her body limits (“taking it easy”).

Addressing playing tension through the application of technical adjustments and the conscious reduction of excess tension are recommended measures of PRMD prevention according to performing arts health experts (Horvath, 2009). Andrews (2005) reinforces the need for tension reduction by stating that pain and muscle tension often manifest in the left hand and forearms of string players. She stated that technical adjustments needed to be made in order to accommodate difficulties such as wide finger stretches. Rietveld et al. (2007) further stated that excess muscle exertion when under stress may mediate one’s risk for developing RSI, confirming that this strategy was a valuable method of reducing PRMD risk in the musicians.

**Practice/play strategies.**

Musicians #1 and #4, who did not have PRMD symptoms, both incorporated regular practice into their playing schedules. Their practice routines included slow warm-ups on the instrument or the practice of technical skills. Musician #5 reported warming up away from the instrument using cardiovascular activity as well as hand putty. She incorporated a technical warm-up only when her work schedule permitted.

The musicians who had years of PRMD symptoms, (in particular Musicians #2 and #3), made a conscious effort to avoid or minimize practicing in order to avoid aggravating their symptoms. Avoiding practice was reported only by the injured musicians and not by the musicians who were symptom-free. This suggests that the avoidance of practice was more of a reactionary precaution against pre-existing PRMD symptoms rather than a preemptive prevention strategy. Literature findings have frequently made recommendations that all musicians take healthy rest breaks in order to preserve playing health (Andrews, 2005; Horvath, 2009; Wu, 2007), however,
the healthy musicians in this study (Musicians #1 and #4) seemed to have no need or incentive to monitor their practice/playing load. Musician #4 did however admit to playing sparingly in the summer months and to consciously building up his playing stamina in preparation for the subsequent season.

In regards to ergonomic adjustments, Musician #3 made adjustments to equipment by experimenting with different shoulder rests and making changes in muscle holding patterns. She claimed however that though she made these ergonomic and technical adjustments to her playing, it was the management of stress that led to the greatest improvement in her symptoms. This finding provides support for the importance and relevance of incorporating stress management as a supplement to a biomechanically-oriented PRMD prevention strategy.

**Physical health and strategies.**

The case study musicians incorporated various physical fitness activities, somatic education modalities, and postural training in their daily lives. The musicians without PRMD histories (#1, 4) reported light physical activity that included swimming and light upper body weight training. The musicians who reported a PRMD history (#2, 3, 5) reported physical activity in the form of walking, cycling, swimming, Tai Chi, and stretching. They also pursued somatic education and postural training in the form of Pilates and Alexander Technique. Postural training and somatic education were only reported in the musicians with PRMDs suggesting that these modalities appeal most to musicians who are motivated by PRMD symptoms.

Taylor and Wasley (2004) stated that the benefits of chronic and acute exercise in musicians include the reduction of cardiovascular response to physical and psychological stressors. They also stated that exercise may also result in a reduction of anxiety and musculoskeletal problems.
Despite these statements, it was beyond the scope of this study to determine to what degree physical exercise might have positively affected PRMD symptoms in the musicians. The case study findings simply revealed that the musicians each engaged in uniquely different pursuits and had varying histories with PRMDs.

Specific musicians also reported various means of self-care and prevention, which included regular warm-up routines with and without the instrument. Musicians #1 and #4 (who had no PRMD symptoms) used warm-up routines on the instrument (technical scales and exercises) as a means of warming up the muscles and maintaining technical skills. Musician #5 (who sustained an acute injury in her hand) reported warming up away from the instrument, which included a cardiovascular warm-up as well the use of putty as a hand strengthener.

The musicians who had PRMD histories reported the use of stretching and icing muscles after performance, as well as physiotherapy exercises. The avoidance of potentially fatiguing extra-curricular activities (such as extensive computer use) was also reported as a precautionary technique. Most noticeably, the musicians who reported PRMD histories made conscious efforts to significantly reduce their total playing time. This was done by minimizing private practice time and reducing their work schedules. These behaviours, which were in comparison to the musicians who did not have PRMD histories, seemed also to be a reactionary measure incorporated only by the injured musicians.

The injured musicians also reported various professional healthcare modalities such as chiropractic, Active Release Therapy, physiotherapy, massage, acupuncture, laser therapy, Bowen Therapy, osteopathy, and psychotherapy. The musicians without PRMDs did not seek
any specific healthcare treatments. Musicians #2, 3, and 5 consulted with a variety of practitioners to benefit from a broad, holistic approach. Musicians #3 and #5 particularly believed in the importance of seeking out a combination of different health care treatments and prevention behaviours in order to create a prevention strategy that is uniquely individualized for each musician. Not surprisingly, PRMD prevention and overall health appeared to take on increased importance to the musicians who developed PRMD symptoms. Based on the musicians’ descriptions, considerable experimentation with a wide variety of strategies appeared necessary in order to find the most effective approach suited to each musician.

**Mental/emotional health.**

The musicians incorporated mental and emotional practices that included cognitive therapy, positive attitude, psychotherapy/counseling, and stress management techniques that included meditation, mindfulness, breath awareness, breathing techniques, and humour. The following sections provide an overview of the strategies used to address mental/emotional health in each of the musicians.

**Stress management.**

Various stress management strategies were reported by each case study musician and had varying results on their PRMD experiences. These included instrumental and emotion-focused coping strategies. As mentioned in Chapter Two, instrumental coping techniques are generally considered more effective than emotion-focused coping strategies (Halleland et al., 2009). The following paragraphs summarize the stress-coping strategies cited by the case study musicians.

**Case study #1.**

Musician #1, who did not have a PRMD history, utilized both instrumental and emotion-focused
stress-coping strategies. Her spiritual faith enabled her to approach challenges directly and rationally by creating and believing in comforting cognitions. Based on her perception of stressors, which were influenced by her faith, she was able to efficiently overcome emotional upset and occupational stress. She also reported benefiting from emotion-focused coping through social support from her spouse and from psychotherapy.

Case study #2.
Musician #2 described herself as a “worrier,” taking on the stress of others. Taking an active problem-solving approach, she educated herself about stress management and incorporated meditation and mindfulness strategies. Social support came in the form of professional counseling. Actively educating herself on stress management techniques, she incorporated meditation and mindfulness (cultivating the ability to be aware and observant of one’s thoughts and experiences in a non-judgmental way; Kristeller, 2007). Through these mental/emotional strategies, she reported positive results and a significant decrease in the severity and incidence of her PRMD symptoms.

Case study #3.
Musician #3 initially exhibited depressive reactions as a response to self-criticism of her work performance. She sought help and social support in the form of psychotherapy, learned to encourage more positive self-talk, and how to create comforting cognitions to reframe the severity of her stressors. She engaged in an active problem-solving approach, which involved cultivating increased self-awareness of stress triggers, her stress response, and stress response management. Like Musician #2, after incorporating effective stress-coping strategies, she reported a positive effect on her PRMD symptoms.
Case study #4.

Musician #4’s response to stress was through the active expression of his feelings, i.e., venting frustration and promptly dissipating negative emotions. He also reported benefiting from social support in the form of psychotherapy and coworker support. His stress-coping behaviour also included palliative reactions in the form of humour and comic relief to diffuse workplace tension. Musician #4 did not have a PRMD history.

Case study #5.

Musician #5 did not specifically report any stress-coping mechanisms but reported a systematic and holistic approach to addressing her acute injury/PRMD symptoms. Her strategy indicated an instrumental stress-coping style, which consisted of an active problem-solving approach to her symptoms.

Based on these five case study reports, personality and stress-coping styles appear to play a plausible mediating role in PRMD risk by way of providing a protective mechanism against PRMD inducing stress. Allread (2000) provides support for this observation stating that, according to personality theory, a worker’s personality factors may influence injury risk in a physically demanding work environment.

Psychotherapy/counseling.

Four of the five musicians (#1, 2, 3, 4) reported seeking regular counseling or psychotherapy to improve mental and emotional health. Musicians #2 and 3 reported that counseling/psychotherapy made great improvements in their PRMD situations. The benefits of psychotherapy for musicians were made apparent by Romeo’s (2007) large-scale questionnaire study on professional orchestral musicians. This study revealed that 63% of the 932 surveyed
musicians experienced depression severe enough to disrupt playing, and that violinists were a particularly susceptible group. Musicians #2 and #3’s positive experience with psychotherapy/counseling on their PRMD symptoms is consistent with Brandfonbrener’s (cited in Horvath, 2009) observation that depression is correlated to increased injury risk, pain, and other musculoskeletal conditions.

Though depression was not explicitly reported in the case studies, mental/emotional stress did have a significant effect on both the severity and subjective experience of Musician #2 and #3’s PRMD symptoms. Based on the assumption that addressing depression and improving mental/emotional health can positively influence PRMD symptoms, one can speculate that psychotherapy might have played a contributing role in preventing PRMD symptoms in Musicians #1 and #4 who reported no PRMD history.

Overall, the results of the case study findings along with statements made by Brandfonbrener (cited in Horvath, 2009) and Romeo (2007) suggest that counseling/psychotherapy may positively influence PRMD symptoms.

**Humour.**

Musician #4 (who did not have a PRMD history) coped with occupational stress by using humour and comic relief to break workplace tension. According to Seaward (2008), humour is a stress-coping technique, which involves cognitive and behavioural functions that serve “to promote well-being through positive thoughts, attitudes, and emotions by counterbalancing the deleterious effects of negative thoughts, perceptions, and emotions on one’s health” (p. 259). As a possible PRMD prevention strategy, it is obviously a more indirect method of addressing performance health; however as Seaward (2008) suggests, it may serve to positively contribute to
mental health, and thus reduce overall stress levels that may negatively contribute to PRMD risk.

**Nutritional/pharmacological approach.**

One musician (Musician #3) reported making an attempt to address PRMD symptoms through dietary changes, specifically, by reducing alcohol and salt intake. Health professionals such as James (2000) and Watson (2009), as well as authors Pirtle and Fallon (2006) endorse a nutritional approach as a part of a PRMD prevention strategy. They explain that physiological stress can result from harmful food substances, inadequate nutrition, and poor nutrient absorption. Based on Musician #3’s permanent remission of PRMD symptoms, one might speculate that this approach successfully contributed to her prevention and treatment efforts.

**Time management.**

The musicians were aware of the importance of time management to ensure efficient muscle use and sufficient rest and recovery. They strategically scheduled their work schedules by declining extra freelance work, requesting to play partial work schedules, and taking sick days to allow for muscle recovery. Musicians #2, 3, and 5 also reported minimizing and making efficient use of their private practice time. As Wu (2007) stated, inadequate rest breaks and overplaying were determined as PRMD risk factors, thus lending support to the efficacy of this strategy for PRMD prevention.

**Holistic approach to PRMD prevention.**

Musicians #2, #3, and #5 were aware of and advocated for holistic health strategies for PRMD prevention. Despite their recommendations, Musicians #2 and 5 observed that there was still a general lack of awareness of the importance of a holistic healthy lifestyle for PRMD prevention.
Musicians #3 and 5 observed that healthcare practitioners occasionally differed in their diagnoses and treatment/prevention protocols. Thus, seeking multiple healthcare practitioners appeared to be an important strategy in ensuring a broad approach to address PRMD symptoms.

Musicians #2 and 3, who reported histories with PRMDs, experienced considerable improvement in their symptoms after supplementing their biomechanically oriented strategies with stress reduction techniques. Achieving a balance of several physical and mental/emotional/spiritual strategies appeared to have provided these musicians with a well-rounded and successful approach to PRMD treatment and prevention. Hagglund and Jacobs (1996) confirm that it is the uniqueness of the individual that largely determines the treatments required for an injury and that PRMD prevention and treatment often require “multiple modalities” (p. 20). Along this line of reasoning, Musicians #1 and 4, who reported no PRMD histories, were also likely influenced by a beneficial complex interaction of numerous factors and behaviours that reduced their PRMD risk.

Table 10 summarizes the case study musicians’ PRMD prevention strategies and healthy lifestyle behaviours.
## Case Studies: PRMD Prevention and Healthy Lifestyle Practices

<table>
<thead>
<tr>
<th>PHYSICAL:</th>
<th>Musician #1</th>
<th>Musician #2</th>
<th>Musician #3</th>
<th>Musician #4</th>
<th>Musician #5</th>
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<tbody>
<tr>
<td>Professional healthcare</td>
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<td>Self-care</td>
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<td>Body awareness</td>
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<td>Biomechanical, play-related</td>
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<td>Physical conditioning</td>
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<td>Situational</td>
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<td>Dietary</td>
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<td>MENTAL/EMOTIONAL</td>
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<td>SPIRITUAL</td>
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### PHYSICAL:
- **Professiona**l healthcare
- **Self-care**: DML therapy, rest and recovery, and other techniques.
- **Biomechanical, play-related**: Energy technique, reduction of stress, and technical adjustments.
- **Physical conditioning**: Swimming, Pilates, Tai Chi, stretching, and walking.
- **Situational**: Reducing playing time, managing freelance schedule.
- **Dietary**: Improved nutrition.
- **MENTAL/EMOTIONAL**: Psychotherapy, counseling, cognitive therapy, stress management, breathing techniques, and meditation.
- **SPIRITUAL**: Practices spiritual faith, balance, and practices.
Strengths of Study

As stated in Chapter Three, the musicians selected to participate in the interviews were chosen from a single orchestra to ensure uniformity of work-place exposure. In an investigation of typical behaviours of professional orchestral musicians, the fact that orchestral musicians often supplement with additional freelance engagements or other professional music-related activities (Mäkirintala, 2008) has the potential to add complexity to findings. Non-performance related work might include work in music administration, librarian work, contracting, or teaching. Performance activities may include solo or chamber music, or the performance of music in other styles, which would naturally increase a musician’s hours of playing and practicing. Increased workload that would be supplementary to orchestral playing would contribute an additional level of risk exposure, which could add complexity to study results. This study however, only had two musicians who reported additional music-related work outside of orchestral playing. This work was confined to non-playing related activities (teaching), for which the hours were insignificant or part-time. In this regard, this study successfully presented five case studies that represented reasonably uniform levels of exposure to orchestral PRMD risk factors.

By adopting a qualitative approach as well as limiting the investigation to a small sample size, this study provided a depth and richness of data that would have otherwise not been possible in a quantitative study. To quantitatively gather information on the numerous integrated aspects of a musician’s PRMD prevention behaviours would have required an extensive survey, which would have likely resulted in a severely limited response rate. In this regard, the comprehensive study of the numerous factors involved in PRMD prevention, as well as their complex interaction, would have been insufficiently served with a quantitative approach. With private interviews, the musicians were able to describe in their own words the rich details of their history and
experiences, allowing for the subtle nuances and details of their individual profiles. The case study presentations thus allowed for an integrative, bio-psycho-musical representation, as was described by Quentzel and Loewy (2010a, b). The data resulting from this study may thus provide healthcare professionals with insightful information on the specific needs and lived experiences of professional musicians, which Park et al. (2007) claimed to have been poorly understood.

Limitations of Study
The limitations of a small-scale study naturally include restrictions on time and scope. In addition, the breadth of the investigation topic, which was best served by a qualitative approach, necessitated a compensatory limitation on the study’s population sample. Despite the depth and richness of information presented, findings reflected the experiences and opinions of only a small group of musicians and thus, precluded generalization to a larger musician population.

Candidate self-selection also ultimately affected the results of this study. Preliminary recruitment originated from a restricted population (string section), which was originally chosen to help ensure study sample homogeneity. Despite successfully preserving homogeneity, candidate self-selection further reduced the sample size, which was also ultimately affected by candidate dropout. The result was a random cross-section of potential interview candidates from which a selection of musicians was chosen for interviews. The results of this process thereby eliminated potential candidates who might have otherwise offered equally valuable data to this study.

In an integrative investigation of PRMD variables and various aspects of health, discussion is naturally inclusive and broad in scope, though by necessity, limited in depth. Individual factors in an otherwise more focused investigation might have been studied in greater detail to better
isolate their effect on PRMDs (e.g., physical fitness, mental health). This study, however presented a comprehensive discussion, providing a more holistic view.

Spiritual well-being, though a necessary inclusion in a discussion of holistic health and well-being, is nevertheless a challenging subject for scientific discussion. It is a topic that has often been presented through anecdotal evidence due to its subjective and experiential nature. It is acknowledged that this study reported spiritual well-being (as well as the other aspects of health: physical, mental, emotional, social) in a subjective manner without the purported benefits of quantitative data.

**Significance of Study**

To this researcher’s knowledge, this study is the first to investigate the lived experiences of professional orchestral string musicians under the framework of holistic health and PRMD prevention. It is unique in that it makes a comparison of the practices and behaviours of professional string musicians both with and without PRMDs, and that it includes in its discussion the subject of spiritual well-being. Written from the perspective of a professional musician, this study takes on the vantage point of an insider, providing the benefit of intimate knowledge of the occupation.

This study contributes to the performing arts health literature by providing qualitative data that helps to increase awareness of orchestral string musicians’ lived experiences with PRMDs. As mentioned by Guptill (2010), a “culture of silence” (p. 115) still prevails in the orchestral occupation. This study comes to a similar conclusion and suggests that both better awareness and active support of suffering musicians are still in need of promotion and reinforcement.
The objective of this study was to gain further understanding of the lived experiences, typical behaviours, and opinions of professional orchestral string musicians within the framework of holistic health and PRMD prevention. Based on literature findings that link stress to PRMDs, this study emphasized the reduction of stress as part of an integrative strategy that considers physical, mental, emotional, social, and spiritual health. Assuming this holistic model, the definition of stress was established to indicate stressors that threaten all aspects of holistic health. Applied to PRMD prevention, the purposes of this study were to investigate the role of holistic health behaviours in reducing overall stress in professional orchestral string musicians, and to investigate the role of stress management in PRMD prevention. The researcher’s perspective was that of a full-time professional musician, allowing for an insider’s advantage in gathering relevant data.

To address the research questions, this study assumed a qualitative approach presenting case study interviews with five professional orchestral string musicians selected from a single major professional Canadian orchestra. Semi-structured interviews were supplemented with health and well-being assessments used to provide quantitative and comparable data that revealed further details of the musicians’ general health and well-being. These health and well-being assessments were created based on various established scales used to assess general health, mental health, emotional health, as well as the areas of life satisfaction and subjective well-being.

Following initial recruitment, the interview participants were selected to reflect different instruments, genders, and PRMD profiles. The interviewed musicians included two musicians.
(one male and one female) with no significant PRMD history, two female musicians with significant PRMD histories, (one of whom had achieved successful remission of symptoms), and one female musician with an acute injury that developed into chronic playing-related symptoms.

The results of the interviews revealed that a complex interaction of numerous variables accounted for PRMD occurrence (or absence thereof) in the musicians. Despite a relatively uniform exposure to orchestral risk factors in this study, individuality of the musicians largely influenced PRMD risk and experience, as well as dictated their prevention and treatment protocols.

The impact of mental/emotional stress on PRMDs emerged as a theme. The effect of this stress (from both occupational and non-occupational sources) was mediated by the individual stress personalities of the musicians, i.e., their appraisal and stress-coping styles. Stress-coping styles combined with intrinsic factors (e.g., age, gender, physical make-up, fitness levels), biomechanical factors (e.g., play/practice patterns, playing styles, ergonomic factors), and psychosocial factors (e.g., low decision latitude, domestic stress) to draw a complex portrait of PRMD risk.

This study also found that PRMDs were reported to have a negative impact on mental/emotional well-being, strongly suggesting that a bi-directional relationship exists between PRMDs and stress. In this study, PRMDs had an effect on a range of psychological and psychosocial issues and were reported to contribute to mental/emotional strain: worry, guilt, performance pressure, anxiety, and low self-efficacy. PRMDs also negatively affected social well-being, which resulted from a lack of understanding and support from coworkers and management.
Consistent with previous literature findings, this study revealed that a variety of methods were simultaneously employed for PRMD prevention and maintenance. This study discussed a broad range of prevention techniques, holistic health behaviours, and other relevant factors that affected PRMDs. The individuality of each musician determined his or her unique combination of treatment and prevention modalities. Each strategy served to address the stressors that originated from multiple sources (physical, mental, emotional, social, and spiritual). As such, their prevention and treatment modalities combined to form a holistic ‘stress reduction’ strategy that included ergonomic, postural, and technical adjustments, professional healthcare treatment, stress management, physical fitness, and somatic education.

Opinions and observations on PRMDs varied between the musicians, some of which contradicted previous literature findings. This study also found that exposure to stressors and PRMD risk factors did not uniformly contribute to significant PRMD symptoms in the study participants. These disparities, along with reports of a general lack of awareness, understanding, and support for injured musicians, suggest that continued investigation and better education on PRMDs is necessary to decrease the gap in knowledge.

**Contribution to Knowledge**

This study addressed the acknowledged need for a better understanding of the specific needs and experiences of musicians with PRMDs. It also addressed the need for a holistic assessment of musicians, which considers the musician as a whole and not merely a sum of physical symptoms. This study was also the first to provide a focused investigation on professional orchestral string musicians and the first to investigate PRMD prevention within the framework of holistic health. This model included the domain of spiritual well-being, which to this researcher’s knowledge,
had not been addressed in previous PRMD literature.

This study found that all the aspects of holistic health (physical, mental, emotional, social, and spiritual) have the potential to play a mediating role in PRMDs. Specifically, deficiencies or imbalances in any of these domains were experienced by the musicians as contributing to overall stress, the management of which proved profitable in several of the case studies.

This study’s discussion of stress management (in all areas of physical, mental, emotional, spiritual, and social health) serves as an important contribution to the performing arts health literature. Results found that the management of stress exerted an influence on the subjective experience, severity, prevention, and treatment of PRMDs. This dissertation also furthered the discussion of personality factors and stress-coping styles, and integrated it with the discussion of other intrinsic factors (e.g., gender, instrument), biomechanical, and psychosocial factors that determine PRMD risk.

An integrative approach is considered valuable in assessing and treating musicians’ PRMDs as it acknowledges and respects the uniqueness and individuality of each musician. As such, the qualitative and integrative approach of this study provides healthcare practitioners with rich information that may facilitate better understanding of the specific needs and experiences of professional orchestral string musicians.

**Recommendations**

The complexity of the professional orchestral musician’s experience and the individuality of each musician demand a client-centered approach, one that acknowledges the injured musician as a unique and whole person. Holistically oriented investigation is thus a useful and appropriate
methodology of engaging in an etiologic investigation of PRMDs. Health care practitioners would thus benefit their musician clients by adopting a holistic perspective, i.e., in considering the whole individual beyond the reports of their physical symptoms and encouraging multiple treatment modalities.

Musicians, both healthy and injured, would also benefit from taking personal responsibility in adopting a holistic approach to their performing health. The prevention of PRMDs may require an approach that goes beyond merely physical or biomechanical issues. This strategy, which would likely involve initial experimentation, would include any or all of the following: professional healthcare therapies, self-care strategies, technical, ergonomic, situational, and environmental adjustments, somatic education, physical fitness, nutritional strategies, time management, stress management (of mental, emotional, and social issues), cognitive-behavioural techniques, as well as spiritual practices and philosophy.

Acknowledging that social and coworker support influence social and emotional well-being, better understanding and support for injured musicians would serve to help minimize the strain of the PRMD experience. This requires increased education and awareness of PRMDs, both among professional circles and preemptively in student populations. Collegial support in the official form of orchestra committees, as well as informally in the form of supportive relationships at work, have the potential to reduce the amount of emotional and psychosocial strain that may mediate the severity of stress-induced PRMD symptoms. Increased PRMD awareness combined with a shift in workplace culture may lead to healthier, happier musicians, improved coworker support, more positive work environment, better music-making, and, of interest to orchestra management, less injured musicians.
**Future Research**

Points of departure for future research include continued investigation of PRMD prevention, typical behaviours, lived experiences, and occupational stressors in musicians of other instrument classes (i.e., brass, woodwind, percussion, keyboard, vocal), musicians in other genres (e.g., jazz, pop, church), as well as soloists, chamber musicians, music teachers, etc. These studies may also increase research scope through broader sample recruitment. This may include simultaneous investigation of a cross-section of different instrument groups within a single orchestra, or across multiple orchestras. Future investigation may also delve further into the mediating role of emotional and spiritual health on PRMDs.

With this preliminary investigative study and these suggestions for continued investigation, it is hoped that future research efforts will serve to expand the quickly growing field of performing arts health. With more knowledge and understanding of this area of occupational health, it is hoped that musicians will benefit from improved health, care, and support in order that they may better serve their profession and the creation of art.
References


History of Tom Bowen’s therapy. (n.d.) In *Bowen Canada Registry of Practitioners*. Retrieved
from http://bowencanada.ca/history.html


http://www.shape.bc.ca/resources/pdf/msi.pdf


stress in the daily lives of musicians. (Doctoral dissertation). Available from ProQuest Dissertations and Theses database. (AAT 9734938)


Appendices

Appendix A: Brief Preliminary Questionnaire

Have you had any history of performance-related musculoskeletal disorder (PRMD), a.k.a. ‘injury’, either treated or untreated?

- Muscular fatigue
- Nerve tingling
- Specific diagnoses such as: Carpal Tunnel Syndrome
- Tightness
- Inflammation of soft tissue
- Tendonitis
- Discomfort
- Loss of fine motor control
- Bursitis, etc.
- Pain
- Loss of strength

N.B. For the purposes of this research, performance-related injuries that are not considered ‘musculoskeletal’, e.g., focal dystonia, Dupuytren’s contracture, hearing loss, etc.) are excluded.

__YES:

1. I currently have symptoms and am proactive about preventative measures, maintenance, and treatment.

2. I currently, or have in the past, experienced symptoms and do not participate in preventative measures or seek treatment.

3. I have little to no symptoms, or have experienced symptoms in the past, but am currently achieving successful prevention and/or maintenance.

__NO, never had a problem.

I have no interest in participating in an interview.

I am willing to participate in an interview to discuss this topic in further detail.

Name ________________________________

Email: ______________________________ Phone: ___________________

Thank-you for your time and participation in this research.

Lynn Kuo
Appendix B: Recruitment Letter and Consent Form

Dear ______________________________,

I am currently conducting doctoral research on the subject of *Holistic Health and the Prevention of Performance-Related Musculoskeletal Disorders in Orchestral String Musicians* - a dissertation as part of my requirements for the Doctor of Musical Arts degree at the University of Toronto, Faculty of Music. This dissertation is being supervised by Faculty of Music Graduate Faculty professors: Dr. Jamie Parker, Dr. Cameron Walter, Dr. Gillian McKay, and Katharine Rapoport.

I am inviting a total of six selected candidates to participate in this research study due to their active role as professional musicians so that they may provide insightful information regarding the relationship between holistic health and the prevention of performance-related musculoskeletal disorders (PRMD), or more often generally referred to as ‘injury’. In order to maintain a homogenous research population, I am selecting only string musicians.

Each musician will be invited to participate in a one-on-one, semi-structured interview conducted by myself, to be arranged at a mutually convenient location and time. The purpose of the interview is to gather information on musicians’ practices and attitudes regarding holistic health and well-being (physical, mental, emotional, social, and spiritual) and the prevention of performance-related musculoskeletal disorders (PRMD). You will first be requested to complete a brief (five-minute) *Health and Well-being Assessment* online as part of the interview process. The actual personal interview will last approximately 45-60 minutes and will be audio recorded for later transcription and analysis.
Potential benefits:

By describing and comparing each musician’s situation and profile in-depth, I am hoping to demonstrate ‘typical instances’ of a professional musician’s occupation and their relationship to PRMD and holistic health and well-being.

The research data gathered from these interviews may provide musicians, orchestras and their management, professional unions, and health care providers with relevant information on the subject of occupational health in the orchestral occupation. As there is a relatively small body of literature investigating the health profiles of musicians in their occupations, it is hoped that this research will make a positive contribution to the awareness, education, and prevention of PRMD in musicians.

Privacy and confidentiality:

All information disclosed by the participants will be at their discretion and shall remain confidential. Anonymity will be maintained and participants will be referred to only by demographic-type description and/or number (e.g., Musician #1, Male, 52, violist).

Withdrawal of participation:

Participation in the interview is voluntary. At any time, participants, at their discretion, may decline to answer any questions during the interview, or withdraw their participation completely.

Should a participant wish to withdraw participation, any data collected will be deleted.

Participant approval and handling of submitted data:

The interviews will be audio recorded for later transcription and analysis. Audio files and interview transcriptions will be stored on the principal researcher’s personal computer and/or
encrypted portable memory devices. These files will be encrypted and/or protected by password and used strictly for the purpose of research. These files will be made available only to the Principal Researcher (Lynn Kuo.)

Following the collection and transcription of interviews, participants may request an electronic copy of their interview transcript for approval purposes, before analysis and inclusion in the research document. Following the completion and publication of the research document (Projected date: Summer, 2011), interview audio files and transcriptions will be subsequently deleted from record.

**Post-research dissemination of information and compensation:**

As compensation for participation in this research, each interview participant shall receive upon request an electronic copy of the completed dissertation, following its approval by the Doctoral Supervisory Committee. Alternatively, a summary copy of the data can be made available either as an e-mail or hard-copy document.

**Publication of research:**

Following completion of the research document, the dissertation will be publicized and subsequently made available to future post-secondary academic researchers. Information taken from the interviews may also be used for further academic purposes (e.g., academic lectures, presentations, articles) outside of the publication of the dissertation. Anonymity of interview candidates will be maintained.
Participant rights:

Research participants may contact the Office of Research Ethics at the University of Toronto should there be any questions regarding their rights as research participants.

Office of Research Ethics at the University of Toronto.
Email: ethics.review@utoronto.ca    Phone: 416-946-3273

STATEMENT OF CONSENT:

I, ________________________________________, acknowledge and understand my participation as part of this research and consent to participate in a private interview with principal researcher, Lynn Kuo, for the purpose of collecting data for the doctoral dissertation: Holistic Health and the Prevention of Performance-Related Musculoskeletal Disorders in Orchestral String Musicians, supervised by the University of Toronto, Faculty of Music.

Name: ________________________________________________________________
Signed: _______________________________________________________________
Date: _______________________________________

Principal Researcher, Lynn Kuo: ______________________________________________
Date: __________________________________

Contact info:
E: lynn.kuo@utoronto.ca    Ph: [Phone number]
Appendix C: Interview Guide

Interview Themes

- What are your attitudes/strategies for PRMD prevention in musicians?
- Do you feel that the pursuit of holistic health and well-being has any effect or impact on PRMD-risk in musicians?

Part I: Background information

- Age
- Gender: Male/Female
- Instrument type: violin, viola, cello, bass
- Playing history
- Number of years in training
- Numbers of years in professional background
- Other occupational activities musical or non-music-related (e.g., teaching, coaching, composing, other part-time employment)
- Practice/play patterns:
  - Please describe your typical work/playing schedule: Percentage of playing devoted to orchestral, chamber, solo, freelance, leisure?
  - How many hours a week do you play? (Including all rehearsals, performances private practice.)
  - Please describe your typical personal practice routine: (Number of hours per week, frequency?)
  - Please describe your typical practice strategy: (e.g., scheduled breaks, warm-up, cool-down routine? Stretch? Mental practice? No particular strategy?)
**PRMD history.**

**Nature of PRMD.**

- Please describe the general nature of your injury(ies).

**Frequency of PRMD.**

- On a scale of 0-10, what is your typical frequency of occurrence of PRMD?

<table>
<thead>
<tr>
<th>Never - Infrequent</th>
<th>Occasional - Frequent</th>
<th>Frequent - Daily</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>4-7</td>
<td>8-10</td>
</tr>
</tbody>
</table>

**Severity of PRMD:**

- On a scale of 0-10, what is your typical severity of PRMD?

<table>
<thead>
<tr>
<th>No symptoms - Mild</th>
<th>Moderate</th>
<th>Severe – Worst imaginable</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-3</td>
<td>4-7</td>
<td>8-10</td>
</tr>
</tbody>
</table>

**Duration of PRMD.**

- At the onset of a PRMD, what is the typical duration of your symptoms? (Days/weeks/months?)
- Are you aware of any specific cause(s) for the injury? (e.g., posture, technique, playing habits, etc.)
- Have you had any acute injuries that you feel has contributed to your PRMD risk? (e.g., motor-vehicle accidents, sports injuries, etc.)
- How often in a year do PRMD symptoms become severe enough to disrupt playing/work (i.e., work stoppage)?
- If so, how long of a time period do you stop playing? (Number of days)
- Please describe any other details regarding your current and/or past relationship to
PRMDs.

Part II: Attitudes and Thoughts on Stress, Holistic Health/Well-being and PRMDs

Attitudes toward PRMD prevention and treatment.

- At the onset of a PRMD, at what level of severity (Scale of 1-10) do you take proactive measures (either injury prevention or injury treatment)?
- How do you approach treating your injury?
- How do you approach preventing your injury?
- What are your thoughts and opinions on healthy play/practice/work routines?
- What are your thoughts and opinions on the general awareness among musicians about injury prevention?
- What are your thoughts and opinions on injury disclosure in the workplace?

Thoughts on occupational and non-occupational stress (and relationship to PRMD).

- What are your thoughts on the role occupational and non-occupational stress play in the risk for developing injury?
- What are some of the things or situations in your occupation that cause you the most stress?
- What are some of the things or situations outside of your occupation (life in general) that cause you the most stress?
- Can you describe how you typically react in these stressful situations?
**Frequency of stress reaction.**

- On a scale of 1-10, how often would you consider yourself to feel ‘stressed”? (0 = never, 5 = occasional, 10 = daily)

**Severity of stress reaction.**

- On a scale of 1-10, how severe would you say your typical stress reactions are? (0 = no reaction, 5 = moderate reaction, 10 = extreme reaction)

**Duration of stress reaction.**

- When you are feeling stressed, how long do your symptoms or behaviour last? (Minutes/hours/days/etc.?)

**Stress and its relationship to injury.**

- What are your thoughts on stress and injury-risk in musicians?
- Do you observe a relationship in your own life between stress and injury?
- Does stress affect how you perceive the severity of your injury?

**Injury and its relationship to stress.**

- Can you describe how being injured affects you?

**Stress management.**

- What do you do to reduce or manage your stress in these situations?
- Are you aware of your typical stress reactions and responses and are you usually able to manage them?
- Do you feel that stress management, including awareness of one’s stress reaction and personality tendencies, helps musicians in preventing injury?
Attitudes towards holistic health and well-being (and injury prevention).

- What are your opinions on the relationship between holistic health and injury prevention for musicians?
- What are your thoughts as it pertains to your personal experience?
- What are your thoughts as it pertains to musicians in general?
- Do you feel that any of your activities that are related to the pursuit of holistic health and well-being has had any effect or impact on your injury-risk?
Appendix D: Ethics Review

PROTOCOL REFERENCE #25715

October 28, 2010

Dr. Cameron Walter  Ms. Lynn Kuo
Faculty of Music  Faculty of Music
University of Toronto  University of Toronto
80 Queen’s Park Cres. 80 Queen’s Park Cres.
Toronto, ON M5S 2C5  Toronto, ON M5S 2C5

Dear Dr. Walter and Ms. Kuo:

Re: Your research protocol entitled “Holistic Health and Wellbeing and its Role in the Prevention of Performance-Related Musculoskeletal Disorders in Musicians”

ETHICS APPROVAL

Original Approval Date: October 28, 2010
Expiry Date: October 27, 2011
Continuing Review Level: 1

We are writing to advise you that a member of the Social Sciences, Humanities and Education Research Ethics Board has granted approval to the above-named research study, for a period of one year. Ongoing projects must be renewed prior to the expiry date.

All your most recently submitted documents have been approved for use in this study.

Any changes to the approved protocol or consent materials must be reviewed and approved through the amendment process prior to its implementation. Any adverse or unanticipated events should be reported to the Office of Research Ethics as soon as possible.

Please ensure that you submit an Annual Renewal Form or a Study Completion Report 15 to 30 days prior to the expiry date of your study. Note that annual renewals for studies cannot be accepted more than 30 days prior to the date of expiry, as per federal and international policies.

If your research has funding attached, please contact the relevant Research Funding Officer in Research Services to ensure that your funds are released.

Best wishes for the successful completion of your project.

Yours sincerely,

[Signature]

Dean Sharpe, Ph.D.
Research Ethics Board Manager—Social Sciences and Humanities

OFFICE OF RESEARCH ETHICS
McMichael Building, 13 Queen’s Park Crescent West, 2nd. Floor, Toronto, ON M5S 1S8 Canada
Tel: +1 416 946-3573 • Fax: +1 416 946-3063 • ethics.review@utoronto.ca • http://www.research.utoronto.ca/for-researchers-administrators/ethics
Appendix E: Health and Well-being Assessment

(Administered through http://questionpro.com):

Dear __________,

In preparation for your interview participation as part of the doctoral research, *Holistic Health and the Prevention of Performance-Related Musculoskeletal Disorders in Orchestral String Musicians*, you are requested to complete a brief *Health and Well-being Assessment*. The purpose of this questionnaire will be to help complete your background information in the interview process.

It will take less than five minutes to complete the questionnaire. Please complete all 15 questions.

Your responses will be kept strictly confidential and data from this questionnaire will be incorporated into the information gathered in your personal interview.

If you have questions at any time about the survey or the procedures, you may contact me (Lynn) at [phone number] or by email: lynn.kuo@utoronto.ca.

Thank you very much for your time and support. Please start with the survey now by clicking on the Continue button below.

How do you relate to the following statements of optimal Health and Well-being?
Please answer on a scale of 1-5:

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>At no time</td>
<td>Some of the time</td>
<td>Less than half of the time</td>
<td>More than half of the time</td>
<td>Most of the time</td>
<td>All of the time</td>
<td></td>
</tr>
</tbody>
</table>

1. I feel good and am in the best imaginable health.
2. I have no pain or discomfort.
3. I am not anxious or depressed.
4. I am calm and relaxed.
5. I am cheerful and in good spirits.
6. I feel active, vigorous, and energetic.
7. I typically wake up feeling fresh and rested.
8. I feel capable, useful, and able to accomplish tasks.
9. I cope well with change, problems, and unexpected events.
10. I am able to make up my own mind easily.
11. I feel confident and good about myself.
12. I accept myself for both my strengths and weaknesses.
13. I feel highly satisfied with my life.
14. My life is filled with things and activities that keep me occupied, and are meaningful and interesting to me.
15. I have a social network of quality relationships.
16. I feel optimistic about the future.