The prevalence of playing-related musculoskeletal disorders in selected Western classical music students at the South African College of Music, University of Cape Town

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Declaration

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

Signed by candidate

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Signature:_____ Date: 20/05/2016

Dedication

This dissertation is dedicated to Eben Meyer who inspired this research in more ways than he can ever know.

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Abstract

The study aimed to ascertain the prevalence of playing-related musculoskeletal disorders (PRMDs) among Western classical instrumentalists at the South African College of Music. Seventy-two undergraduate string, woodwind and keyboard instrumental students were approached during classes or individually and asked to complete a specially designed questionnaire. Data were sent to a statistician at the University of Cape Town Statistics Consulting Unit and the statistical package SPSS (Version 22) was used to analyse the data.

Seventy-one (71) of the 72 questionnaires were returned. The average respondent was a 20-year-old, right-handed female who had been playing her instrument for 10.8 years; 88.8% of the respondents had experienced a PRMD at some point in their lives, 82.1% within the preceding 12 months and 46.3% had a PRMD at the time of the study. No correlation was found between the prevalence of a PRMD and age, gender, instrument type, number of years of playing the instrument, playing another instrument or the university programme, stream or year. A significant relationship was found between the instrument level and the current prevalence of PRMDs.

The most commonly affected area was the shoulder followed by the back, neck, hand or wrist and fingers. The most commonly indicated duration was 1 week (35.3%), though many PRMDs had lasted for more than 2 years (19.6%); 46.3% of the PRMDs had a severity of 3/5 or higher, and 34.2% of PRMDs were both 3/5 or higher for severity and frequency.

Only 3.7% of the responses indicated that a body awareness technique was being used regularly, while 37.4% of the answers indicated that the techniques had “never been heard of”. Over half (51.7%) of respondents had consulted a health professional. Physiotherapists and Alexander teachers were the most frequently consulted professionals. Treatment strategies were non-invasive and mostly self-reliant and though most respondents felt that the treatment strategies had helped temporarily, there was little long-term satisfaction.

This study concludes that the prevalence of PRMDs in students at the South African College of music is high and around half of the PRMDs affect the students’ ability to play or perform their instrument at an optimum level. Actions can and need to be taken to reduce these values in future.

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Introduction, rationale and methodology

1.1 Historical background

The earliest known written record of the problems experienced by musicians appeared in 1713 in Ramazzini's treatise *Disease of Tradesmen*. His documentation of musicians' problems include problems in the ears and eyes, head, neck and even groin. The nineteenth century saw increasing interest in the subject and in the twentieth century a book dedicated entirely to the subject of musicians' problems, Kurt Singer's *Diseases of the Musical Profession* (1932), was published (Harman 2010:1). Interest grew throughout the 1960s and 1970s, but it was only in 1981, when the pianists Leon Fleisher and Gary Graffman revealed the details of their hand problems in the *New York Times*, that public interest grew and the field of performing arts medicine gained traction (Harman 2010:9). In the immediately following years the United States of America (USA) saw the first conference being held in Aspen, Colorado (1983), the establishment of a Performing Arts Medicine Association (PAMA) (1988) and an associated quarterly journal, *Medical Problems of Performing Artists* (MPPA) (Devroop 2014:47). In 1983 another important centre for performing arts medicine was developed in Australia and the Performing Arts Medicine Society was established (Harman 2010:12).

In 1986 Fishbein and Middlestadt (1988:5) presented the findings of a landmark quantitative study on playing-related pain and injury in orchestral musicians at the International Conference of Symphony and Opera Musicians (ICSOM) in the USA, showing that 76% of orchestral musicians had experienced a playing-related disorder at some point in their career. Around the same time Fry published the first Australian studies on orchestral (1986) and student musicians (1987). In the late 1980s and 1990s studies on the prevalence of playing-related disorders followed, predominantly in North America[1] and Australia (Fry 1988; Fry, Ross & Rutherford 1988; Fry & Rowley 1989).

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[1] Caldron *et al.* 1986; Manchester and Lustik 1989; Dawson 1990; Pratt, Jessop and Niemann 1992; Christine Zaza 1992; Larsson *et al.* 1993; Roach, Martinez and Anderson 1994; Shoup 1995; Salmon *et al.* 1995; Hagglund 1996; Manchester and Park 1996; Brown 1997; Cayea and Manchester 1998; Blackie, Stone and Tiernan 1999; Zaza and Farewell 1997; Zaza, Charles and Muszynski 1998.

Throughout this dissertation, lengthy in-text references are placed in footnotes to facilitate fluent reading.

Though the USA and Australia have remained important research centres in this field,[2] performing arts medicine has also established a strong foothold in Germany, the Netherlands and the United Kingdom. In these countries performing arts organisations have been established[3] and numerous quantitative studies on the physical and psychological disorders of musicians have appeared.[4] Performing arts medicine has become an international field of research, with studies undertaken in Brazil (Dawson, Kaneko & Lianza 2005), Denmark (Paarup *et al.* 2011), Sweden (Zetterberg *et al.* 1998), Poland (Nawrocka *et al.* 2014), Spain (López & Martínez 2013), Portugal (Sousa *et al.* 2016), Iran (Mehrparvar, Mostaghaci & Gerami 2012), Israel (Kaufman-Cohen & Ratzon 2011), Japan (Sakai 1992; Nemoto & Arino 2007; Yasuda *et al*. 2016), Iceland (Árnason, Árnason & Briem 2014), the Czech Republic (Ioannou & Altenmüller 2015), Slovenia (Crnivec 2004; Plevnik, Bažon & Pišot 2016), Greece (Fotiadis *et al.* 2013), India (Mishra *et al.* 2013) and South Africa (Van der Walt 2006; Hohls 2010; Barnes *et al.* 2011; Ajidahun & Phillips 2013; Panebianco-Warrens, Fletcher & Kreutz 2015).

1.2 Defining playing-related musculoskeletal disorders (PRMDs)

During the 1980s and 1990s some important steps were taken towards understanding the aetiology[5] of musicians' problems as well as in developing standardised definitions and research practices.

Playing-related musculoskeletal disorders (PRMDs) are among the most common problems that musicians experience (Zaza 1998a:7). Zaza (1998b:1022) completed a metastudy on major research published worldwide and found that the prevalence of PRMDs ranged from 39% to 87%. The discrepancy in the results is largely attributed to varying definitions of PRMDs and differences in methodological procedures (Roach Martinez & Anderson 1994:125; Zaza 1998b:1023). Zaza has contributed towards the standardisation of research practices by developing important criteria for studies conducted in this field. These criteria help increase validity and reliability, thereby reducing

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2 Guptill, Zaza and Paul 2000; Pak and Chesky 2001; Ackermann, Adams and Marshall 2002; Ackermann and Adams 2004; Brandfonbrener and Burkholder 2004; Guptill and Golem 2008; Barton *et al.* 2008; Sandell *et al.* 2009; Kenny, Cormack, and Martin 2009; Brusky 2009; Allsop and Ackland 2010; Ackermann, Kenny and Fortune 2011.

3 Deutsche Gesellschaft für Musikphysiologie und Musikermedizin (DGfMM) in Germany, Nederlandse Vereniging voor Dans- en Muziek Geneeskunde (NVDMG) in the Netherlands and the British Association for Performing Arts Medicine (BAPAM) in the United Kingdom.

4 Dockrell 2000; Spahn, Hildebrandt and Seidenglanz 2001; Spahn, Richter and Zschocke 2002; Miller, Peck and Watson 2002; Harper 2002; Spahn, Strukely and Lehmann 2004; Kreutz, Ginsborg and Williamon 2008; Steinmetz, Seidel and Muche 2010; Zander, Voltmer and Spahn 2010; Leaver, Harris and Palmer 2011; Voltmer *et al.* 2012; Kok *et al.* 2013; Van Fenema and Van Geel 2014; Spahn *et al.* 2014; Kok, Nelissen and Huisstede 2015.

5 "Aetiology" or "etiology" (US) is a branch of medicine concerned with finding the causes and origins of a disease (Merriam-Webster 1995:218).

the discrepancies in results. Zaza (1998b:1024) recommends that the following aspects be taken into consideration for future research:

- Aiming for higher response rates;
- Developing systematic data measurement instruments with sound designs and methodologies as well as using appropriate statistical analyses;
- Determining a clear outcomes definition that excludes non-playing-related disorders and distinguishes between mild and severe disorders.

Zaza, Charles and Muszynski (1998) interviewed professional and student musicians as well as health care professionals experienced in the field of performing arts medicine and derived a definition for PRMDs:

> Pain, weakness, lack of control, numbness, tingling, or other symptoms that arise from playing, and that interfere with your ability to play your instrument at the level you are accustomed to. (Zaza, Charles & Muszynski 1998:2016)

They clarify that pain or any other symptoms that are caused by an accident or other events not related to playing the instrument are not considered to be PRMDs (Zaza, Charles & Muszynski 1998:2015).

The above definition is useful for musicians and researchers, as it describes what constitutes a PRMD while also demarcating the parameters. Several studies have subsequently used the definition formulated by Zaza *et al.*[6] However, ten years after this definition was derived, Dawson (2008:32) still comments on the wide range of definitions present in the field and the lack of standardisation. Even the relatively well established definition of PRMDs by Zaza *et al.* leaves room for interpretation. The definition does not indicate which tissues of the body or parts of the playing apparatus are included and excluded, suggesting that the researcher also needs to look outside the field of performing arts medicine.

The World Health Organisation (WHO) defines work-related musculoskeletal disorders (WRMDs) as "health problems" affecting the "locomotor apparatus" that occur as a result of work and the performing of associated tasks. Included in this definition are muscles, tendons, the skeleton, cartilage, ligaments and nerves (Luttmann *et al.* 2003:1). Although the WHO definition can be applied to musicians, it is necessary to define PRMDs in terms of the "locomotor apparatus" that is used for playing the instrument. Attention should be devoted to all the structures of the body that

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[6] Zaza and Farewell 1997; Yeung *et al.* 1999; Ackermann and Adams 2004; Ranelli, Straker and Smith 2008; Kenny, Cormack and Martin 2009; Hohls 2010; Ackermann, Driscoll and Kenny 2012.

have a load-bearing or movement function in the physical process of making music. The definition for PRMDs should therefore include problems of the jaw, lips, embouchure[7] and other orofacial structures, as these are used to play an instrument. Problems related to hearing and vision, which are only indirectly used to play an instrument, should be excluded from such a definition

1.3 Rationale

Although there is a great amount of literature in America, Europe and Australia, Devroop reminds us that there is a dearth of research in developing countries. He contends that there is a greater need for such studies as musicians in developing countries, such as South Africa, are often more vulnerable and less financially stable, with a lack of resources at their disposal to help treat problems (Devroop 2014:50–51). Because of the paucity of "baseline data", he emphasises the need for quantitative studies in South Africa in order to establish the prevalence of playing-related problems and discover trends that lead to follow-up studies (2014:52).

The majority of existing South African research focuses on the effects of the Alexander technique or other somatic approaches to playing an instrument or using the voice[8] as well as various psychological aspects of music making, such as performance anxiety, stress disorders and the psychological effects of injuries on musicians.[9] These studies are predominantly qualitative or consist of literature reviews, and several studies draw on the authors' own personal experiences.[10] Though experience-based[11] research has merit, especially in a developing field such as performing arts medicine, it is highly subjective and easily biased.

Two articles written in South Africa engage with the physical problems of the performing artists (Mennen 1999; Michels 2004), while there are several South African quantitative studies evaluating the physical problems of performing artists (Van der Walt 2006; Hohls 2010; Barnes *et al.* 2011; Ajidahun & Phillips 2013).

Hohls (2010) surveyed 27 string players from the Cape and KwaZulu-Natal philharmonic orchestras. This study makes use of the definition formulated by Zaza *et al* .(1998). There was a low response rate in this study (34%) (Hohls 2010:45) and some of the statistics were not clearly reported; however, on the whole the methodology was clear and systematic. In 2014 Ajiduhan conducted a study on students at the Centre of Performing Arts, University of Western Cape. These

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7 The embouchure is defined as the formation of the mouth and surrounding muscles in order to produce the sound of a wind instrument (Lederman 2001:53).

8 Cox 1990; Bosch 1997; Roos 2001; Louw 2004; Hoberg 2008; Boonzaaier 2011.

9 Janse van Rensburg 2005; Siebrits 2005; Kirsch 2006; Marshall 2008; Swart 2013; Foxcroft 2014.

10 Bosch 1997; Roos 2001; Louw 2004; Siebrits 2005; Kirsch 2006.

11 Experience-based research refers to research that draws on the researcher's personal experience.

musicians ranged from 10 to 52 years of age, and encompassed a range of levels, from beginners to educators (Ajidahun 2011:36). This study also had a low response rate (41.67%) (Ajidahun 2011:39) and though it defined PRMDs according to Zaza *et al.* (1998), the Standardised Nordic Questionnaire[12] (Kuorinka *et al.* 1987) was used to gather data on musculoskeletal disorders. Both the studies by Hohls and Ajidahun have very small sample sizes, which limits the statistical power of their results. Barnes *et al.* (2011) conducted a study on 45 members of the Free State Symphony Orchestra in Bloemfontein. This study focuses on professional musicians, but the term "injury" is used without a clear definition. The definition of "injury" will be discussed further below.

Van der Walt (2006) carried out a mostly descriptive study on 122 students from the University of Cape Town and the University of Stellenbosch. This study looked at the prevalence of injuries and other symptoms in music students, investigated how students treated these physical problems, and suggested some possible causes of the injuries. There are several problematic aspects of this study, the most serious being the outcomes definition for the term "injury".

Van der Walt asked respondents in separate questions whether they experienced (a) pain, (b) pain, stiffness, fatigue, cramping, lack of co-ordination and (c) an injury. The term "injury" as opposed to "pain" or other symptoms needs further definition. Where does the researcher draw the line between having pain or other symptoms, and being injured? Fry (1987:39) classifies injury as structural changes to the affected tissues that would be seen in a biopsy of the affected tissues. He concludes that, especially with respect to "injuries" as a result of overuse, there have been no studies in which the affected tissue has been biopsied, making it difficult to classify them as injuries (Fry 1987:39). Subsequent studies have biopsied the tissue of keyboard operators and revealed structural changes (Dennett & Fry 1988). This kind of study, however, remains controversial and could be seen as unethical practice on professional musicians (Bird 2013:477).[13] Defining an injury solely as tissue damage is limited and slightly outdated because it excludes psychological and emotional damage, as well as other events that are consistently considered as injuries (Langley & Brenner 2004:69). In the field of sports medicine, for example, Clarsen *et al.* (2013:8) mention three ways that injury can be defined: (a) all physical complaints, (b) complaints leading to a medical diagnosis, and (c) a person's inability to participate in normal training and competitions. All these definitions are

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[12] The Standardised Nordic Questionnaire was developed to gather data on musculoskeletal problems of the general population. Musicians make use of small muscle groups and structures such as the fingers or orafacial structures which are not specifically demarcated in this questionnaire. It also makes use of a different outcomes definition for musculoskeletal complaints.

[13] A biopsy is a small diagnostic procedure in which a part of the living tissue is removed. Both healthy and affected tissue is removed (Van De Graaff 2002:102). Removing healthy muscle tissue from a musician may have adverse effects and has no treatment benefit for the musician.

problematic and ambiguous, and without a clear definition of what constitutes an injury in a musician, the line between symptoms (pain, stiffness, tingling etc.) and injury becomes very vague. In studies such as that by Van der Walt or Barnes *et al.*, which used a self-report measure (Field & Hole 2003:43), a term such as injury would call on respondents to define their own boundaries between symptoms and injury, or between the criteria outlined by Clarsen *et al.*

In addition to the terminology problem, Van der Walt makes no distinction between mild and severe conditions, and students were asked to report symptoms during playing and performance only, excluding symptoms that may be present between playing sessions. No distinction between point or lifetime prevalence is made, and no allowance or distinction is made for people with multiple PRMDs (Van der Walt 2006:130).

The only other published study dedicated to student musicians in South Africa is that by Panebianco-Warrens, Fletcher and Kreutz (2015).[14] This study investigates the health-promoting behaviours of student musicians at the University of Pretoria, but does not include any data on the physical problems of students. This lack of research on the student population is especially significant, considering that being a student musician may increase the risk of developing a PRMD. Students are undergoing constant change and development. Their technique is being established and many hours are spent practising under high levels of pressure to succeed. Norris (2011:23) suggests that students suffer more than other musician populations as lessons and orchestra, chamber music and sectional rehearsals follow a full day of practising. A case study by Guptill and Golem (2008:309) shows how the pressure to succeed as well as the pressure imposed by an intimidating teacher could lead to a student developing a serious PRMD. Fry (1987:38) found that students suffered injuries after a sudden increase in the number of hours of practice in preparation for examinations, auditions or competitions. He also found that learning new repertoire, exercises or a change in teachers contributed to the development of an injury. Though these elements are not exclusive to students, they are more commonly experienced by students.

Not only is there a need in South Africa for quantitative studies that make use of the criteria for research practices outlined by Zaza in the previous section, but especially noticeable is the gap in research with regards to the student musician. This study aspires to make a first step towards bridging this gap.

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[14] Other studies are currently in progress such as research by Rennie-Salonen, who is working on a PhD thesis entitled: "Exploring tertiary music students' experience of an occupational health course based on the Body Mapping approach". The study aims to qualitatively assess the experience of participants of a health-promoting course at the South African College of Music, University of Cape Town.

1.4 Research questions and objectives

This study aims to ascertain the prevalence of playing-related musculoskeletal disorders (PRMDs) amongst a selected group of students at the South African College of Music, University of Cape Town (SACM, UCT), and to identify in which groups of students, if any, PRMDs are most prevalent. It also aims to evaluate to what extent PRMDs impact on students and assess how students treat these disorders as well as establish how successful treatment is. These objectives can be further defined through the following main and secondary research questions.

Main question:

- To what extent are or have the students of the South African College of Music, University of Cape Town been affected by playing-related musculoskeletal disorders (PRMDs)?

Secondary questions:

- How do PRMDs relate to age, gender, handedness, instrument types, years of playing the instrument, playing a second instrument, level of instrument and university programme, stream and year?
- Using the location, duration, severity and frequency of PRMDs as measures of impact, to what extent do PRMDs interfere with students' ability to play their instruments at the level they are used to?
- How are students preventing and/or treating PRMDs?

1.5 Methodology

The study makes use of a quantitative, cross-sectional, descriptive design based on an epidemiological approach (Katzenellenbogen, Joubert & Abdool Karim 1997:66; Brink, Van der Walt & Van Rensburg 2006:106). Epidemiology is an area of medicine defined as the

> study of the occurrence and distribution of health-related events, states and processes in specific populations, including the study of the determinants influencing such processes and the application of this knowledge to control relevant health problems. (Porta *et al.* 2014:95)

Epidemiological studies can be experimental or observational. [15] In epidemiology, experimental studies are concerned mainly with evaluating the intervention in dealing with the health-related event, while observational methods are used for describing and analysing health problems. There are two types of observational epidemiological approaches: descriptive and analytical

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[15] Experimental studies are studies that are concerned with controlling the variables within a study, manipulating them systematically and measuring the effects of this manipulation. Observational studies are concerned with objectively and systematically observing the outcomes of variables that occur naturally (Field and Hole 2003:63–64).

(Katzenellenbogen, Joubert & Abdool Karim 1997:66). Descriptive epidemiology explains how health-related events occur in specific populations, by *describing the person* (age, sex, social class), the *location* (where they occur) and the *time* (season, time of day and/or week) (Katzenellenbogen, Joubert & Abdool Karim 1997:5). A descriptive study is the first step in ascertaining how severe a disease is in a population, while at the same time gaining important information about the circumstances surrounding that disease. A descriptive study has two benefits for the community: (a) giving service providers and policy makers vital information to design policies and, where necessary, allocate funds toward prevention and treatment of the problem; and (b) highlighting trends that may give rise to further research questions which are beneficial to the academic community.

Following the descriptive study phase, further research is needed to ascertain the causes of the disease (Katzenellenbogen, Joubert & Abdool Karim 1997:66). In epidemiology, this is generally done using an analytical study in which the relationship between a health problem and a risk or preventative factors is investigated (Katzenellenbogen, Joubert & Abdool Karim 1997:5). In order to establish a connection between an exposure (risk factor) and an outcome (health-related event), a temporal relationship must be established; the exposure must precede the onset of the outcome (Field & Hole 2003:11; Katzenellenbogen, Joubert & Abdool Karim 1997:68). Field and Hole (2003:64) point out that experimental study designs are the only way to unequivocally establish a causal relationship between the exposure and the outcome. However, this is not always possible in epidemiology as it is unethical to deliberately expose human beings to a health risk. Studies that are reliant on establishing the causes of a disease are therefore often restricted to observational methods such as a questionnaire-based survey.

As will be discussed in Chapter Two, practice habits and sedentary lifestyles are considered to be major contributors to the development of PRMDs (Norris 2011:7–8). Using an observational method such as a questionnaire, various researchers investigating the causes of PRMDs have attempted to find a statistical relationship between the presence of a PRMD and practice habits or sedentary lifestyles.[16] However, as Zaza (1992:50–51) discovered in her study, asking students about their current practice habits does not guarantee that a temporal relationship will be established. She is not alone in suggesting that students are more likely to change their practice and

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[16] Zaza 1992; Roach, Martinez and Anderson 1994; Zetterberg *et al*. 1998; Dawson, Kaneko and Lianza 2005; Kreutz, Ginsborg and Williamon 2008; Brandfonbrener 2009; Ackermann, Kenny and Fortune 2011; Árnason, Árnason, and Briem 2014; Ioannou and Altenmüller 2015.

exercise habits as a result of a PRMD than continue with their old habits (Barton *et al.* 2008:77). In a later study by Zaza and Farewell (1997:294) they looked specifically at behaviours of individuals before a PRMD, therefore reducing the chance of reverse causality. Based on their evidence, they suggest that "musicians who have experienced a PRMD may change some, but not all, of their practice behaviours as a result of the injury" (Zaza & Farewell 1997:297).

Though asking respondents to recall their behaviours prior to the PRMD is a possible solution, the researcher's findings are limited by a strong recall and measurement bias. Katzenellebogen *et al.* (1997:68) as well as Field and Hole (2003:64) identify the difficulty in establishing an accurate temporal relationship in observational methods such as a cross-sectional study using a self-report questionnaire. In future different study designs or methodologies specifically designed to answer analytical questions are needed in order to effectively investigate the causal factors of PRMDs.

As the prevalence of PRMDs (using a standard definition of PRMDs) in the student population at the SACM, UCT has not been established, this research project is an important first step. Therefore this study restricts itself to descriptive research questions. As a temporal relationship does not need to be established for a descriptive study, the use of a self-report measure for data collection, in the form of a questionnaire, is appropriate. A questionnaire is favoured over personal interviews or medical examinations as they have a greater research bias (Zaza 1998a:36; Field & Hole 2003:44).

A questionnaire was designed specifically for the study. The majority of keyboard, string and woodwind students registered at the SACM, UCT were approached during their weekly studio class[17] during the first two weeks of the academic year (17 February to 2 March 2015). The questionnaire took 10-15 minutes to complete. A few students who could not be reached during a studio class were approached individually. Students were invited to participate in the study. Participation was voluntary and anonymous, and informed consent was received from each respondent before they began the questionnaire. A total of 72 questionnaires were distributed.

1.6 Demarcation of the study

All the respondents were undergraduate, Western classical instrumental students from the SACM, UCT. All classical voice or opera students as well as students from the jazz or African music department, were excluded in order to keep the study more focused. These groups are all faced with very different course and instrument requirements in comparison to Western classical instrumental

[17] At the SACM, UCT, a studio class is a weekly class organised by the teacher of the class or head of section in which all members of the class meet and play for one another or discuss various aspect related to playing. At UCT all the woodwinds have a class together, the violinists and violas all have a class together, while the pianists are separated into classes according to lecturer.

students (such as playing multiple instruments, or different rehearsal or practice schedules and performance requirements).

The sample was further restricted to woodwind, string and keyboard players. Other instrumental groups (brass, percussion and plucked strings) were disproportionately small and assessing to what extent these groups are affected by PRMDs, especially in comparison to the other larger instrument groups, would therefore not have great statistical strength.

The inclusion criteria for this study were that participants are:

- Playing a woodwind, string or keyboard instrument on A or B level;[18]
- Studying Western classical music;
- Registered at the SACM, UCT;
- Above the age of 18 at the time of the study;
- Willing to participate by signing a consent form.

1.7 Ethical clearance

The UCT code for ethical clearance <UCTethics 2013>[19] and other literature on the ethical issues were consulted (Katzenellenbogen, Joubert & Abdool Karim 1997:25–34) before applying for the study to be given ethical clearance from the Higher Degrees Committee, SACM, UCT.

Participation in the study was both anonymous and voluntary. Each participating student signed an informed consent form (see Appendix A), which included an overview of the study and researcher, as well as a description of the consequences of taking part in the study. Respondents were informed that participation was voluntary and that they may withdraw from the study at any point. They were also informed that their identity would not be disclosed and that all data collected would be published in aggregate format. Respondents were invited to request a copy of the dissertation upon its completion and were asked to write their email address on the consent form if they wished to have the PDF emailed to them. The consent forms were handed out and collected before the questionnaire was distributed, so that no association could be made between signed consent forms and completed questionnaires.

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[18] At UCT the instrument courses are divided into four levels, A, B, C and D. A and B level are for first instruments, i.e. instruments that students intend to major in, while C and D levels are for second instruments.

[19] Throughout the dissertation URLs are given short descriptions and placed in angle brackets to avoid lengthy URLs in the text. For further details see the list of references.

Because this is a small community and certain combinations of data could reveal a respondent's identity, the handling of all data was kept absolutely confidential, with only the researcher, supervisor and statistician viewing the raw data.

1.8 Chapter overview

In order to get a better picture of the field of performing arts medicine and PRMDs, Chapter Two presents a more in-depth discussion of the types, risk factors, prevention and treatment of PRMDs. The chapter gives a critical overview of experienced- and evidence-based literature[20] in order to provide a balanced perspective on the field. In the light of gaps within evidence-based research, it is important that it is cross-referenced with experience-based literature. Some important debates emerge from the recommendations from experienced-based research and findings of evidence-based research.

Chapter Three details the procedures for data collection and analysis; it looks at the development process of the questionnaire, and presents the results and a discussion of these results. The chapter discusses the various stages of questionnaire development and outlines the structure of the questionnaire. The results and discussion of them are presented simultaneously, placing the results in the comparative context of the national and international body of research. Special attention is given to studies that make use of a similar outcomes definition as well as to existing South African studies. Similarities and differences are highlighted and possible explanations for trends in the data are explored. The findings begin with a description of the personal and study profile of respondents. An overview of current, 12-month and lifetime prevalence of PRMDs is presented as well as how many PRMDs respondents have experienced in their lifetime. This overview is followed by further analysis of the basic descriptive data, using statistical tests to find significant relationships between PRMDs and age, gender, handedness, instrument types, years of playing the instrument, playing another instrument and the university information (programme, level of instrument, stream and year). The chapter then investigates the impact of PRMDs on respondents by looking at the location, duration, severity and frequency of PRMDs recorded in the study. The chapter concludes with an examination of how extensively movement awareness and somatic methods[21] are used; details of which, if any, health professionals were consulted; and an overview of which treatment strategies were used and how effective respondents felt they were.

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[20] Evidence-based research is research that is based on the findings of a study (quantitative or qualitative), (Experienced-based research: see footnote 11).

[21] "Somatic" refers to specific body awareness and conditioning methods (see Chapter Two).

Chapter Four presents conclusions drawn from the findings and the research questions are answered. The conclusions are preceded by a summary of Chapters One to Three and are followed by recommendations based on the results of the study.

Chapter Two
Playing-related musculoskeletal disorders (PRMDs)

2.1 Introduction

There are various aspects of playing-related musculoskeletal disorders (PRMDs) that need to be explored before designing and conducting a study on the topic. By investigating the scholarly debates and contradictions within the field, informed decisions can be made to develop a questionnaire, while also establishing a basis for the contextualised discussion of the results in Chapter Three. This chapter therefore focuses on commonly experienced general and specific PRMDs amongst musicians, the factors responsible for causing PRMDs as well as a discussion of prevention and treatment strategies.

2.2 General playing-related musculoskeletal disorders (PRMDs) amongst musicians

Musicians are most commonly afflicted by problems of the upper extremities and facial muscles (Zaza 1998a:7) as these are the structures predominantly used to play an instrument. Zaza (1998a) divides PRMDs into three groups: *Inflammatory PRMDs, nerve entrapment syndromes* and *other PRMDs.*

Inflammatory PRMDs: Zaza (1998a:9) defines inflammatory PRMDs as "pain, tenderness and swelling related to inflammation". Although the affected area might be tender and not necessarily appear red, other abnormal signs are present. While there may be weakness, "[n]umbness, tingling, burning, and other neurological symptoms are uncommon". Symptoms may present at the site of inflammation or elsewhere (Zaza 1998a:9).

The most familiar inflammatory PRMD is so-called "tendonitis",[22] also spelt "tendinitis". The term is notoriously misused to refer to any pain in the hand, wrist or forearm (Dawson 2008:49). Tendonitis is a specific condition in which the tendon itself is inflamed; however, the tendon sheath can also present with inflammation, a condition which is then referred to as "tenosynovitis". Norris (2011:7) argues that the tendon may not necessarily be the cause of pain, but rather the muscle attached to it, and so he includes both the tendon and the muscle in his definition of tendonitis.

Nerve entrapment syndromes: Nerve entrapment syndromes are disorders that arise when the nerves of the peripheral nervous system are compressed or pinched by surrounding structures such as

[22] The term "tendonitis" will be used throughout this dissertation.

tendons (Zaza 1998a:10). Symptoms include "pain, numbness, tingling, burning, 'pins and needles' and other neurological sensations" as well as "weakness, clumsiness and muscle atrophy." Symptoms may be deferred; for example, pain felt in the arm may stem from the neck (Zaza 1998a:10).

Other PRMDs: This group includes temporomandibular joint dysfunction syndrome (TMJ or TMD), hypermobility, focal dystonia and overuse syndrome also known as repetitive strain syndrome (RSI) or musculotendinous overuse (Zaza 1998a:11).

Overuse syndrome has been defined by some researchers as "persisting pain and tenderness in muscles and joint ligaments of the upper limb due to excessive use" (Fry 1987:35) and this general definition has been adopted by many subsequent researchers (Bejjani, Kaye & Benham 1996; Brusky 2009; Hohls 2010). Other researchers have defined overuse syndrome as a non-inflammatory response to overuse of a specific area that does not have a specific diagnosis (Schaefer & Speier 2012:317), or as Bird (2013:476) states, it refers to "[a] diagnosis of exclusion", where overuse is diagnosed when other disorders have been ruled out. Zaza (1998a) makes a distinction between "overuse problems" (1998b:1020), which includes specific diagnoses, and inflammatory responses and "musculotendinous overuse", which is more in line with the definition of Schaefer and Speier (Zaza 1998a:11).

Focal dystonia is a painless "incoordination" occurring only with certain tasks such as playing an instrument. Very little is known about the condition, which is a localised, non-progressive problem. It often occurs in the lip muscles (embouchure) of brass players, and the ring and little finger of the right hand in pianists. Musicians may increase their practice time, misinterpreting the incoordination as weakness because of too little practice. This may then result in pain and overuse problems as well (Zaza 1998a:13).

Hypermobility, a condition in which joints are able to move beyond their normal range of movement (Brandfonbrener 2010:30)., will be discussed later in this chapter when the risk factors that contribute toward the development of PRMDs are examined. TMJ or TMD, a condition causing pain in the jaw joint and surrounding muscles (Zaza 1998a:12), cannot be discussed without exploring all of the common disorders found in specific parts of the body.

Zaza's classification system outlined above serves as a guideline for organising the specific PRMDs discussed in the section to follow.

2.3 Specific playing-related musculoskeletal disorders (PRMDs)

2.3.1 Neck, back and shoulder

A frequent complaint among musicians is shoulder, back and neck pain. Several studies found high levels of shoulder, neck and back pain.[23] Back pain is associated with musculoskeletal strain most often related to tight and weak muscles (Norris 2011:29). Bad sitting and standing habits and asymmetrical posture (as occurs with instruments such as the flute and violin) can have negative impacts on the postural structures (Brandfonbrener 2010:33; Watson 2009:28, 34). Lower back pain is most prevalent and associated with tight hamstrings and pelvic muscles (Norris 2011:29; Watson 2009:26). Neck pain is similarly related to strain and caused by incorrect posture or bad instrument setup (such as a violinist needing to extend the neck down toward the instrument) (Brandfonbrener 2003:235).

Back and neck pain are common in the general population (Hogg-Johnson *et al.* 2008; Cote *et al.* 2009), making it difficult to identify whether or not symptoms are caused by playing the instrument. It is not clear under which of the aforementioned three categories outlined by Zaza back and neck pain should be classified. While studies suggest that muscle strain is associated with inflammation (Smith 1991; Miles & Clarkson 1994), muscle spasms do not fit into any of Zaza's classifications. It has been suggested that muscles cramps arise from over-stimulation of motor neurons (Van De Graaff 2002:286), making a possible case for the classification of muscle spasms as an extension of overuse disorders.

The shoulder is the most mobile joint of the body and an extremely complex structure (see Fig. 2.1). "Shoulder impingement", "bursitis" and "bicipital tendonitis" are the most common problems in this area among musicians. Many instrumentalists need to hold their shoulders in the same position for many hours, especially violinists and violists who use the shoulder to support instruments. Symptoms are typically pain and tenderness with the restricted and painful range of motion (ROM). Shoulder impingement, bursitis and bicipital tendonitis are classified as inflammatory PRMDs (Zaza 1998a:9).

Impingement occurs with the elevation of the arm, causing the "supraspinatus" tendon to be pinched while passing under the "acromion*"* (Watson 2009:77). Zaza (1998a:9) refers to impingement as "supraspinatus tendonitis" or *"*rotator cuff tendonitis".

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[23] Fry 1986; Caldron *et al.* 1986; Fishbein *et al.* 1988; Roach, Martinez and Anderson 1994; Zetterberg *et al.* 1998; Crnivec 2004; Van der Walt 2006; Abreu Ramos and Micheo 2007; Hohls 2010; Leaver, Harris and Palmer 2011; Kaufman-Cohen and Ratzon 2011; Ackermann, Driscoll and Kenny 2012; Kok *et al.* 2013.

Bursitis is the inflammation of the bursa, a synovial fluid-filled sac in the joint. Bursitis may present with symptoms very similar to impingent (Zaza 1998a:9).

Bicipital tendonitis is inflammation of the tendon attaching the bicep to the top of the "humerus" (Schaefer & Speier 2012:318).

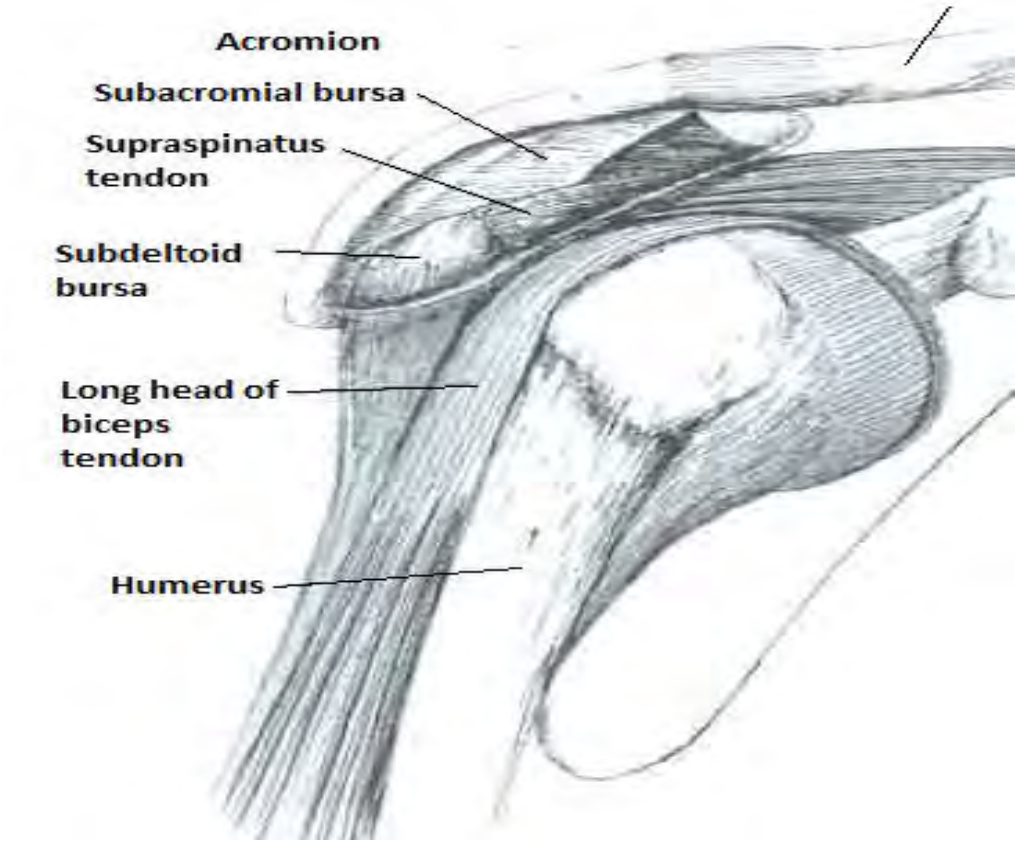

Figure 2.1: The shoulder joint and its associated structure (Hoppmann 2000:217)

Thoracic outlet syndrome refers to compression of the nerves ("brachial plexus", see Figure 2.2) and blood vessels travelling through the space between the neck, chest and shoulder (the thoracic outlet). Thoracic outlet syndrome is classified as a nerve entrapment syndrome (Zaza 1998:11). The nerves may be compressed by the "scalene" muscle in the neck or by an inflamed tendon of the "pectoralis minor muscle" (Norris 2011:26; Zaza 1998a:11). This condition is often found in the right shoulder of flute and horn players, and in the left shoulder of string players, in particularly double bassists, harpists and guitarists (Norris 2011:26). While some researchers list this condition as a common playing-related problem, electromyographics (EMG) and other conventional imaging are unable to help establish a clear diagnosis (Schaefer & Speier 2012:320). Many of the symptoms are similar to those of other conditions and individual symptoms differ from patient to patient, making diagnoses very difficult (Zaza 1998a:11). Paull claims that in her experience as a physiotherapist, thoracic outlet syndrome is not only an overused diagnosis, but that she has never

treated a musician with this ailment. She attributes prevalence rates of this injury to the carrying of heavy instruments or non-music-related activities (Paull & Harrison 1997:81). Watson (2009:84) acknowledges that thoracic outlet syndrome is controversial in the medical field, but considers it the most common nerve compression problem in musicians.

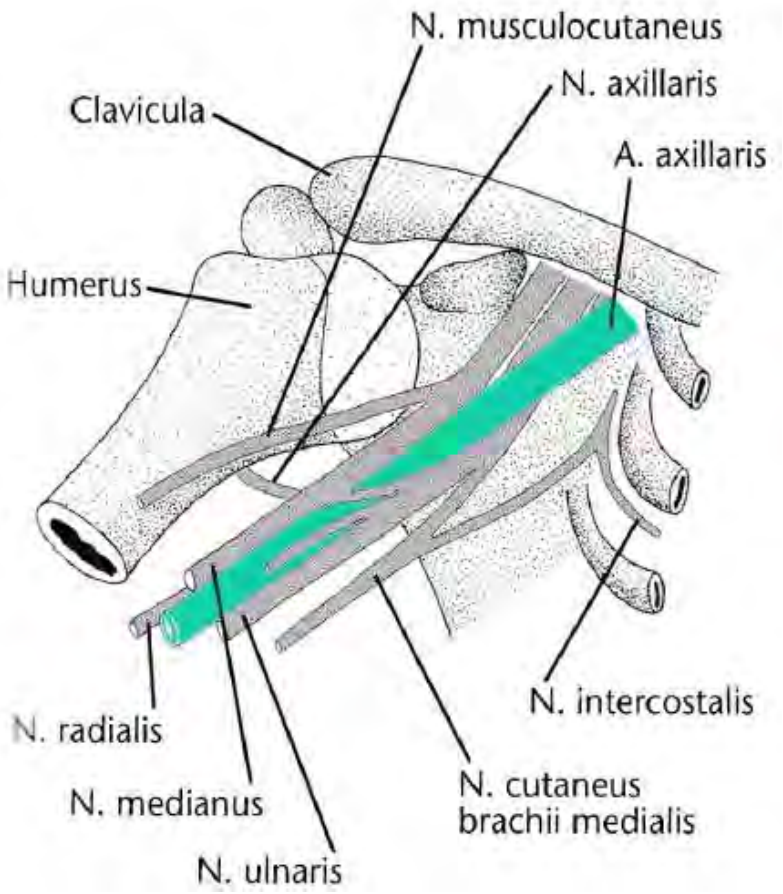

Figure 2.2: View of the brachial plexus (thoracic outlet) (Moll & Möller 2006:205)

2.3.2 Elbow and forearm

The most common problems in the elbow are "lateral" and "medial epicondylitis", both considered to be inflammatory PRMDs (Zaza 1998:9).

Lateral epicondylitis, known more commonly as "tennis elbow", is pain over the bony protrusion at the elbow known as the "epicondyle" (see Figure 2.3). The problem is commonly found in percussionist or instrumentalist performing repetitive wrist movements (Schaefer & Speier 2012:318).

Medial epicondylitis (golfers' elbow) is similar to tennis elbow but, according to Brandfonbrener (2003:234), is more common among musicians. It is an inflammation of the "common flexor tendon" (tendon of the forearm at the elbow). Symptoms for both medial and lateral epicondylitis

include pain in the wrist, forearm or elbow. This pain may occur with or without exertion (Zaza 1998a:9).

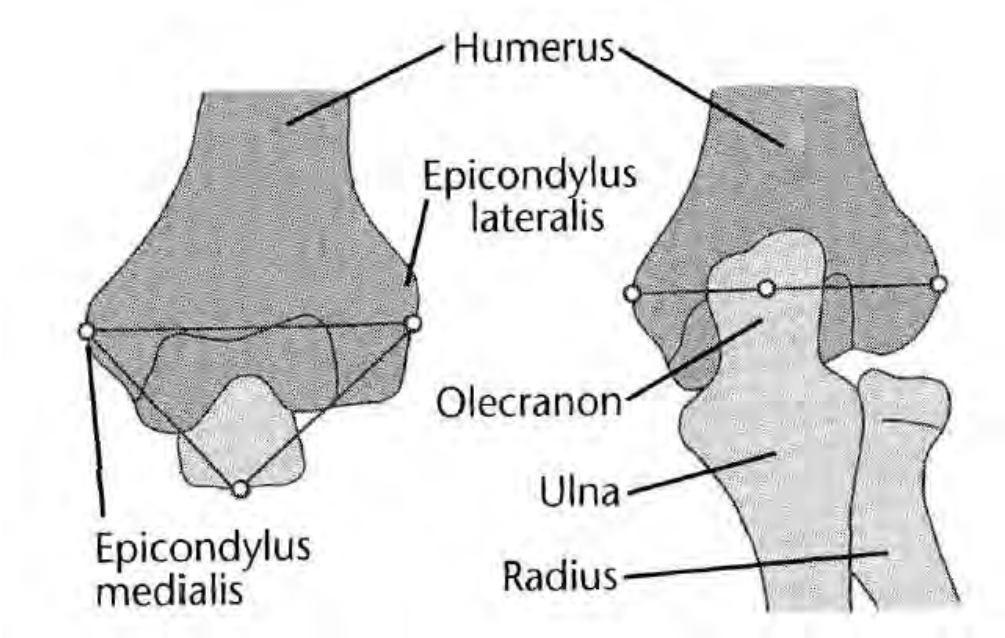

Figure 2.3: Medial and lateral epicondyle (dorsal view) (Moll & Möller 2006:178)

Cubital Tunnel Syndrome is an ulnar nerve entrapment syndrome at the elbow associated with flexed arms (see Figure 2.4). The syndrome is often found in cellists and bassists playing in the first positions, but can be present in any instrumentalist requiring frequent or extreme arm flexion (Norris 2011:36). The ulnar nerve could also become entrapped in "Guyon's canal" (canal where the nerve passes through into the wrist) and symptoms here would include numbness and tingling in the little finger and half of the ring finger, and sometimes in the palm and back of the hand (Zaza 1998a:11).

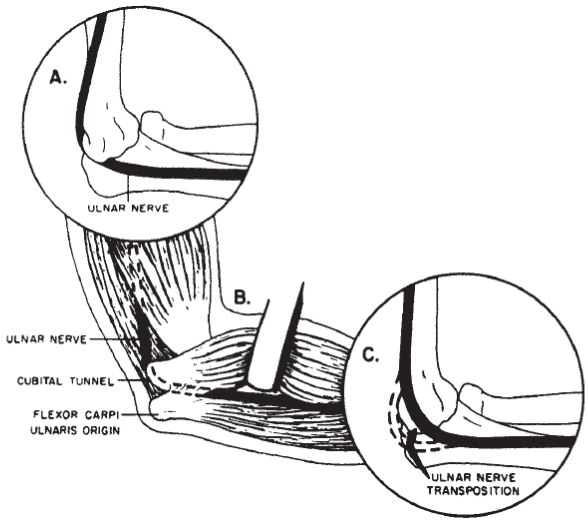

Figure 2.4: Ulnar nerve entrapment in the cubital tunnel (Nolan & Eaton 1993:50)

2.3.3 Wrist and Hand

Arm, wrist and hand injuries are some of the most common injuries among musicians (Brandfonbrener 2003:234). Various conditions are written about, including "carpel tunnel syndrome", "ganglion cysts" (discussed in this section), "de Quervain tenosynovitis"and tendonitis of the finger tendons (discussed in the next section on finger and thumb problems) .

Carpel tunnel syndrome, perhaps the most familiar nerve entrapment syndrome (Zaza 1998a:10), refers to the compression of the median nerve in the carpel tunnel. The prevalence of this syndrome amongst musicians is disputed. Studies show that between 1% to 13% of musicians are affected, a statistic that is less than the general population (Schaefer & Speier 2012:320). Symptoms can be felt in the thumb, index finger and middle finger as well as the side of the ring finger closest to the middle finger and is commonly known to cause waking at night due to the symptoms (Zaza 1998a:10).

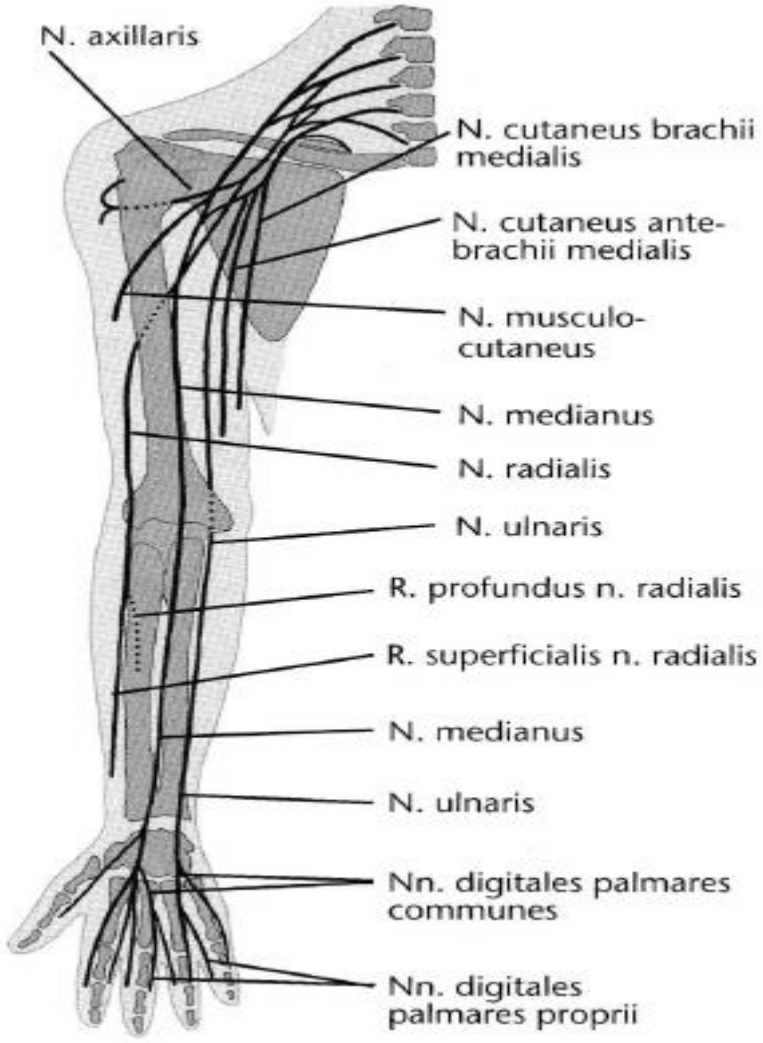

Figure 2.5: Nerves of the right arm (Moll & Möller 2006:205)

Ganglion cysts present most commonly in percussion players. They are fluid build-up, typically in the wrist which can push against the tendons causing pain and inflammation (Watson 2009:78).

2.3.4 Fingers and thumb

De Quervains tenosynovitis is an inflammation of the tendon at the base of the thumb (i.e. the tendons of the long and the short extensor muscles of the thumb) associated with supporting an instrument with the thumb such as woodwind instruments as well as playing piano octaves (Schaefer & Speier 2012:319). The disorder is therefore found most commonly in pianists, oboists and clarinettists. Pain in the thumb, side of the wrist and the back of the hand are the main symptoms (Zaza 1998a:9). Inflammation at the base of the thumb is not exclusively present in the instruments mentioned by Zaza, but also known to affect the bow hand of violinists and other string players (Norris 2011:44).

Tendonitis or tenosynovitis in the fingers is particularly precarious because of the length of the tendons. If they become inflamed and scarring occurs between the tendons and the sheaths, chronic tendonitis may result as the tendons will be aggravated by damaged sheaths (Paull & Harrison 1997:89).

2.3.5 PRMDs of the face and head

Wind players present with very specific injuries to the "stomatognathic*"* structure (muscles, teeth, nerves and temporomandibular joints) (Dana 2000:468). These disorders are a result of very exact coordination of the muscles around the mouth and the jaw joint which form an embouchure and the use of lip pressure to create sound. A very common problem is "temperomandibular joint pain" (TJP) and dental problems (Brandfonbrener 2000:187).

Temperomandibular joint pain (TJP or TMD) is pain or tenderness in the temporomandibular joint and the muscles used for chewing. Symptoms include pain and tenderness in the affected areas. TJP limits the ability to open the mouth or creates a crooked opening of the mouth. Clicking or popping noises can be heard when the jaw moves (Zaza 1998a:12).

Brass players have to be aware of overuse of the lips as this can lead to serious or permanent damage to the lip muscles. Since brass players are very sensitive to these risks, they often deploy healthy practice habits as part of the fundamental pedagogy (Culf 1998:76–77).

Though there seems to be a close link between types of PRMDs and the specific instruments played, the following section will describe further causal factors of PRMDs.

2.4 Risk factors in the development of playing-related musculoskeletal disorders

Playing-related musculoskeletal disorders (PRMDs) are often caused by a combination of factors (Ackermann 2010:248–249). However, there is some debate around the importance and legitimacy of various risk factors. There seems to be a rift between research-based and experience-based literature (see Chapter One). Zaza (1998a:45) states that the majority of research related to causal factors is based on opinion and clinical experience instead of research-based evidence from empirical studies. However, when comparing studies, certain aspects of the findings are often incongruent and contradictory. Such contradictions or discrepancies could be attributed to flawed or weak research methodologies, raising concerns about the legitimacy of results. It is therefore important to confront these variations and contradictions.

2.4.1 Gender

Gender is considered by many to be the most important risk factor in many studies showing that females are more likely to develop a PRMD than males are.[24] Some studies have shown that there is no significant relationship,[25] but no studies have indicated the opposite (that males are more likely to get a PRMD than females are).

Why females may be more at risk is difficult to determine. It has been argued that men have stronger muscles than women; however, this argument cannot be substantiated because of a lack of research (Zaza 1998a:45). Theories such as women having a smaller hand span, greater flexibility or performing other activities in their daily lives that increase the risk of getting a PRMD have been disproven in studies (Zaza & Farewell 1997:294–297; Allsop & Ackland 2010:71). There is also a possibility that women are more likely to report PRMDs than men. Spahn (2011a:53) suggests that women are more open to dealing with their problems than men are, and this could have led to misleading statistics. In many societies social conventions dictate that men should not show weakness. In a study done by Fry (1987:37–38) in seven universities in Australia, clinics were held at two of the universities to encourage students to report early symptoms. At the universities where no clinics were held, women reported more symptoms than men, however at the universities where students were encouraged to report early symptoms, men and women were equally represented.

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[24] Fry 1987; Fishbein *et al.* 1988; Manchester and Flieder 1991; Roach, Martinez and Anderson 1994; Zaza and Farewell 1997; Guptill, Zaza and Paul 2000; Barton *et al.* 2008; Kreutz, Ginsborg and Williamon 2008; Kenny, Cormack and Martin 2009; Allsop and Ackland 2010; Árnason, Árnason and Briem 2014; Kok, Nelissen and Huisstede 2015.

[25] Guptill, Zaza and Paul 2000; Dawson, Kaneko and Lianza 2005; Van der Walt 2006; Kenny, Cormack and Martin 2009; Brandfonbrener 2009; Hohls 2010; Ajidahun and Phillips 2013; Árnason, Árnason and Briem 2014.

This result may indicate the reluctance of men to report symptoms unless encouraged to do so. Zaza (1998a:45) points out that studies done in other occupational groups have shown a similar tendency towards women reporting more problems than men (cf. Mergler *et al.* 1987). More research is needed to find reasons for this phenomenon.

2.4.2 Age and years of playing the instrument

Studies have shown varied and conflicting elements with regard to age and years of playing as a risk factor. The ISCOM study found that most injuries occurred in orchestral midlife (35–45 years old) (Fishbein *et al.* 1988:5). Allsop and Ackland (2010:71) found that musicians between the ages 41–89 years experienced the most problems, while the youngest group (12–21 years) had the least. Other studies have found no relationship between age and PRMDs (Zaza & Farewell 1997; Dawson, Kaneko & Lianza 2005).

In undergraduate student groups such as the one investigated and reported on in this dissertation the range of ages is smaller and therefore a less important factor. A more relevant question is whether or not the number of years of playing an instrument affects the risk of developing a PRMD. Research by Zaza and Farewell (1997:296) and Davies and Mangion (2002:161) shows that the longer musicians have been playing an instrument, the less likely they are to develop a PRMD. This statistic could, however, be influenced by the fact that older musicians who have suffered a severe PRMD are no longer in the profession as performers (Zaza 1998a:46), but could be active as teachers As a result of these statistics, Zaza (1998a:46) claims that younger musicians are more at risk than older players. Other studies have found no relationship between number of years of playing an instrument and the prevalence of PRMDs (Brandfonbrener 2009; Dawson *et al.* 2005; Hohls 2010). As opposed to Zaza, Spahn (2011a:53) believes that the longer a musician has been playing an instrument, the greater the chances that they would have developed a PRMD during that time. Further research is needed to investigate this factor.

2.4.3 Instrument

While all instruments put musicians at risk of developing a PRMD, some instruments seem to put musicians more at risk than others. Studies indicate that string players[26] and keyboard players (Manchester & Flieder 1991; Cayea & Manchester 1998; Van der Walt 2006) are more at risk. Zaza and Farewell (1997:296) found that string players were four times more at risk of developing a PRMD than non-string players. Some studies also put woodwind players at a high risk (Fry 1987;

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[26] Fishbein *et al.* 1988; Cayea and Manchester 1998; Manchester and Flieder 1991; Larsson *et al.* 1993; Zaza and Farewell 1997; Van der Walt 2006; Kaufman-Cohen and Ratzon 2011.

Larsson *et al.* 1993) and several studies show that brass players are least affected (Fry 1987; Fishbein *et al.* 1988; Dawson 2002).

Zaza (1998a:46) and Brandfonbrener (2010:31) attribute the possible increased prevalence in keyboard and string players to the fact that these groups make greater use of repetitive movements, practicing many hours trying to learn difficult repertoire. Zaza (1998a:46) also attributes the high rates in string players to the asymmetrical posture of string playing, commenting on the high risk of flute players developing a problem as a result of an equally asymmetrical posture.

2.4.4 Practice habits

Although practice habits are among the most important risk factors, as they can be altered to help prevent a PRMD, not many studies have been dedicated to investigating this factor (Zaza 1998a:47).

The *total practice time* measured daily or weekly is perhaps the most widely investigated factor in terms of practice habits. However, studies investigating this factor did not find a statically significant relationship between the practice time and the presence of a PRMD (Roach, Martinez & Anderson 1994; Zaza 1998; Dawson, Kaneko & Lianza 2005; Ioannou & Altenmüller 2015). As Zaza (1998a:47) points out, using total practice time as a measure is very problematic. Musicians do not usually have the same playing schedule each day; playing for many hours on one day and very little on the next (Zaza 1998a:47). As discussed in Chapter One, it is also difficult to establish a temporal relationship between the practice time indicated by respondents at the time of the study and PRMDs, as student are more likely to change their practice habits because of PRMDs. Zaza (1998a:47) claims that practice time alone is not considered a causal factor.

What has been shown to have an effect on preventing a PRMD is taking regular breaks and doing instrument-related warm-ups and physical warm-ups (Zaza & Farewell 1997:296). The results of Zaza and Farewell's study confirm the recommendation of much of the experienced-based literature written on the topic.

2.4.5 Playing technique and body posture

Most PRMDs seem to demonstrate a direct relationship to the repetitive and forceful movements required to play the respective instruments (Dawson 2002:139). Musicians are under pressure to play technically accurate concerts, exams and auditions. They spend many hours repeating physically demanding passages that are often uncomfortable, tense or unnatural, while supporting heavy instruments. Excessive tension and lack of ergonomic posture and movements while playing

exacerbate the situation further. There are many possibilities for students to improve their posture and playing techniques, as will be discussed later in this chapter.

2.4.6 Exercise

Studies have found it difficult to directly link regular physical exercise to a reduced risk of getting a PRMD (Kreutz, Ginsborg, & Williamon 2008; Brandfonbrener 2009; Hohls 2010; Ackermann, Kenny & Fortune 2011). Studies of more specific exercise programmes have, however, shown a moderate reduction of PRMDs (Ackermann, Adams & Marshall 2002; de Greef *et al.* 2003; Chan, Driscoll & Ackermann 2014b; Chan, Driscoll & Ackermann 2014a). Brandfonbrener (2009:34) argues that clinical experience has shown that a poor physical condition seems to be an important risk factor contributing towards the development of medical problems. These are recommendations made by most health professionals in the field. Kreutz (2008:10) attributes the lack of a correlation between healthy lifestyles and beneficial effects on practice and performance to the "lifestyles" in question perhaps not being healthy enough to show results. Others experienced-based literature even warns against certain exercises that could potentially harm musicians (Paull & Harrison 1997:79; Norris 2011:35). Ackermann *et al.* (2011:257) proposes that exercise programmes specifically targeted at musicians' needs are required. It has been shown, for example, that physically warming-up and cooling down before and after practice significantly prevents PRMDs (Zaza & Farewell 1997:297).

Of course, plenty of research-based evidence documents the effects of physical activity on the health of human beings. A lack of physical activity has been linked to cardiovascular disease, diabetes, cancer, hypertension, obesity, depression and osteoporosis (Warburton, Nicol & Bredin 2006:801). Regular exercise has also been shown to reduce stress and improve mental health (Salmon 2001:33). As will be discussed in the next section, there is a significant connection between psychological and physical problems (Spahn 2011b:135). A reduction in the effects of stress and depression is therefore beneficial to musicians.

2.4.7 Psychological stressors, hypermobility and genetic predisposition

Zaza and Farewell (1997:296) show a relationship between high levels of anxiety and/or stress and risk of developing a PRMD. This finding is consistent with the findings of Davies and Mangion (2002:161) and it may be that the increased muscle tension brought on by the stress and/or anxiety could contribute to a PRMD (Zaza 1998a:47). However, there seems to be an even more significant connection between the psychological and physical factors, which moves the study into the realm of psychosomatic medicine. As Spahn (2011b:135) points out, the musician makes use of the physical,

emotional, psychological, social and even spiritual elements in the process of making music. Any disturbances in one of these areas could have a significant impact on the others.

Sometimes pain and other symptoms are even prolonged by psychological and emotional problems (Altenmüller & Jabusch 2011:202–203). Musicians often suffer from depression and anxiety as a result of a PRMD, which could consequently slow down the healing process (Brandfonbrener 2003:237). The psychological aspects of PRMDs should be considered throughout the prevention and treatment process.

Aside from these psychological aspects, PRMDs sometimes have physiological origins. Brandfonbrener (2010:30) warns of the dangers of joint laxity or hypermobility.[27] She argues very strongly that her 25 years of clinical experience have shown that hypermobility has almost always resulted in pain. In her experience hypermobility often affects musician's hands and fingers and is a source of pain in surrounding tissues as a result of increased strain on the muscles trying to support the joint (Brandfonbrener 2010:30). Zaza (1998a:46–47) contests this notion, stating that research has shown that hypermobility is not harmful and that one must be careful of basing results on experienced-based evidence. Doctors working with injured hypermobile musicians are seeing only those who are injured and therefore have a biased or restricted view. She agrees that much more work is needed to understand the effects of hypermobility (Zaza 1998a:46–47). In fact, in a study done by Zaza and Farewell (1997:296) hypermobility was found to actually protect musicians. More studies are needed to investigate the effects of hypermobility.

PRMDs may also occur as a result of pre-existing anatomical variations. An extra rib or band of fibre can induce certain types of thoracic outlet syndrome. Likewise, tendon variation in the hand can increase the risk of getting tendonitis (Zaza 1998a:45; Norris 2011:52). This final risk factor contributing towards the development of PRMDs reminds us that while some risk factors are negated by changing behaviours and attitudes, many are unalterable. This difference needs to be carefully considered in attempting to prevent PRMDs.

2.5 Prevention strategies

Naturally, there are many overlaps between of risk factors and prevention. Individual susceptibility, age, gender, hypermobility, instrument type and number of years playing an instrument are all

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[27] Hypermobility is a condition in which moderate hyperextensible joints (joint capable of moving beyond their usual range) occur without any defects of the surrounding connective tissue. Interestingly, instrumentalists seem to be more afflicted with hyperextensible joints (20%) compared to the rest of the musician population (5-6%). The condition is seen to be a genetically inherited one, however, and typically affects females more than males and Asians more than Caucasians (Brandfonbrener 2010:30).

factors that can be used to gauge the vulnerability of a musician. Musicians with one or more of these factors may need more awareness of PRMDs and will benefit from learning to treat the body more carefully. Practice habits, regular exercise and reduction or improved management of stress, depression and other mental problems can be influenced directly, as can the playing technique and body posture.

There are essentially three key areas of prevention applicable to all musicians, but specifically for students in the context of this study: (a) awareness of and education about PRMDs, (b) the role of the teacher in improving the technique and practising strategies of the student, and (c) the improvement of posture in relation to body awareness.

2.5.1 Awareness and education

It is important that musicians be aware that they are at risk of developing a PRMD. Such awareness should be accompanied by proper education on how to prevent the condition, or identify early symptoms and treat or seek treatment for a problem. Education should take place in as early a stage in the musician's development as possible. According to Chesky *et al.* (2006:143), the "physical, psychological and sociological determinants" are often set in the early years of playing an instrument. However, one of the most logical places to incorporate preventative education is at universities. In 2004 at a conference with the theme "Health Promotion in Schools of Music at the Texas Centre for Music and Medicine" the following recommendations were made for music intuitions: (a) Adopt a health-promotion framework; (b) Develop and offer an "occupational health" course for all undergraduate musicians; (c) Educate students on hearing loss; and (d) Help students access appropriate health care resources (Chesky, Dawson & Manchester 2006:143). These recommendations were adopted by the National Association for Schools of Music[28] in the USA (Devroop 2014:48). In Germany the majority of universities and conservatoires have also incorporated prevention education courses into their music degrees and diplomas (Spahn 2011a:64). Worldwide many of these programmes have been studied showing their benefit for musicians.[29]

2.5.2 The role of the teacher

Dawson (2008:24) emphasises the importance of all teachers having a basic knowledge of musicians' health issues. Educated teachers would help prevent or manage PRMDs, facilitate

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[28] The National Association for Schools of Music is an overarching organisation for school, conservatoires, colleges and universities in the USA, which establishes standards for degrees and other credentials <NASM 2015>.

[29] Spahn, Hildebrandt and Seidenglanz 2001; Barton and Feinberg 2008; Zander, Voltmer and Spahn 2010; López and Martínez 2013; Chan, Driscoll and Ackermann 2014b.

treatment by sending students to the appropriate medical professionals as well as increase education and awareness of musicians' problems.

The role of the teacher becomes especially important with regards to the student's technique and practice methods. Teachers need to help students develop a natural, ergonomic and efficient technique and encourage effective, efficient and healthy practice habits. Students learn a great deal from their teachers and intervention during the learning process is vital to reduce PRMDs.

In order to produce teachers capable of identifying, managing and preventing such problems, education is needed. Courses at universities could once again serve as an important platform for educating future educators; however, as is the case in certain parts of Europe,[30] specific further training courses are useful resources for in-service teachers and performing musicians.

Globally, performing arts medicine has worked its way into music education. At the 2014 International Society for Music Education (ISME) conference in Brazil, nine papers on the topic of musicians' health were presented (Forrest & Del-Ben 2014). The official position of the National Association for Music Education (NAFME) on musicians' health and education outlines the importance of the educator's role in preventing musicians' problems <Health-in-Music 2016>.

2.5.3 Body awareness and posture

The final important aspect of prevention is the various movement awareness and somatic methods available to musicians. Ideokinesis, the Alexander and Feldenkrais technique, dispokinesis, biofeedback, yoga, Pilates, body mapping, cranial-sacral therapy and applied kinesthesiology are just some of the numerous techniques available internationally (Hildebrandt & Spahn 2011:36). This list of movement and somatic methods is not exhaustive and other methods such as the Laban/Bartenieff movement studies are also available <LIMS 2016>. Although there has been no formal study on the availability and use of movement awareness and somatic methods in South Africa, it seems that only the Alexander technique, the Feldenkrais technique and the body mapping approach are commonly used by musicians. Yoga, Pilates, tai-chi/qigong and biofeedback are available to musicians, though not always used specifically in conjunction with the prevention of PRMDs. In the discussion below only techniques generally used in South Africa are presented.

Alexander technique: The Alexander technique was developed around the 1900s by Frederick M. Alexander (1869–1955). The technique is a method of gaining complete body freedom and ease of movement by utilising the natural mechanisms of the body, in which a free head and spine

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[30] The researcher conducted a comparative study on four different courses in three countries in a project at the University of Music and Performing Arts, Vienna (see Appendix C).

relationship is considered to be of primary importance. Using a process of awareness (identifying the incorrect movement), "inhibition" of incorrect movement and the correction of the habit using a new mental image ("directions") or getting prompts by the therapist, the unhealthy posture and movement patterns are slowly changed into healthy ones (Conable & Conable 1995:1–2; Hildebrandt & Spahn 2011:42). Lessons are usually taught individually and may incorporate the instrument (Hildebrandt & Spahn 2011:43).

Feldenkrais method: Moshé Feldenkrais (1904–1984) developed the method around 1935. It is a method that aims to retrain the movement and postural patterns of the body using sensomotoric stimuli. Very slow movement patterns are used to mindfully improve both co-ordination and body awareness. He referred to this process as "Awareness through movement". Lessons are done individually and in groups. In group lessons the participants are guided through the movements with instructions. In individual lessons the participant remains more passive and is given sensomotoric stimulations by being moved by the instructor, helping improve efficiency of all movements while increasing body awareness (Hildebrandt & Spahn 2011:42).

Body mapping: Body mapping is an approach in which a correct physiological map of the body is created, thereby learning how to move the body in a natural way. It is an approach that grew out of the Alexander technique and encompasses other approaches such as Feldenkrais, However, unlike Alexander and Feldenkrais, this method has been designed specifically for musicians (Conable & Conable 2000:5). Through diagrams, the use of kinaesthetic sense and palpitation of parts of the body, musicians are able to change the incorrect concept they have of how the body works, allowing the musician to change his or her movement patterns.

Yoga: Yoga is an old Eastern practice. More than 20 practices and philosophies have combined to form the practice of yoga, which has become widely popular in the Western world. Yoga has three essential elements:

1. Posture – using exercises and static postures to stretch, align and support the normal bodily functions;
2. Breathing – controlled breathing is integrated into all the postures;
3. Meditation – striving to achieve *nirvana* or *enlightenment* in meditation through detachment from the surrounding environment.

Yoga is not only very good for stress release and inner balance, but it also improves the kinaesthetic sense and is a good body conditioner (stretching, strength and endurance training) (Dawson 2008:101–102).

Tai chi/qigong: The practice, originating in China, is a martial art that makes use of slow meditative movements (Jin 1992:361). Tai chi is designed to help increase body awareness (Kerr *et al.* 2008:318) and can be especially helpful for musicians in improving body awareness and posture. Tai chi has also been shown to reduce stress and has physical impacts that have been compared to a brisk walk (at about 6 km/h) (Jin 1992:367–368).

How this practice can be effectively used for musicians is evident in its use at summer schools such as the European Flute Academy in Fiss that takes place in Austria every year <Flute Academy 2016>. Tai chi is offered for one hour every morning. The European Flute Academy attracts top flute students from across Europe and abroad, offering a ten-day workshop in a constructive and highly competitive environment. Students are encouraged to attend tai chi classes daily and are offered two sessions with a specialist on body movement and awareness training. Here body health and awareness are successfully combined with competitive playing and many hours of daily practice.

Biofeedback: Biofeedback is used to reduce muscle tension and excessive force, while training muscle relaxation in order to improve muscle control needed to play an instrument (Howard 2010:189). Electromyography (EMG) is used, giving musicians feedback using sound pitches, light intensities or a combination of the two. Through this feedback, musicians are able to actively retrain their movements and relaxation patterns (Levee, Cohen & Rickles 1976:113–114). The technique is used for various purposes in medicine. For musicians biofeedback can be useful as a relaxation technique, as a method of reducing performance anxiety, as treatment for specific disorders in musicians and as a pedagogical tool for training or retraining musicians (LeVine & Irvine 1984:161).

Pilates: Pilates, an exercise programme based on the teachings of Joseph Pilates (1880–1967), is designed to increase muscle strength, flexibility, endurance and neuromuscular control with particular emphasis on the so-called "core" muscles or abdominal muscles. Similarly to yoga, it synchronises breathing with movement, and through strengthening of the core muscles, the shoulders, pelvis and rib cage are stabilised allowing for a neutral positioning of the head, neck and spine. The aim is to protect the joints and structures of the body from excessive strain. Pilates was originally used by athletes and dancers, but in recent years it has become very widely practised by the general population (Kava *et al.* 2010:4). In a preliminary study musicians reported benefits such as increased breath control, reduced pain, improved posture, increased playing endurance and decreased muscle tension (Kava *et al.* 2010:15).

Many of these practitioners are not only useful in promoting the prevention of problems, but also in treating problems. Their role in treatment, in combination with other medical and music professionals, needs to be explored.

2.6 Treatment

The treatment of musicians' problems is often a very complex process. Many doctors and surgeons are not accustomed to working with musicians. As Winsur and Warrington (2010:229) point out, on the one hand, surgeons often fail to understand musicians, who tend to describe their symptoms in "musical terms". Musicians, on the other hand, often distrust surgeons, who they feel do not fully understand their needs and concerns. In a study done by Guptill *et al.* (2000:88) 79% of the students who answered the question felt it was very important that the health professional have musical knowledge. Brandfonbrener (2010:29) reminds us that musicians often present with few or no obvious pathological signs and as a result inexperienced doctors often dismiss musicians and their symptoms. Pain in a finger can have very few repercussions for a non-musician, but for a musician it can be catastrophic. Therefore treatment of musicians' problems needs to be approached very differently.

Playing-related problems are usually caused by a combination of factors rather than a single *modus operandi*. These factors range from psychological stressors to errors in posture, playing technique and practice habits. The constellation of these factors is different in each musician, creating highly individualised patients. Health professionals need to look at the musician as a whole – their social, physical and psychological or emotional history and symptoms. They need a broad understanding of various topics related to music and musicians in order to treat them adequately, calling for a combination of specialists. Teams of health professionals need to work together in order to assess and treat musicians (Ackermann 2010:248–249).

2.6.1 Treatment models

The biopsychosocial model is an approach to medicine that views human beings in terms of their physical, psychological and/or emotional, social and environmental state, in contrast to the biomedical model which takes only the physical body into account (Engel 1978). The biopsychosocial model could offer musicians a holistic treatment approach that addresses not only the physical symptoms, but rather the interaction of risk factors and emotional or psychological concerns that result from the problem. Anxiety and depression often accompany the PRMD and need to be integrated into the treatment process (Brandfonbrener 2003:237).

Both in diagnosis and treatment, medical doctors and specialists need to work together with movement specialists, physiotherapists, occupational therapists, psychologists and music educators. Each of these groups is limited in their ability to treat a musician successfully; however, together they can offer a very effective and well-rounded treatment model (Spahn, Richter, & Altenmüller 2011:25). Lederman (1995:117) found that this multidisciplinary or interdisciplinary approach helped 40% of musicians get rid of their original symptoms and a further 42% had "significantly improved" symptoms after a five-year period.

With a great shortage of health professionals experienced in treating musicians in South Africa (Devroop 2014:51), the need for coordinated and interdisciplinary treatment of musicians is essential. Networks of teachers, medical doctors and specialists, movement awareness and somatic method trainers, physiotherapists, occupational therapists and psychologists need to be established.

2.6.2 Treatment strategies

A holistic diagnosis of PRMDs and their causes should inform treatment strategies that should take into account the age and the professional status of a musician (Ackermann 2010:248). A student, for example, has more schedule flexibility than working professionals, whose ability to play is the source of their income. An older musician may make use of ergonomic modifications rather than changes to the body and the treatment goals of an amateur musician will not be the same as those of a professional (Ackermann 2010:248). The socio-cultural economic environment and circumstances of musicians are also important, especially in South Africa, where resources are often limited, especially for students. It is important to investigate the work environment, so that where necessary possible adjustments can be made (Ackermann 2010:248). In the case of students, the cooperation of the relevant university is needed to improve the work environment and involve the teacher in the treatment process.

The treatment strategies include, but are not limited to: massage, ice and heat therapy, non-steroidal anti-inflammatory medication, cortisone and non-steroidal anti-inflammatory injections, rest or relative rest (reduced playing), changes to diet and lifestyle, exercises (especially exercises based on work with a physiotherapists, body movement specialists, occupational therapists etc.), psychological treatment and in some cases even surgery (Norris 2011:11–12). Distrust of medical doctors and of some specialists' abilities to adequately understand and treat musicians, coupled with some musicians' experiences of inefficiency in treatment, have increased musicians' willingness to turn to alternatives. These alternatives (which include practices such as the Alexander and Feldenkrais methods) can be very effective in combination with more traditional Western practices

(Dawson 2008:95–96). Ackerman *et al.* (2011:258) caution against reliance on only alternative treatment options, emphasising the importance of seeing a medical specialist.

People are generally cautioned to avoid long periods of complete mobilisation of a muscle or joint during treatment of a problem, with the exception of structures that are inflamed or have acute symptoms. Joints can stiffen, muscles can weaken or atrophy, and anxiety and depression can increase if complete rest is imposed for too long. These adverse effects are especially true for musicians, who often use muscle groups for the playing of the instrument that are not used in everyday life and who are therefore more affected by the possible effects of complete rest than the general population might be (Winspur & Warrington 2010:233). Norris (2011:46) argues that immobilising a joint completely (such as in de Quervain's tenosynovitis) can aggravate the symptoms and cause stiffness. Schaefer and Speier (2012:321) suggest that where possible, moderate playing should be continued, provided that the technique or posture responsible for the problems is altered. Reasonable maintenance of playing is important for retaining playing technique and strength as well as alleviating anxiety and depression (Schaefer & Speier 2012:321). This part of the treatment process highlights the importance of the interaction between the student, teacher and movement and/or medical specialist.

Once the problem has been treated and the symptoms have gone, musicians need to find a way to return to normal playing. Problems will recur if the causal factors are not addressed, or if musicians do not allow enough time for rehabilitation (Norris 2011:9). Strengthening and flexibility exercises given by physiotherapists (Dawson 2008:109) and consultation of Alexander, Feldenkrais and body mapping specialists are all useful and effective methods of returning to playing and preventing further injury, while facilitating further healing (Dawson 2008:100–101). Exercises and manual therapy can be used with or without the instrument to increase range of motion (ROM). Motor skills, strength and endurance can be increased with specific exercises. Especially with neurological problems, sensory re-training may be necessary (Dawson 2008:111–112). Returning to playing the instrument at the level the musician is accustomed to should be done gradually. There are several models for a return to playing, which are based on increasing the duration of practice by small increments each day (usually about 3–5 minutes a day) over several weeks (Norris 2011:64–65; Winspur & Warrington 2010:234).

2.6.3 Availability of health professionals in South Africa

According to the website of the South African Society of Teachers who Teach Alexander Technique <SASTAT 2014>, there are 32 listed Alexander technique teachers in the country. It is not clear how many Feldenkrais teachers are working in South Africa; however, according to a

website offering Feldenkrais lessons <Beautifulmind 2014>, there are only two. There is currently only one Andover educator focusing on the body mapping approach who is practising in South Africa. Yoga, tai chi and Pilates are offered widely across the country and physiotherapist, occupational therapists, psychologists, medical practitioners and other health professionals are also available to musicians. It is equally unclear how many of these professionals are experienced and specialised in working with and treating musicians. Especially in a third world country such as South Africa, where resources and expertise are not always as freely available as elsewhere, more emphasis needs to be given to creating networks between professionals who are experienced in working with the musician and health professionals who are experienced in treating their medical conditions.

2.7 Conclusions

Musicians are most commonly affected by upper extremity PRMDs, which show a direct correlation to playing their instruments. While most conditions are well understood, there are contradictory opinions on the extent to which PRMDs specifically affect musicians as a result of playing an instrument. Other conditions, such as overuse syndrome and focal dystonia, are less understood and more research into these conditions is needed in future.

Though PRMDs are caused by a combination of factors, some seem to be mentioned more consistently in literature. Gender and instrument types appear to be the most consistently indicated risk factors for developing a PRMD. However, healthy practice habits, changes in technique and posture as well as regular exercise are seen as the most important factors in preventing PRMDs, though there is not a great deal of evidence-based research output to support this.

Prevention and treatment of PRMDs require an integrated and well-coordinated programme. In South Africa these approaches are often difficult to achieve as there is a lack of professionals experienced in working with musicians. However, there are international prevention, education and treatment models that could guide and benefit the South African performing arts community as a whole.

Chapter Three

Questionnaire-based survey: methodology, findings and discussion

3.1 Methodology and procedure

The study aimed to determine the prevalence of playing-related musculoskeletal disorders (PRMDs) in Western classical keyboard, string and woodwind students registered at the South African College of Music (SACM), University of Cape Town (UCT) making use of a quantitative, cross-sectional descriptive design, based on the epidemiological approach. Data were collected using a self-report measure through the use of a 10–15 minute long questionnaire.

For optimal response rates, the questionnaire was not completed electronically (email or internet server) but administered by the researcher in person to create a more controlled environment and ensure a higher response rate. The response rate for the current study was 98.6%. Studies that used electronic servers achieved very low response rates (below 30%).[31] Zaza (1998:36) recommends a response rate of at least 60% for result to be credible. In addition to this, students who have already encountered a problem are more likely to respond to an email asking them to complete an electronic questionnaire than those who have not experienced a problem (non-response bias).

Seventy-two (72) respondents were approached during their weekly studio class in the first two weeks of the academic year (17 February to 2 March 2015). At the beginning of each studio class students were given a basic introduction to the researcher and an overview of the study. Students who wished to participate were invited to stay behind for 10 to 15 minutes at the end of their studio class and were then given the informed consent form to sign and return prior to receiving the questionnaire. Respondents were given sufficient time to complete the questionnaire. The researcher remained present until all questionnaires were returned. In one studio class the study was done at the beginning of the class. Students in this class were informed that they were not obliged to participate and were permitted to return unanswered questionnaires and consent forms.

Several students could not be reached during a studio class. These included students in the woodwind class who had other lectures during the scheduled woodwind studio class, and cello and bass students, who do not have a studio class. These respondents were approached individually and asked if they wished to participate. The procedure then followed as described above.

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[31] Hagglund 1996; Kreutz, Ginsborg and Williamon 2008; Kok *et al.* 2013; Kok, Nelissen and Huisstede 2015.

3.2 Questionnaire

3.2.1 Development

The questionnaire began construction after a thorough investigation of existing questionnaires from other studies. The following questionnaires were reviewed: the Standardised Nordic Questionnaire (Kuorinka *et al.* 1987); questionnaires used by Zaza (1994) and adapted by Hohls (Hohls 2010); questionnaires designed by Ackermann and Driscoll (2010); a questionnaire by Ingle (2013) under the supervision of Ackermann and a brief questionnaire by Spahn *et al.* (2002). Many other studies were also reviewed.[32]

Following the review of existing questionnaires it was decided that the questionnaire being developed for the current study would not include questions regarding practice or exercise habits. Most questionnaires in the literature ask for the number of hours practising and doing non-music related physical exercise daily or weekly. The decision to omit these questions on these two topics was made for three reasons:

1. As mentioned in Chapter One, it is not possible to establish a reliable causal relationship between rate of PRMDs and the current number of hours practising the instrument or doing physical exercise in a day or week;
2. The number of hours practised or exercised has not been shown to have a statistically significant effect on the prevalence of PRMDs. Research is becoming more focused on specific practice and exercise habits;
3. Even for obtaining a purely descriptive statistic, asking students about how much they practice daily or weekly is problematic. As discussed in Chapter Two, students' practice habits change on a daily basis because of busy schedules and other academic demands. Likewise, physical exercise is often more sporadic than regular and is difficult to quantify. The type of physical exercise done is also important. Some physical activities can be more harmful than helpful (Norris 2011:39; Paull & Harrison 1997:134–136). Additionally, students may tend to indicate how much they "should" practise and exercise daily instead how much they realistically do.

To investigate these elements reliably a very detailed questionnaire is needed, dedicating an entire study to the impact of practising musical instruments or physical exercise on musicians. Omission of these issues does not affect the questionnaire as the focus was on describing the occurrence of PRMDs in the student population.

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[32] Fry 1987; Fishbein *et al.* 1988; Roach, Martinez and Anderson 1994; Zaza and Farewell 1997; Ackermann and Adams 2004; Van der Walt 2006; Kreutz, Ginsborg and Williamon 2008; Barton *et al.* 2008; Guptill and Golem 2008; Brandfonbrener 2009; Allsop and Ackland 2010; Ackermann, Kenny and Fortune 2011; Ajidahun and Phillips 2013; L. Kok *et al.* 2013.

After the initial construction of the questionnaire was completed, Bridget Rennie-Salonen, an experienced musician, teacher and body-mapping specialist, was consulted to comment on the questionnaire, which led to further development of the questionnaire.

A pilot study was conducted to test the research instrument, gaining feedback from a selection of students at the University of Cape Town who were not eligible for the study. Twelve students were asked to comment on the questionnaire, point out any ambiguities and uncertainties, and criticise any short-comings or omissions. Many completed the questionnaire without query, but some respondents indicated that the question on the duration of PRMDs did not cater for recurring problems. Students did not view each recurrence of the same problem as a separate event, but rather as a part of a larger problem persisting over time. A question enquiring about the characteristics of the PRMD during the indicated duration was added. Other small changes of wording were made to eradicate ambiguities based on feedback from the pilot.

The questionnaire was discussed with Matthias Bertsch, head of research in the Department for Music and Medicine at the University of Music and Performing Arts in Vienna, which led to changing the originally open-ended question on prevention strategies into a closed question on body movement and awareness methods.

3.2.2 Structure

The questionnaire, consisting of four sections, is a fifty-item questionnaire that contains no opened-ended questions, except where respondents were asked to specify when ticking the box "Other". The four sections A to D covered the following areas: personal and study profile, overview of PRMDs, specific details of PRMDs, and consultation and treatment approaches.

Section A looked at the overall demographics of the students as well as their detailed study profile. Students were asked for their age, gender and handedness. They were asked what their main instrument is, how long they had played this instrument, if they played any additional instrument and, if so, which additional instrument they played. The respondents were asked what programme, stream,[33] year and instrument level they were currently registered for at the university.

Section B gives an overview of "playing-related problems".

The term "playing-related musculoskeletal disorder" is a complex term that could be overwhelming and deter respondents. Therefore, for the purposes of the study the term "*playing-related problems"*

[33] The stream refers to the classification of the degrees and diplomas at the University of Cape Town <HUMUCT 2015>.

was used instead. The term "disorder" has many negative connotations attached to it and students may find it difficult to understand. It was therefore replaced with a more neutral term "problem".

A definition of "playing-related problems" was given at the beginning of the section. This definition is a modified version of the definition developed by Zaza (1994) and Zaza *et al.* (1998). The definition was shortened and certain words were replaced with more colloquial language in order to ensure maximum comprehension and reduce any chance of deterring students. The definition was changed as follows:

Original

> Pain, weakness, lack of control, numbness, tingling, or other symptoms that arise from playing, and that interfere with your ability to play your instrument at the level you are accustomed to. (Zaza, Charles & Muszynski 1998:2016)
>
> Pain or any other symptoms that are caused by an accident or other non-playing related events are not considered to be a playing-related disorder. (Zaza 1994)

Modified

> Pain, weakness, lack of control, numbness, tingling, or other symptoms that come from playing, and that interfere with playing your instrument *at the level you are used to.*
>
> NB: Pain or any other symptoms that are caused by an accident or other non-playing related events are NOT considered to be a playing-related problem.

Participants were asked for point prevalence ("Are you currently suffering from a playing-related problem?"), prevalence within the past twelve months ("Have you experienced a playing-related problem at any time in the past 12 months?") and lifetime prevalence ("Have you at any time in your life experienced a playing-related problem?"). Following these questions, respondents had to indicate approximately the number of different playing-related problems they had experienced in their lives.

The last question in this section asked for information regarding different movement awareness and somatic methods. The most common techniques that are available in South Africa were listed: Alexander technique, Feldenkrais technique, body mapping, biofeedback, yoga, tai-chi/qi gong and Pilates. Respondents were asked how well they knew each technique ranging from "Never heard of it" to "Make regular use of it". Respondents who had not experienced a problem reached the end of the questionnaire at this point.

Section C asked the students to give further details of the three most recent problems they experienced. Limiting respondents to recent problems was done to reduce recall and measurement bias, as respondents are likely to remember recent incidences of PRMDs more accurately. Respondents were asked for the location, time, duration, severity and frequency of their PRMDs.

The time of the PRMD (whether it is current, occurred in the past twelve months or within the lifetime of the respondents) is used to gauge two important factors. First, it helps identify how recently the problem occurred. Outliers that occur because of memory bias can be more easily identified. Secondly, the question helps to work out the most common duration interval. Current PRMDs needed to be omitted from the calculation because these problems are still on-going.

The quality of that duration was also assessed. Respondents were asked whether the problem "Occurred consistently", "Fluctuated between better and worse but never went away completely" or "Went away completely but returned periodically (recurring)" each time they played their instrument during the duration of the problem they had indicated.

A severity scale was created using similar scales as those developed by Hoppmann (2010:211) and Fry (1987:40). Respondents were given a five-point Likert to rate the severity of the PRMD. The numbers are accompanied by descriptions of the effects the PRMD has on the practice session and time between practice sessions. These descriptions were included in order to reduce measurement bias. People have varying perceptions of what constitutes a severe problem. The descriptions offer systematic parameters in which respondents can position their perception and experience of the problem. Respondents were asked how frequently they suffer from the playing-related problem on a five-point Likert-type scale ranging from 1 ("Once") to 5 ("Constantly").

The duration, quality of the duration, severity and frequency help the researcher to understand to what extent the PRMD interferes with the students' ability to play their instrument at the level they are used to, while distinguishing between milder and more severe PRMDs. For the location each body part is given a letter name and participants were asked to write down the letter name and the body part from the list provided (see Addendum A in Appendix B).[34] They were then asked, where applicable, to add the side of the body it occurred on (left, right or both). A similar system for the identification of the location was used in a questionnaire designed by Ingle and Ackermann (2013).

Section D looks at the treatment history of respondents. This section aims to get a broad overview of how PRMDs are treated in South Africa. This overview could give rise to further research questions and highlight any obvious trends. Students were asked if they had consulted any health professionals and, if so, which types of health professionals they had consulted using a list

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[34] In order to ensure maximum clarity of the location of the body parts, accessible diagrams are used in a similar manner to diagrams used in the Nordic Standardised Questionnaire (NSQ) (Kuorinka *et al.* 1987:235). As the diagram in the NSQ is too general and impractical to rework, labelled diagrams of the body and head were created and modified by the researcher from web sources (<Szymczuk 2014>;<The Human Body 2014>; <Discover-How-to-Draw 2016>) and cross-referenced with more complex diagrams from medical literature (Van De Graaff 2002). The accompanying wording is taken from the Nordic Standardised Questionnaire (Kuorinka *et al.* 1987:235).

provided. This list contains the most common types of health professionals used for treatment of problems cited in literature, as well as some other health professionals that are commonly available in South Africa. They were asked which treatment strategies they had made use of and then to rate the extent to which these treatment strategies had been effective. The list of treatment strategies was drawn from the literature. The question on the effectiveness of treatment strategies is used to assess how satisfied students are with the treatment strategies available to them, rather than gauging the effectiveness of individual treatment strategies. The lists of health professionals and treatment strategies contain an "Other" option which asked respondents to specify.

3.3 Data capturing and analysis

Data were captured by the researcher using Excel (2010), and SPSS (Version 22) was used for statistical analysis by Ushma Galal at the University of Cape Town Statistics Consulting Unit. During the first stage of analysis frequency tables were generated for each question on the questionnaire. A second stage followed when, after reviewing the initial results, the researcher[35] gave further instructions for more in-depth analysis to the statistician regarding comparisons between variables and the performance of statistical tests to confirm any trends in the data. Chi-square tests and Fisher's[36] exact test were used for categorical data, while the t-tests and the Mann-Whitney U-tests were used for continuous data. A *p*-value of less than 0.05 is considered statistically significant.

The statistics are reported and discussed simultaneously in this chapter, placing the findings of the current study in the South African and international context. The international studies that are compared to the current study all investigated the student population.

3.4 Response rates

Of the seventy-two (72) questionnaires handed out, 71 were returned.[37] Of the 71 returned questionnaires, one was removed from the sample because the respondent's main instrument was "voice" (see the inclusion criteria in Chapter One). Three other questionnaires were excluded from the sample for the following reasons:

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[35] The researcher passed a first-year mathematics course (MAM1000W) at UCT and has a good grasp of statistical principles. Working with a statistician strengthened the objectivity of the analysis.

[36] For all cells in the cross-tabulation tables of categorical variables (see Appendix D) with an expected cell count that is less than 5 the value for the Fisher's exact test was used. The expected cell count is calculated by multiplying the sum of the corresponding row of the cell by the sum of the corresponding column of the cell and dividing the product by the total *n*.

[37] To the researcher's knowledge only one student of the targeted population did not participate. The student, who had to leave early to attend another lecture, requested a questionnaire to fill in later, but did not return it.

- The questionnaire was not completed;
- Less than 90% of the total questions were answered correctly;
- There was a general tendency of the respondent not to follow the instructions correctly, putting into question the legitimacy of his/her results for the questionnaire as a whole.

A tally of appropriate responses was done for each question in the questionnaire (including the three excluded questionnaires). Percentages of how many students answered each question without any irregularities ranged from 77.4% to 100%, indicating that on the whole most students understood the questions. In single cases where instructions were not followed, possible reasons could be (a) inevitable language barriers because of the eleven official languages used in South Africa, despite English being the official language of UCT and the language adopted for the questionnaire; (b) misinterpretation of some questions by a few individuals; and (c) time pressure because of having to rush to the next class despite being given the opportunity to complete the questionnaire later.[38]

On the whole the response rate for the study (98.6%) and the individual questions was very satisfactory and any irregularities would not have had a significant effect on the results.

3.5 Overview of descriptive statistics

3.5.1 Personal profile

An analysis of the personal profiles (Table 3.1) indicated that the mean and median age of the respondents was 20 years (SD = 1, n = 67). There were no outliers and respondents' ages ranged from 18 to 23 years. Twenty-five (25, 37.3%) of the 67 respondents were male and 42 (62.7%) were female. Seven (7, 10.4%) respondents of the total (67) were left-handed and 59 (88.1%) were right-handed. One respondent ticked both the left and right handed boxes and a separate category "Both" was created.[39]

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[38] Eight respondents had left section D of the questionnaire incomplete, strengthening the speculation that some students might have been rushing through it.

[39] It has been shown that mixed-handedness (ambidextrousness) is incredibly rare (around 1%) (Rodriguez *et al.* 2010:e342). Those who were truly mixed-handed were not limited in the questionnaire to ticking only one box but were free (though not instructed) to tick both and were therefore accommodated.

Table 3.1: Demographic overview of the respondents

Subjects	67
Age, *years*	
Mean (SD)	20 (1)
Range	18–23
Gender	
Male	37.30%
Female	62.70%
Handedness	
Left	10.40%
Right	88.10%
Both	1.50%
Main instrument	
Strings	34.30%
Woodwind	25.40%
Keyboard	40.30%
Number of years playing main instrument	
Mean (SD)	10.8 (3.1)
Range	0.5–17
Other instruments played	
Yes	67.20%
No	32.80%

The mean age of students in the current study is slightly lower than in other studies. Most studies conducted with students had age averages between 21 to 25 years.[40] The studies that were closest in age were those of Barton *et al.* (2008:74), Ioannou and Altenmüller (2015:136) and the South African study by Ajidahun and Phillips (2013:97) (though the age group in this last study ranged from 10 to 52). The reason for this fairly low mean age is because the present study was limited to undergraduate students, while other studies included postgraduate students.

A similar distribution of gender was reported in various studies.[41] Of the South African studies done, Van der Walt (2006:18) had 58% females and 42% male respondents, Ajidahun and Phillips (2013:97) 80% females and 20% male respondents, and Hohls (2010:47) 32% females and 68% male respondents.

An online study done on seven ethnic groups showed that left-handedness was prevalent in about 7% to 11% of the population (Peters, Reimers & Manning 2006:62). The percentage of left-handed

[40] Zaza 1992; Roach, Martinez and Anderson 1994; Hagglund 1996; Zetterberg *et al.* 1998; Miller, Peck and Watson 2002; Spahn, Richter and Zschocke 2002; Kreutz, Ginsborg and Williamon 2008; Kenny, Cormack and Martin 2009; Ackermann, Kenny and Fortune 2011; Kok *et al.* 2013; Árnason, Árnason and Briem 2014.

[41] Hagglund 1996; Miller, Peck and Watson 2002; Spahn, Richter and Zschocke 2002; Kreutz, Ginsborg and Williamon 2008; Kenny, Cormack and Martin 2009.

respondents in the current study lies within this range and is almost exactly the same as in the study by Hohls (2010:115), which found that 10.1% of the respondents were left-handed.

The mean value for the number of year that respondents had been playing their instrument is shown in Table 3.1. One respondent did not answer the question for no apparent reason, making the total 66 for this question. Another respondent gave an interval for the number of years (s)he had been playing the instrument. A middle value of this interval was taken. One respondent gave a very low value (0.5 years) indicating that (s)he had recently changed instruments (this was a different but similarly-played string instrument). When treated as an outlier, there is no significant change to the mean of the numbers of years playing an instrument or to the standard deviation (SD), which changes from 10.8 (SD 3.1) to 11 (SD 2.9). Therefore, this value was kept in the data set.

Various studies examined the relationship between the number of years students have been playing an instrument and the prevalence of a PRMD. The mean number of years found in the current study (10.8 years) correlates with that of two studies done abroad (Zaza, 1992; Árnason *et al.* 2014).

The main instruments played by respondents can be divided into the following groups: strings (violin, viola and cello), woodwinds (flute, oboe, clarinet, saxophone and recorder) and keyboard (piano). This traditional grouping of instruments is used because the instruments in these groups make use of similar playing techniques. There are 23 string players (34.3%), 17 woodwind players (25.4%) and 27 (40.3%) keyboard players. Figure 3.1 shows that the most prevalent instruments are piano (40.3%), violin (26.9%) and flute (14.9%).

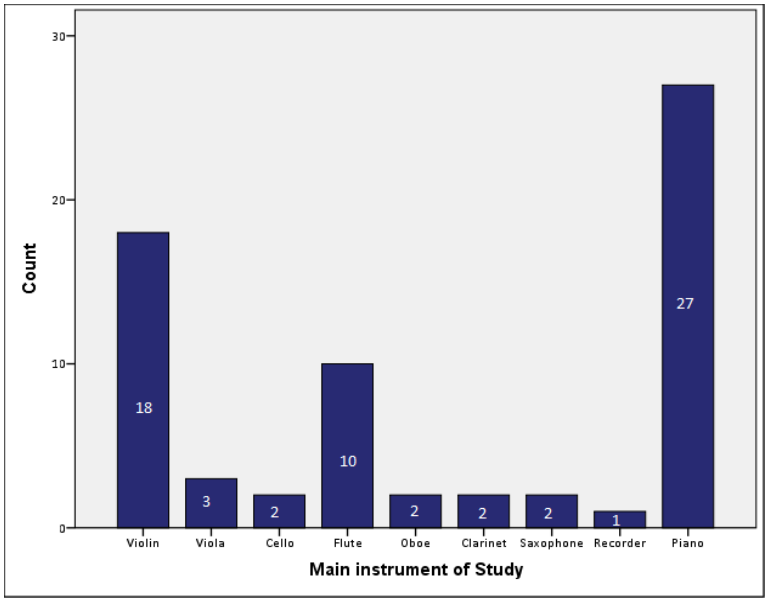

Figure 3.1: Distribution of main instrument

Two thirds (67.2%) of the total respondents (n = 67) indicated that they were currently playing another instrument. Table 3.2 shows which instruments respondents played. The most commonly played additional instrument is the piano (46.7 %) followed by the violin (13.3%). Respondents were playing up to three additional instruments, some of which were outside the traditional classical spectrum, such as African instruments or bass guitar. The reason that so many students play the piano as an additional instrument is that most students in their first and second year, whose main instrument is not piano, are required according to the curricula to take the subject "secondary piano". This course is aimed at giving students a basic proficiency on the piano.

Table 3.2: "Other instruments" distribution of respondents

	Count	Column N %
Violin	6	13.3%
Cello	3	6.7%
Double bass	1	2.2%
Clarinet	3	6.7%
Saxophone	4	8.9%
Recorder	3	6.7%
Piano	21	46.7%
Organ	1	2.2%
Harpsichord	1	2.2%
Guitar	3	6.7%
Bass guitar	4	8.9%
Voice	8	17.8%
Percussion	2	4.4%
African instruments	1	2.2%

3.5.2 Study profile

Sixty-two (62) or 92.5% of the total respondents (n = 67) were registered for a "Degree", while five (7.5%) were registered for a "Diploma".[42] Figure 3.2 shows that the majority of the total respondents (n = 67) were registered for the "Performance" stream (43.3%) followed by the "General" stream (32.8%). The remaining streams "Education (9%), "Composition" (7.5%), "Bachelor of arts" (BA) and "Other" (3%) made up a total of 23.9%.

Two respondents ticked two boxes for the university stream. One was a first-year who ticked boxes for the "General" and "Performance" streams. In the first year all students are required to officially register for the "General" stream, although they intend to pursue "Performance". In the first few weeks of the year the first-years are often unsure as to how the curriculum works. The stream for "Performance" was chosen, as most of the other first-years had indicated they were doing "Performance" rather than "General". The university stream often shows how important practising and performing the main instrument are in comparison to other university subjects. First-years

[42] A performance degree differs from a performance diploma in two essential ways: (1) it is a year longer than the diploma (degree four years, diploma three); (2) more music theoretical and historically based subjects are included in the curriculum. The practical requirements are very similar.

pursuing “Performance” may place more emphasis on their main instrument than first-years who intend to do a “General” degree. Therefore this distinction is important.

The other participant who ticked two boxes for the university stream indicated that, while studying composition, s/he was also registered for a performance-level instrument (A instead of the required B level). This is permitted at UCT if a student meets performance-level criteria, as some students choose to study their instrument at the highest possible level. The instrument level is accounted for in a later question; therefore, the ticked box for “Composition” was taken as the answer and the box ticked for “Other” was excluded.

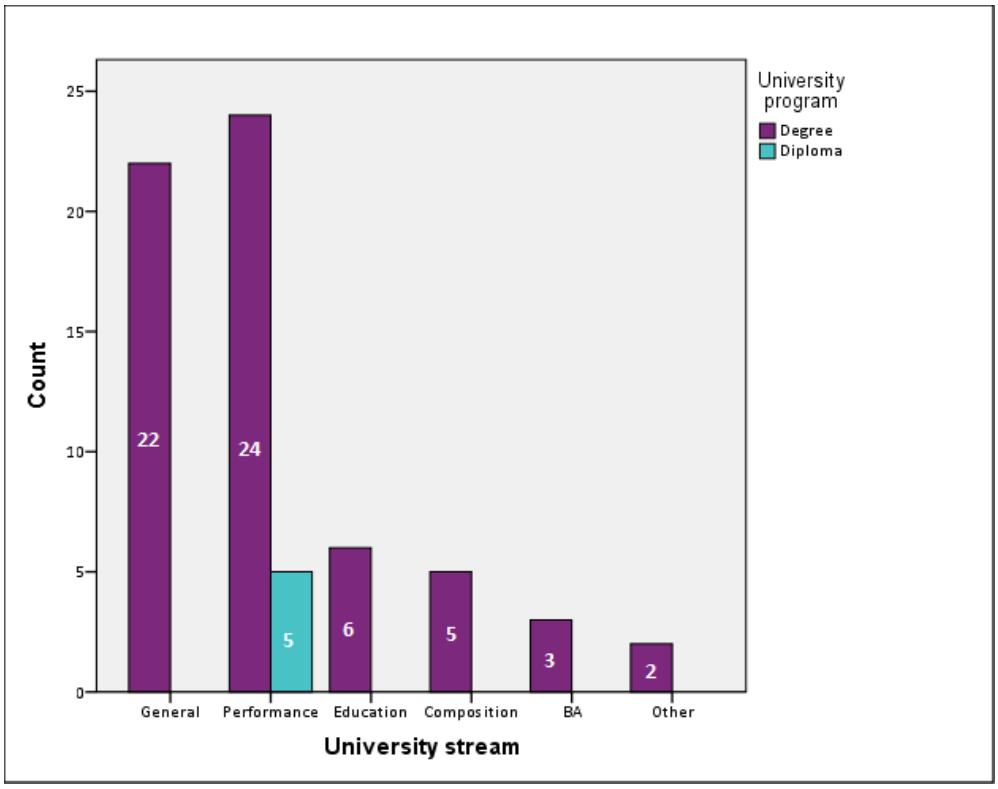

Figure 3.2: Distribution of registration for university programme and streams

The distribution of the total respondents (n = 67) across the years (first, second, third, fourth and extended programme) is shown in Table 3.3. The number of respondents in the first, second and third year is quite even (first = 29.9%, second = 26.9% and third = 26.9%). The fourth year (13.4%) and extended programme (3%) are smaller groups. Students make curriculum changes, fall back or potentially drop out as they move through their studies, resulting in a considerably smaller fourth-year class than a first-year class.

Table 3.3: Distribution of the year of study

Year	Frequency (n)	%
1st year	20	29.9
2nd year	18	26.9
3rd year	18	26.9
4th year	9	13.4
Programme extended	2	3.0

The distribution of instrument levels of all the respondents (n = 67) is shown in Table 3.4. The group B1 (32.8%) is the largest, as all first-years must register for this instrument level. There are more students registered for B1 than registered for the first year, because any of the other years can register for this instrument level as well. There are an even number of respondents registered for B2 and A2 (13.4%) and considerably more registered for A3 (17.9%) than B3 (10.4%). The smallest groups are B4 (7.5%) and A4 (4.5 %).

Table 3.4: Distribution of instrument levels

Instrument level	Frequency	% of n
B1	22	32.8
B2	9	13.4
B3	7	10.4
B4	5	7.5
A2	9	13.4
A3	12	17.9
A4	3	4.5

3.6 Overview of playing-related musculoskeletal problems

The number of the total respondents (n = 67) who were suffering from a PRMD at the time that the study was conducted is shown in Figure 3.3. Nearly half the respondents (46.3%) answered yes to the question: "Are you currently suffering from a playing-related problem?"

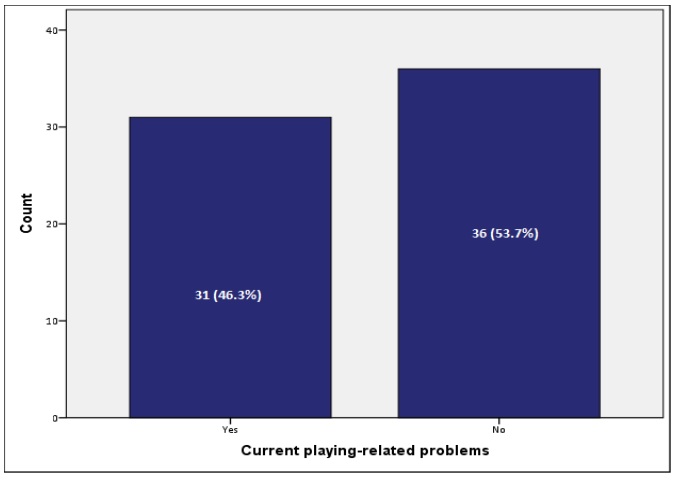

Figure 3.3: Point (current) prevalence of PRMDs

It is necessary to compare this finding with studies that have used the same definition as the current study. Kenny *et al.* (2009:28) found that 44% of the students had a current PRMD, while Árnason *et al.* (2014:76) found results ranging from 34.3% to 66.6%. Kok *et al.* (2015:165) and Kreutz (2008:6), though not using the same definition as the current study, found respectively that 47% and 53.3% of respondents had a current problem. The South African studies done on the student populations by Ajidahun and Phillips (2013:97) and Van der Walt (2006:19) found a lower point prevalence (23.5% and 33% respectively). Hohls (2010:82) found a point prevalence of 63%, but the current study was done on orchestral string players, a slightly different target group, which could account for the difference. Several other studies found a point prevalence of around 62% to 67% (Barton & Feinberg 2008; Kok *et al.* 2013; Roach, Martinez & Anderson 1994). Results for point prevalence in studies vary considerably, but this is to be expected. The time of year, activities at the university at the time of the study and other stressors could all influence the results.

It is surprising that the point prevalence is so high at the start of the academic year. Manchester and Flieder (1991:13) refer to what is called the "back-to-school" phenomenon. Students returning from a holiday suddenly increase their practice time, a factor that is believed to increase the risk of getting a PRMD (Spahn 2011:53). Manchester and Flieder (1991:13) found that the highest number of playing-related problems recorded in their clinic was at the beginning of the school year.

As shown in Figure 3.4, 82.1% of the respondents answered yes to the question: "Have you experienced a playing-related problem at any time in the past 12 months?" Two students ticked the box "No" for this question, although they had indicated "Yes" to the question whether they were currently suffering from a PRMD. It is not entirely clear why this was the case. It is most likely a misunderstanding on the part of the respondents. The students did not understand that having a current problem would automatically mean they had also been affected in the past 12 months. The answers were corrected from "No" to "Yes" for this question.

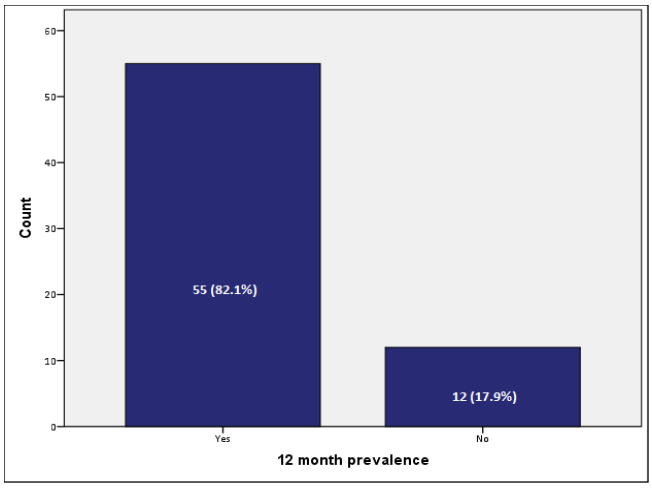

Figure 3.4: 12-month prevalence of PRMDs

Studies looking at 12-month prevalence found that 77.8% (Hohls 2010:84) and 80.7% (Kok, Nelissen & Huisstede 2015:165) were affected by PRMDs, while others found higher rates of 89% (Zetterberg *et al.* 1998:161) and 89.2% (Kok *et al.* 2013:3). The prevalence found in the current study for the preceding 12 months was within these ranges. Though Hohls (2010:8) used the same definition as the current study, the age group is different and the reporting of the 12-month prevalence was not very clear, making comparison difficult.

The lifetime prevalence ("Have you at any time in your life experienced a playing-related problem?") shown in Figure 3.5 was 88.1% of the total (n = 67). Eight (8) respondents (11.9%) answered "No" to all three questions, indicating that they had never suffered from a playing-related problem. One student answered "Yes" to the question on current and 12-month prevalence, but "No" to lifetime prevalence. A misunderstanding of the question is the only logical conclusion for this error and the answer was similarly corrected from "No" to "Yes" as one done in the previous question.

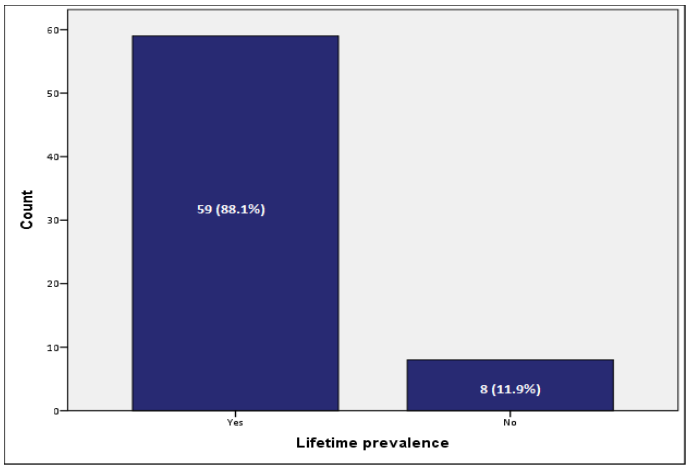

Figure 3.5: Lifetime prevalence of PRMDs

The lifetime prevalence found in other studies varies greatly from 33% (Kenny, Cormack & Martin 2009:27) all the way up to 100% (Van der Walt 2006:18). One of the big problems here was the outcomes definition used and the limitations of this definition. Kenny *et al.* (2009:27) restricted the lifetime prevalence to a "diagnosis by a medical practitioner", while Van der Walt used the very broad term "physical problems" (Van der Walt 2006:19). Various studies found a similar lifetime prevalence (88.1%) to the one in the current study.[43] Other studies found PRMD and injury rates ranging from 61% to 68% (Hagglund 1996; Larsson *et al.* 1993; Spahn, Richter & Zschocke 2002; Árnason, Árnason & Briem 2014). The South African studies found equally varying results. Ajidahun and Phillips (2013:97) found a lifetime prevalence of 82.4%, while Van der Walt (2006:19) found a prevalence of 100% for all physical problems and 26% for injuries. Hohls (2010:98) found that 70.8% of orchestral string players had experienced a playing-related injury at some point in their life. Of the studies that had similar results, two studies used the same definition (Ackermann & Adams 2004:627; Brusky 2009:8) and one used a similar concept ("Have you ever experienced any physical playing-related problems during or after playing your instrument?") (Guptill, Zaza & Paul 2000:87).

The approximate number of different playing-related musculoskeletal disorders (PRMDs) that respondents indicated they had experienced is shown in Figure 3.6. Most respondents (50%) indicated that they had had two PRMDs. The other three groups are fairly even. Nineteen percent (19%) indicated they had had one problem, 13.8% indicated they had had three problems and 17.2% had had more than three problems.

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[43] Pratt, Jessop and Niemann 1992; Guptill, Zaza, and Paul 2000; Ackermann and Adams 2004; Brusky 2009; Ioannou and Altenmuller 2015.

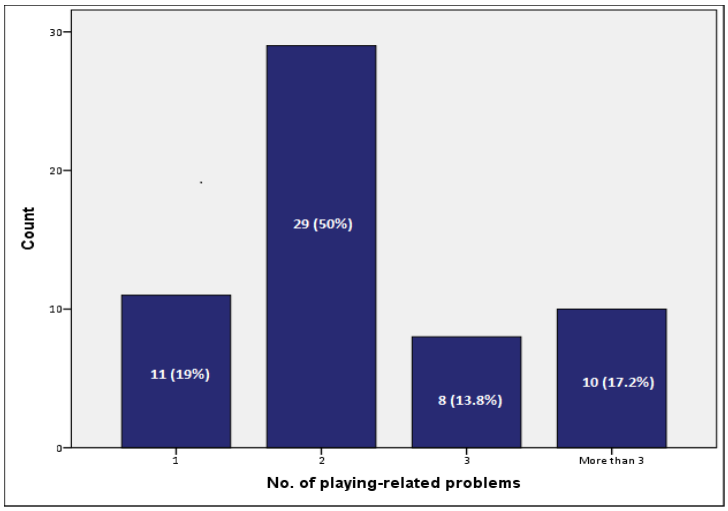

Figure 3.6: Approximate number of different PRMDs per respondent

Hohls (2010:82) found that in the preceding 12 months musicians in his study had a rate of 6.53 PRMDs per musician. This result is considerably higher than that in the current study, where the majority of musicians indicated that they had had two PRMDs in their lifetime. There was a considerable number of respondents who did indicate that they had had more than three PRMDs in their life, so one cannot be certain what the rate of PRMDs per musician is for the current study.

3.7 Significance tests between descriptive statistics and PRMDs

3.7.1 Age, gender and handedness

An independent samples Mann-Whitney U-test (p <0.05) was done and found no statistically significant relationship between age and prevalence of PRMDs (see Age in Appendix D). The small range of ages in the current study could account for the lack of significance of age in relation to the prevalence of PRMDs; however, other studies examining similar age groups also found no relationship (Roach, Martinez & Anderson 1994; Zaza & Farewell 1997; Spahn, Richter & Zschocke 2002).

Thirsty-six percent (36%) of the males and 52.4% of the females were affected by current PRMDs. In order to determine if there was a statistical association between gender and current problems, Pearson Chi-Square test was used. Though proportionately more females than males were affected, no statistical significance could be determined $\chi^2(1, n = 67) = 1.692$, $p = 0.193$. In the preceding 12 months 72% of the male and 88.1% of female respondents had been affected by a PRMD. Fisher's Exact Test showed no significant relationship ($p = 0.112$). Eighty percent (80%) of the male and 88.1% of the female respondents were affected by a PRMD at some point in their life. Fisher's Exact Test showed no significant relationship ($p = 0.138$) between gender and the lifetime

prevalence of a PRMD. Figures 3.7, 3.8 and 3.9 show the relationship between "Yes" and "No" answers to all three questions on prevalence in relation to gender.

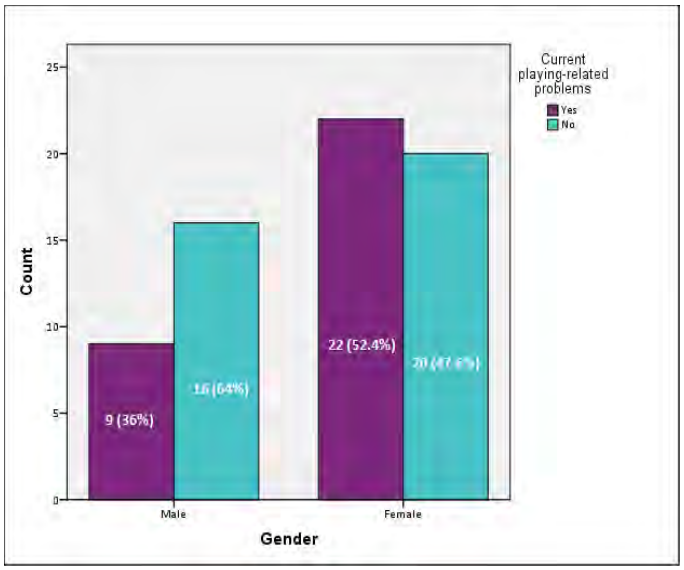

Figure 3.7: Relationship between gender and current prevalence of PRMDs

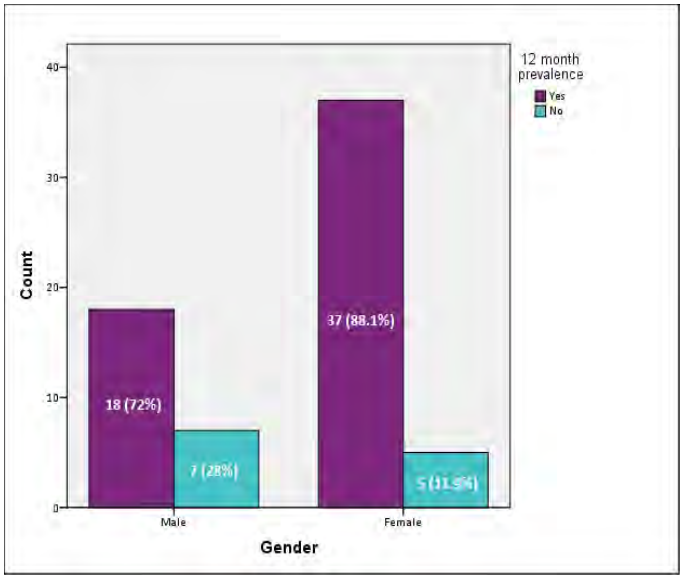

Figure 3.8: Relationship between gender and 12-month prevalence of PRMDs

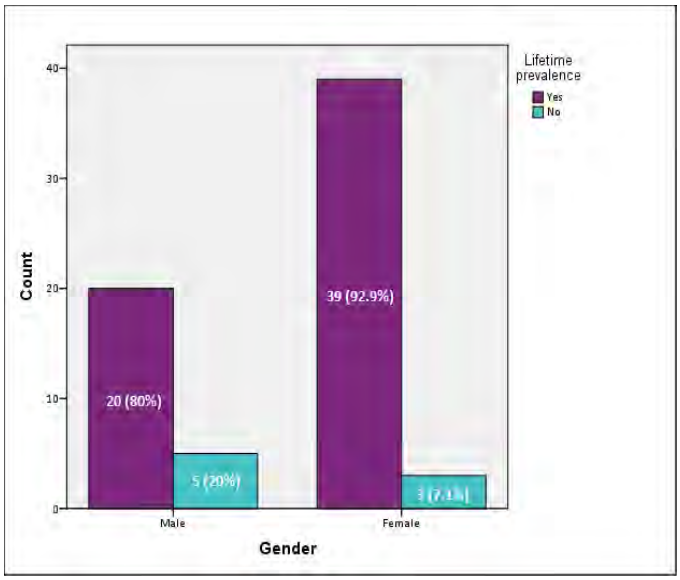

Figure 3.9: Relationship between gender lifetime prevalence of PRMDs

The lack of statistical significance between gender and PRMDs is surprising considering that many studies have shown that there is a relationship (see Chapter Two). Various studies (Guptill, Zaza & Paul 2000; Dawson, Kaneko & Lianza 2005; Brandfonbrener 2009), including some of the South African studies (Van der Walt 2006; Hohls 2010; Ajidahun & Phillips 2013) failed to establish a statistically significant relationship between gender and prevalence of PRMDs. A larger sample would be needed to confirm these results.

Fisher's Exact Test was used and found that there was no significance between handedness and the prevalence of a PRMD (p = 1.00) (see Appendix D). Hohls (2010:115) similarly found no statistically significant relationship between handedness and PRMD prevalence.

3.7.2 Main instrument of study, years of playing instrument and other instruments

The three instrument groups (keyboard, strings and woodwind) were affected by PRMDs in similar proportions and there was no statistical significance between the instrument groups and the prevalence of PRMDs. For current problems, Pearson Chi-Square test was used χ^2 (2, n = 67) = 1.482, p = 0.477. For 12-month (p = 0.919) and lifetime prevalence (p = 0.641) Fisher's Exact Test was used. Though several studies do not find a significant relationship between instrument groups and PRMD prevalence (Dawson, Kaneko & Lianza 2005; Kenny, Cormack & Martin 2009; Ackermann 2010; Árnason, Árnason & Briem 2014), this cannot automatically be regarded as confirmation of the lack of statistical significance in the current study. As mentioned in Chapter Two, many studies have found that string, piano and even woodwind players are at greater risk of developing a PRMD than players in other instrumental groups. As the groups examined in the

current study are keyboard, string and woodwind players, it makes sense that the results in each group are equally high.[44] What stood out, however, was that for current problems, more keyboard and woodwind players indicated they had a PRMD, while more string players indicated they did not have a current PRMD.

Figures 3.10, 3.11 and 3.12 show the changing proportions of the "Yes" and "No" answers on PRMDs in relation to the main instrument group.

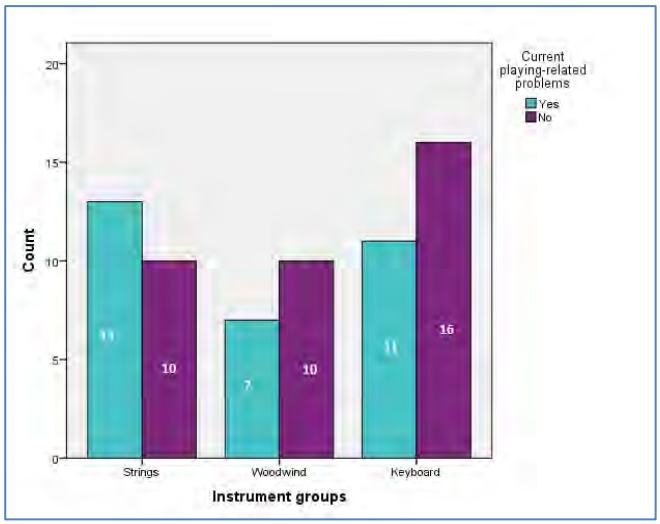

Figure 3.10: Relationship between instrument groups and current prevalence of PRMDs

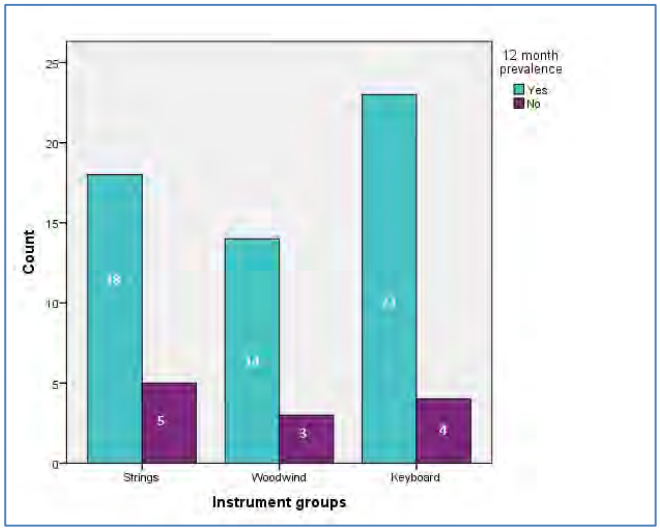

Figure 3.11: Relationship between instrument groups and 12-month prevalence of PRMDs

44 It could be argued that questioning only woodwind, keyboard and string instrumentalists would increase prevalence rate of PRMDs. While brass are reportedly least affected by PRMDs (Fry 1987:36; Fishbein *et al.* 1988:5; Dawson 2002:138), other studies show that large numbers of percussionists (Brandfonbrener 2009:32) and guitarists (Cayea & Manchester 1998:20; Van der Walt 2006:24) are affected and so these groups would likely balance out.

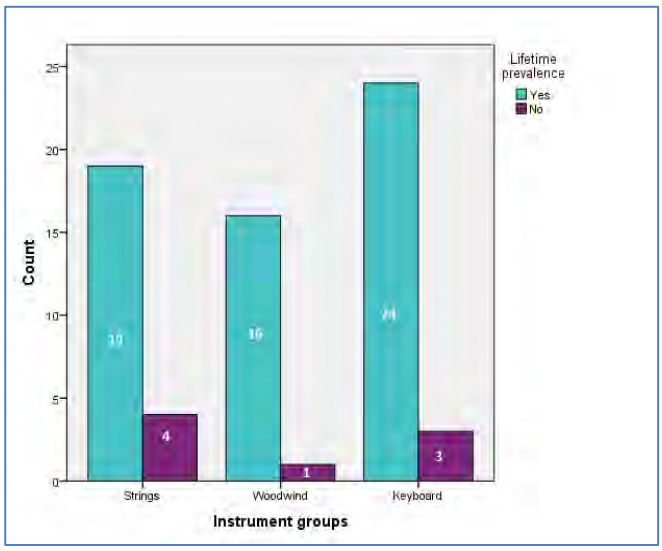

Figure 3.12: Relationship between instrument groups and lifetime prevalence of PRMDs

In order to compare results for the number of years respondents had played an instrument and the prevalence of a PRMD, t-test for equality of means was used. Though the means of the "No" group tended to be slightly lower, no statistically significant relationship could be established between the mean number of years playing the instrument and respondents who had experienced a PRMD (see number of years playing the instrument in Appendix D). As discussed in Chapter Two, there is a great deal of debate on whether and how the number of years playing the instrument affects the prevalence of PRMDs; however, several studies found no statistically significant relationship between the number of years playing an instrument and the prevalence of a PRMD (Dawson, Kaneko & Lianza 2005; Brandfonbrener 2009; Hohls 2010). Figures 3.13, 3.14 and 3.15 show the overlapping boxes in the boxplots, visually representing a lack of significance between number of years playing an instrument and the prevalence of a PRMD.

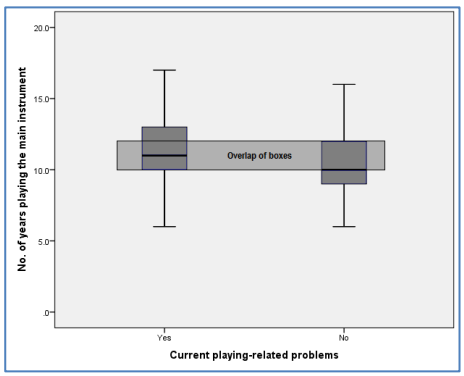

Figure 3.13: Relationship between the number of years playing an instrument and current prevalence of PRMDs

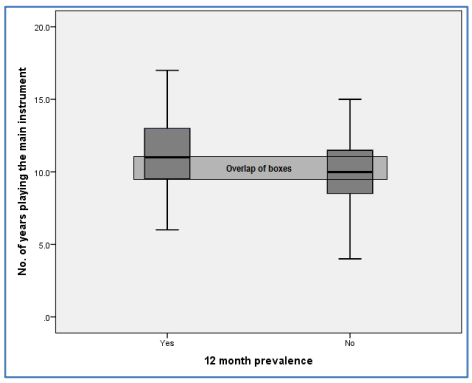

Figure 3.14: Relationship between the number of years playing an instrument and 12-month prevalence of PRMDs

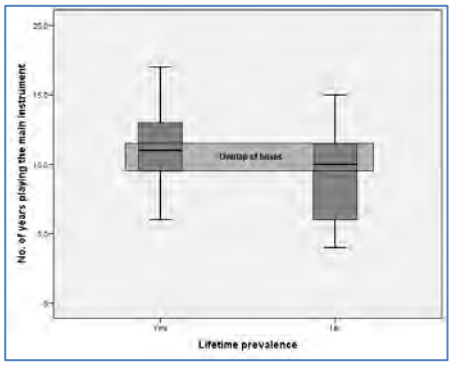

Figure 3.15: Relationship between the number of years playing an instrument and lifetime prevalence of PRMDs

Pearson's Chi-square test was used to determine any significant relationship between playing another instrument and having a current PRMD. No statistical significance could be established $\chi^2(1, n = 67) = 0.378$, $p = 0.538$. Fisher's Exact Test was used for 12-month ($p = 0.187$) and lifetime ($p = 0.103$) prevalence and, likewise, no statistically significant significance was found. It was important to establish a lack of statistical significance in order to rule out the possibility that playing another instrument was not interfering with the results. However, one cannot be certain from the results of the current study that the other instrument played did not contribute to or even cause the PRMD in individual respondents. The amount of time is spent playing the second instrument, the level it is played at, as well as the type of instrument played could affect to what extent a second instrument may contribute towards or even cause a PRMD.

3.7.3 University programme, stream, year and instrument level

Fisher's Exact Test showed no significant relationship between the university programme, stream or year students are registered for and the prevalence of a PRMD (see Table 3.5).

Table 3.5: Relationship between university programme, stream and year, instrument level and PRMDs

	Test	*p*-value
Programme and current prevalence	Fisher's Exact Test	0.174
Programme and 12-month prevalence	Fisher's Exact Test	1.000
Programme and lifetime prevalence	Fisher's Exact Test	0.482
Stream and current prevalence	Fisher's Exact Test	0.096
Stream and 12-month prevalence	Fisher's Exact Test	0.866
Stream and lifetime prevalence	Fisher's Exact Test	0.708
Year and current prevalence	Fisher's Exact Test	0.186
Year and 12-month prevalence	Fisher's Exact Test	0.172
Year and lifetime prevalence	Fisher's Exact Test	0.504
Instrument level and current prevalence	Fisher's Exact Test	0.043*
Instrument level and 12-month prevalence	Fisher's Exact Test	0.264
Instrument level and lifetime prevalence	Fisher's Exact Test	0.517

* $p<0.05$ therefore there is a statistical significance

A significant relationship was found between the instrument level that students are registered for and the prevalence of a current PRMD. Students who were registered for a B3 instrument level were significantly more affected, while students registered for B1 were the least affected (see Table 3.6 and Figure 3.16). Students who take an instrument at level B3 are typically third-year non-performance majors. At the university the third year is traditionally academically demanding. While non-performance majors are focusing on other subjects such as composition or education, they often continue to play an instrument at a very high level and may therefore be subject to greater stress.

Table 3.6: Relationship between instrument level and current PRMDs

			Yes	No	Total
Level of instrument	B1	Count	6	16	22
		% within Level of instrument	27.3%	72.7%	100.0%
	B2	Count	2	7	9
		% within Level of instrument	22.2%	77.8%	100.0%
	B3	Count	6	1	7
		% within Level of instrument	85.7%	14.3%	100.0%
	B4	Count	2	3	5
		% within Level of instrument	40.0%	60.0%	100.0%
	A2	Count	6	3	9
		% within Level of instrument	66.7%	33.3%	100.0%
	A3	Count	7	5	12
		% within Level of instrument	58.3%	41.7%	100.0%
	A4	Count	2	1	3
		% within Level of instrument	66.7%	33.3%	100.0%
Total		Count	31	36	67
		% within Level of instrument	46.3%	53.7%	100.0%

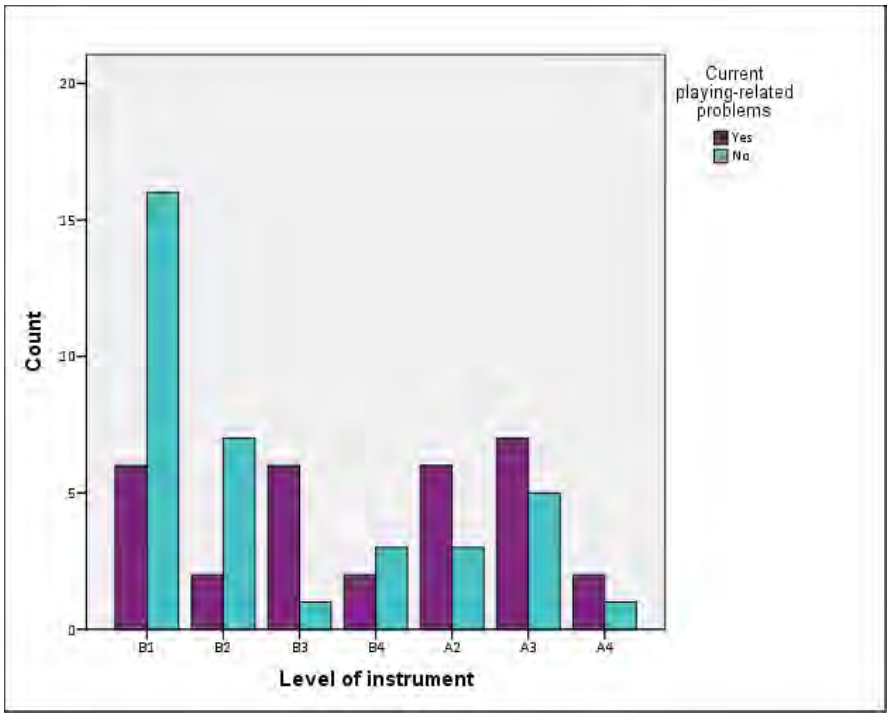

Figure 3.16: Relationship between instrument level and current PRMDs

Some trends can be observed in the data gathered on the university information of students, even though these trends are not statistically significant. All streams, except "General" and "Performance", had too few responses to make any meaningful deductions; however, performance majors reported more current PRMDs than non-performance majors. For 12-month and lifetime prevalence the difference between the numbers affected and not affected in the groups decreases (see Table 3.7). Only five respondents were registered for a diploma, making it impossible to make meaningful deductions about the difference between diploma and degree registered students.

Though not statistically significant, there may be two reasons that performance majors reported more current PRMDs than general majors. Firstly, the level and intensity at which students pursue their instruments may impact on their chance of developing a PRMD. Secondly, the "back-to-school" phenomenon, especially for performance students who are required to play an orchestral audition at beginning of the year (just before the study was conducted), may also account for the sudden increase in PRMDs in this group. Spahn (2011:53) reminds us of the dangers of a sudden increase in practice time right before an exam or audition, and how the psychological stress may contribute further to the development of a physical problem.

Table 3.7: Relationship between performance and general streams and prevalence of PRMDs

			Current problems		
			Yes	No	Total
University stream	General	Count	7	15	22
		% within University stream	31.8%	68.2%	100.0%
	Performance	Count	17	12	29
		% within University stream	58.6%	41.4%	100.0%
			12-month prevalence		
	General	Count	17	5	22
		% within University stream	77.3%	22.7%	100.0%
	Performance	Count	24	5	29
		% within University stream	82.8%	17.2%	100.0%
			Lifetime prevalence		
	General	Count	19	3	22
		% within University stream	86.4%	13.6%	100.0%
	Performance	Count	26	3	29
		% within University stream	89.7%	10.3%	100.0%

Though no statistically significant relationship was found, the higher years were more affected by PRMDs than the lower years, especially for current PRMDs (see Table 3.8, 3.9 and 3.10). Three quarters (75%) of the first-year students were not experiencing a PRMD at the time of the study. The "Programme extended" group was too small to allow any meaningful deductions to be made. While Zetterberg *et al.* (1998:165) found no relationship between the four years of study and PRMDs, Guptill *et al.* (2008:88) found that the highest prevalence was found in sophomores and juniors (equivalent to second- and third-year students), while seniors (fourth-year students) had the lowest prevalence. The study done here also found that third-years were most affected by PRMDs; however, fourth-years were almost equally affected by PRMDs. What is conspicuous is that 100% of the fourth-years indicated that they had had a problem in the past 12 months, indicating that all of them had had a problem during their third year. Once again the academic demands of the third year could be responsible for putting this group at risk.

By contrast, first-year students and B1-level students were less affected by PRMDs than all the other groups in the current study. Approximately 75% of the first-year and B1-level students did not have a current PRMD. Manchester and Flieder (1991:13) found that there were greater number of first- and second-year students in their clinic with playing-related problems than of the later years.

Table 3.8: Relationship between the university year and current PRMDs

			Current problems		
			Yes	No	Total
University year	1st year	Count	5	15	20
		% within University year	25.0%	75.0%	100.0%
	2nd year	Count	9	9	18
		% within University year	50.0%	50.0%	100.0%
	3rd year	Count	11	7	18
		% within University year	61.1%	38.9%	100.0%
	4th year	Count	5	4	9
		% within University year	55.6%	44.4%	100.0%
	Programme extended	Count	1	1	2
		% within University year	50.0%	50.0%	100.0%
Total		Count	31	36	67
		% within University year	46.3%	53.7%	100.0%

Table 3.9: Relationship between the university year and 12-month prevalence of PRMDs

			12-month prevalence		
			Yes	No	Total
University year	1st year	Count	14	6	20
		% within University year	70.0%	30.0%	100.0%
	2nd year	Count	15	3	18
		% within University year	83.3%	16.7%	100.0%
	3rd year	Count	16	2	18
		% within University year	88.9%	11.1%	100.0%
	4th year	Count	9	0	9
		% within University year	100.0%	0.0%	100.0%
	Programme extended	Count	1	1	2
		% within University year	50.0%	50.0%	100.0%
Total		Count	55	12	67
		% within University year	82.1%	17.9%	100.0%

Table 3.10: Relationship between the university year and lifetime prevalence of PRMDs

			Lifetime prevalence		
			Yes	No	Total
University year	1st year	Count	16	4	20
		% within University year	80.0%	20.0%	100.0%
	2nd year	Count	15	3	18
		% within University year	83.3%	16.7%	100.0%
	3rd year	Count	17	1	18
		% within University year	94.4%	5.6%	100.0%
	4th year	Count	9	0	9
		% within University year	100.0%	0.0%	100.0%
	Programme extended	Count	2	0	2
		% within University year	100.0%	0.0%	100.0%
Total		Count	59	8	67
		% within University year	88.1%	11.9%	100.0%

The relationship between the instrument level and 12-month and lifetime prevalence shows that though the groups become more balanced, the instrument levels B3, B4 and A4 report more PRMDs than the lower instrument levels (see Table 3.11and 3.12).

Table 3.11: Relationship between the level of instrument and 12-month prevalence

			12-month prevalence		
			Yes	No	Total
Level of instrument	B1	Count	15	7	22
		% within Level of instrument	68.2%	31.8%	100.0%
	B2	Count	7	2	9
		% within Level of instrument	77.8%	22.2%	100.0%
	B3	Count	7	0	7
		% within Level of instrument	100.0%	0.0%	100.0%
	B4	Count	5	0	5
		% within Level of instrument	100.0%	0.0%	100.0%
	A2	Count	9	0	9
		% within Level of instrument	100.0%	0.0%	100.0%
	A3	Count	9	3	12
		% within Level of instrument	75.0%	25.0%	100.0%
	A4	Count	3	0	3
		% within Level of instrument	100.0%	0.0%	100.0%
Total		Count	55	12	67
		% within Level of instrument	82.1%	17.9%	100.0%

Table 3.12: Relationship between the level of instrument and lifetime prevalence

			Lifetime prevalence		
			Yes	No	Total
Level of instrument	B1	Count	17	5	22
		% within Level of instrument	77.3%	22.7%	100.0%
	B2	Count	7	2	9
		% within Level of instrument	77.8%	22.2%	100.0%
	B3	Count	7	0	7
		% within Level of instrument	100.0%	0.0%	100.0%
	B4	Count	5	0	5
		% within Level of instrument	100.0%	0.0%	100.0%
	A2	Count	9	0	9
		% within Level of instrument	100.0%	0.0%	100.0%
	A3	Count	11	1	12
		% within Level of instrument	91.7%	8.3%	100.0%
	A4	Count	3	0	3
		% within Level of instrument	100.0%	0.0%	100.0%
Total		Count	59	8	67
		% within Level of instrument	88.1%	11.9%	100.0%

3.8 Specific details of the PRMDs

It is necessary to look at the problems that would have affected musicians the most. The location indicates how directly the playing apparatus is affected, while the duration, quality of duration, severity and frequency are all indicators of the extent in which a PRMD affects a musicians' ability to practise and perform.

Participants were asked to report up to three of their most recent PRMDs in separate tables in the questionnaire (Tables 1, 2 and 3 in Appendix B). Three sets of data were generated for each table and later combined to get a profile of the PRMDs experienced by the respondents. One hundred and twenty (120) PRMDs were reported. Eighteen (18) respondents reported three PRMDs, 24 reported

two PRMDs and 59 reported one PRMD. As there were multiple PRMDs reported, the results of the current study show, unless otherwise specified, the distribution of PRMDs and not respondents with regards to location, duration severity and frequency.

3.8.1 Location

The location of PRMDs is reflected in Table 3.13 and Figure 3.17. It must be noted that three respondents indicated combinations of areas as one problem. These were accepted as a single problem because the areas were always adjacent. There are a total of 127 areas indicated by all the respondents with a PRMD. Respondents were asked to indicate (if applicable) which side of the body the problem was on ("Left", "Right" or "Both"). For areas of the body that do not necessarily function separately, such as the back, neck hips, and orafacial structures, the side is not applicable. For simplicity in reporting of results, the omission of an answer for these areas was interpreted as "Both". One person indicated (s)he had had a problem in the shoulder; however, (s)he did not indicate which side it was on or that it was on "Both" sides. This answer was therefore not included in the total. Unlike the back or neck where the side of the body is not necessarily applicable, the left and right shoulders are more separate entities. One cannot assume that the omission means "Both" sides.

The most commonly affected area was the shoulder region. A total of 26 (44%) PRMDs were reported in the shoulder region with 8 on the left, 6 on the right and 12 on both sides. Many of the PRMDs occurred in the back of the neck and back region (neck (back) 25.4%, lower back 23.7% and upper back 20.3%). A fairly large number of problems occurred in the hand or wrist (25.4%) and the fingers (16.9%). The only areas that did not feature were the knee and the ankle. The "Hip" and "Foot" were each indicated once.

Table 3.13: Distribution of the locations of PRMDs

	Side			
	Left	Right	Both	Total
Embouchure/lips	0	0	3	3
Mouth/tongue	0	0	3	3
Jaw/cheek	0	0	7	7
Neck (front)	1	0	2	3
Neck (back)	2	0	13	15
Lower back	0	0	14	14
Middle back	0	2	3	5
Upper back	1	0	11	12
Shoulder	8	6	12	26
Upper arm	1	0	1	2
Elbow	0	0	1	1
Forearm	1	2	1	4
Hand or wrist	4	1	10	15
Fingers	2	3	5	10
Thumb	0	3	2	5
Hip	0	0	1	1
Knee	0	0	0	0
Ankle	0	0	0	0
Foot	0	0	1	1

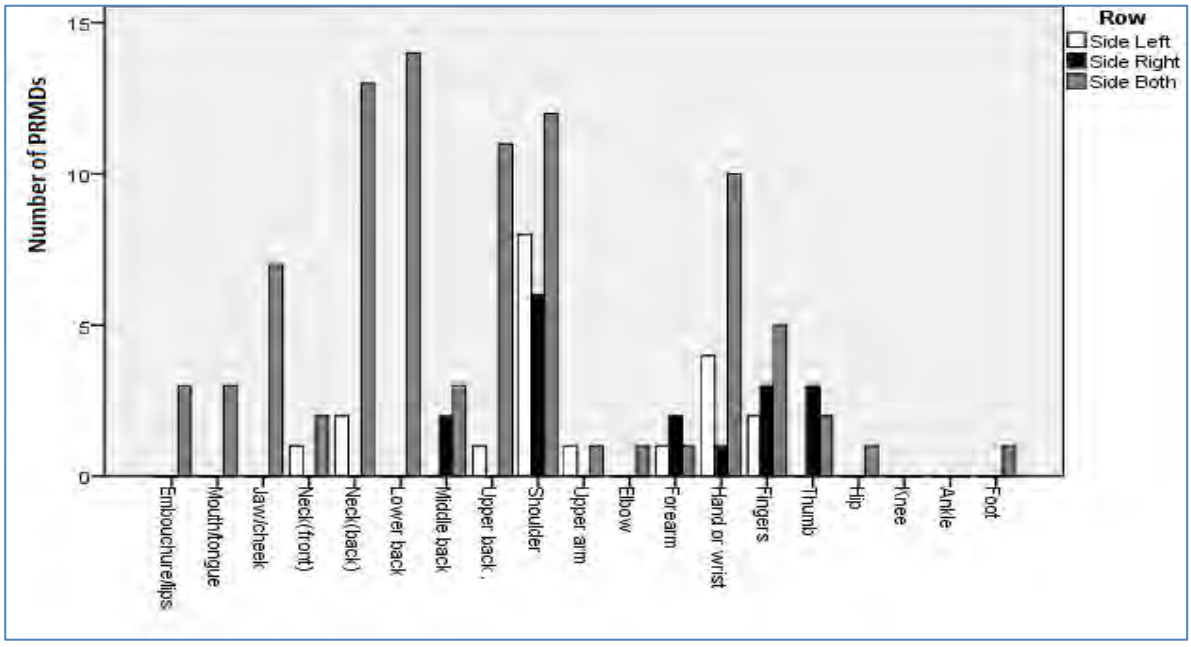

Figure 3.17: Distribution of the locations of PRMDs

Other studies similarly found that the shoulder, neck and back regions were the most affected regions.[45] The current study also found that a large number of respondents had problems in their hands or wrist and fingers. Most of these problems were reported by the pianist. Other studies found a similar percentage (around 25%) of hand, wrist and finger problems (Larsson *et al.* 1993; Hohls 2010).

3.8.2 Time, duration and quality of duration

The point in time that participants had experienced a PRMD (see Table 3.14) is not important on its own, but it is necessary for working out the duration of PRMDs, as was discussed earlier in this chapter; current problems cannot be included in the calculation for the duration of PRMDs as they were still on-going. The only exception was for respondents who had a current problem that had already lasted for more than two years, as this is an open category and therefore requires no finite end.

Table 3.14: Distribution of the point in time that respondents had the PRMD

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I am currently experiencing it	34	28.3	28.6	28.6
	Within the past 12 months	64	53.3	53.8	82.4
	More than 12 months ago	21	17.5	17.6	100.0
	Total	119	99.2	100.0	
Missing	System	1	.8		
Total		120	100.0		

Participants were asked to indicate the duration of each PRMD they had experienced using the listed time intervals. Table 3.15 and Figure 3.18 show which of these duration intervals were most prevalent in the responses. The majority of PRMDs had lasted for less than one week (35.3%). This was followed by the interval of one week to one month (23.5 %) and "More than 2 years" (19.6%). The least number of PRMDs occurred in the interval of one to two years (2.9%).

Table 3.15: Distribution of the duration intervals of PRMDs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 week	36	30.0	35.3	35.3
	1 week–1 month	24	20.0	23.5	58.8
	1–3 months	10	8.3	9.8	68.6
	3–12 months	9	7.5	8.8	77.5
	1 – 2 years	3	2.5	2.9	80.4
	More than 2 years	20	16.7	19.6	100.0
	Total	102	85.0	100.0	
Missing	System	18	15.0		
Total		120	100.0		

[45] Roach, Martinez and Anderson 1994; Zetterberg *et al.* 1998; Van der Walt 2006; Hohls 2010; Kok *et al.* 2013.

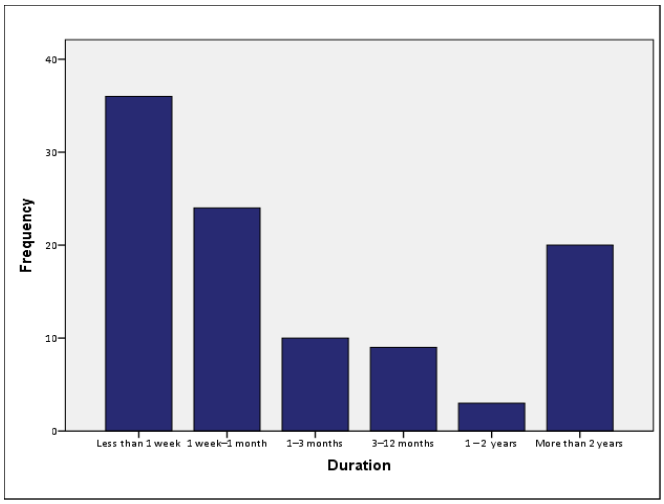

Figure 3.18: Distribution of the duration intervals of PRMDs

The question on the quality of the duration was included in order to gauge how consistently the problem was present during the indicated duration. This differs from the question on severity, which inquires about the quality of the symptoms experienced, and also differs from the question on frequency, which aims to discover how frequently the problem reoccurred.

The majority of PRMDs (48.7%) were problems that "Fluctuated between better and worse but never went away completely" (see Table 3.16). This was followed by problems that "Went away completely, but returned periodically", which made up 37.4% of the responses. Sixteen (16) PRMDs (13.9%) occurred consistently throughout the indicated duration.

Table 3.16: Distribution of the quality of the duration

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Occurred consistently	16	13.3	13.9	13.9
	Fluctuated between better and worse but never went away completely	56	46.7	48.7	62.6
	Went away completely but returned periodically	43	35.8	37.4	100.0
	Total	115	95.8	100.0	
Missing	System	5	4.2		
Total		120	100.0		

The combination of the duration and the quality of duration shown in Table 3.17 allows us to see how disruptive the problem was for the musicians' ability to play their instrument. The respondents with current problems were once again omitted. Twenty (20) of the reported PRMDs (the largest group) lasted for "Less than 1 week" and in this time "Went away completely but returned periodically". These PRMDs are considered to cause the least disruption to playing. The highest degree of disruption would be "More than 2 years" and "Occurred consistently". This was the case for 7 reported PRMDs. Of the PRMDs that lasted for more than two years, 16.4% were consistently present or did not go away completely during this time. It is not possible to accurately grade the

disruptiveness of the other categories; however, the highlighted section on Table 3.17 shows the combination of duration and quality of duration that is considered to have a significant impact on a students' ability to play their instrument.

Table 3.17: Relationship between the duration and the quality of duration

			Quality			
			Occurred consistently	Fluctuated between better and worse but never went away completely	Went away completely but returned periodically	Total
Duration	Less than 1 week	Count	3	9	20	32
		% within Duration	9.4%	28.1%	62.5%	100.0%
	1 week–1 month	Count	3	13	8	24
		% within Duration	12.5%	54.2%	33.3%	100.0%
	1–3 months	Count	2	5	3	10
		% within Duration	20.0%	50.0%	30.0%	100.0%
	3–12 months	Count	1	7	1	9
		% within Duration	11.1%	77.8%	11.1%	100.0%
	1 – 2 years	Count	0	2	1	3
		% within Duration	0.0%	66.7%	33.3%	100.0%
	More than 2 years	Count	7	9	3	19
		% within Duration	36.8%	47.4%	15.8%	100.0%
Total		Count	16	45	36	97
		% within Duration	16.5%	46.4%	37.1%	100.0%

An alarming number of students suffered from problems for more than two years. Within this duration 7 PRMDs had occurred consistently, while 9 had "Fluctuated between better and worse but never went away completely", meaning 16.4% of the PRMDs had lasted for over two years and did not go away in this time.

Several studies showed longer durations for PRMDs (more than two years) (Fry 1987; Zetterberg *et al.* 1998; Kenny, Cormack & Martin 2009). However, the current study found that the majority (66.8%) of reported PRMDs lasted for less than three months. Similar findings were recorded in other studies (Hagglund 1996; Van der Walt 2006); however, many studies reported that the majority of problems lasted more than three months (Fry 1987; Ackermann, Kenny & Fortune 2011; Árnason, Árnason & Briem 2014). Ioannou and Altenmüller (2015:136) looked at how frequently pain occurred during practice. They found that 12.6% had pain "Every time they play", a result very similar to the 13.9% of PRMDs in the current study that occurred "Consistently" each time the instrument was played.

3.8.3 Severity and frequency

The severity of all the PRMDs is shown in Table 3.18, while Figure 3.19 shows the severity of each of the three tables filled out in the questionnaire. The majority of PRMDs were less severe problems. Over a third (35.8%) of the reported PRMDs, were rated on a scale of 1 to 5 as: "1 - only occurs temporarily while/after playing, without having to shorten the playing session" (see

Appendix B). The next largest group (23.3%) was the group of reported PRMDs that were rated as a 4 out of 5 ("Requires the playing session to be shortened, but does not totally stop between playing"). Two (2) respondents indicated that the PRMD had "Prevented playing". The first two categories on the severity are grouped together as they do not infringe upon the musicians' playing-time. From the 3 out of 5 onwards, the playing session needs to be shortened, noticeably impacting on the musicians' ability to play their instrument at a level they are used to. Nearly half (46.3%) of the reported PRMDs were in a category of 3 or higher for the severity scale.

Table 3.18: Distribution of the severity of the PRMDs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1. Only occurs temporarily while/after playing, without having to shorten the playing session	43	35.8	35.8	35.8
	2. Starts while playing, lasting for only a short period after playing, without having to shorten the playing session	21	17.5	17.5	53.3
	3. Requires the playing session to be shortened, but stops shortly after playing	26	21.7	21.7	75.0
	4. Requires the playing session to be shortened, but does not totally stop between playing	28	23.3	23.3	98.3
	5. Prevents playing	2	1.7	1.7	100.0
	Total	120	100.0	100.0	

As each respondent could only give one answer per table for severity in the questionnaire, Figure 3.19 is therefore able to show how many respondents had at least one PRMD of various severities. We see that 37.3% of respondents had at least one PRMD that had a severity of 1 out of 5. Likewise we can see that 27.9% of respondents had at least one PRMD that was rated 4 out of 5. Nearly half the respondents (47.4%) had at least one PRMD that was of a severity of 3 or higher.

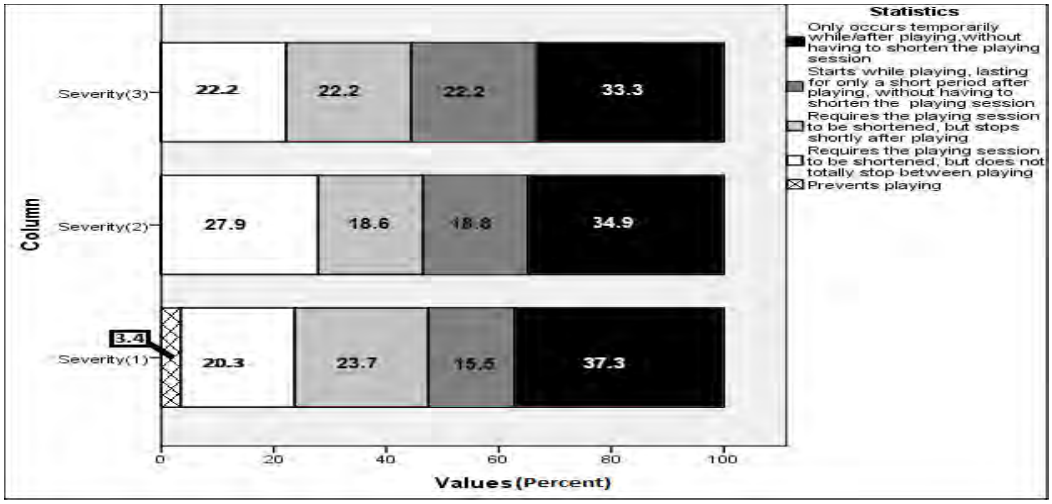

Figure 3.19: Distribution of the severity of the PRMDs for each table in the questionnaire

The most common categories for frequency were “Seldom” and “Often”, with 40.8% and 31.7% respectively. Seven point five percent (7.5%) of the PRMDs occurred constantly, while 5% had only been experienced once. Fifteen percent (15%) of PRMDs occurred “Very often”. It is once again necessary to look at how many PRMDs occurred “Often–Constantly” as is it an indicator of how severely the problem impacts on the musicians. More than half (54%) of the reported PRMDs occurred “Often” “Very often” or “Constantly” (see Table 2.19).

Table 3.19: Distribution of the frequency of PRMDs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once	6	5.0	5.0	5.0
	Seldom	49	40.8	40.8	45.8
	Often	38	31.7	31.7	77.5
	Very often	18	15.0	15.0	92.5
	Constantly	9	7.5	7.5	100.0
	Total	120	100.0	100.0	

The number of respondents who had at least one PRMD of a certain frequency is shown in Figure 3.20. We are able to see that 55.8% of the respondents had at least one PRMD that was a 3 (“Often”) or higher (“Very often” or “Constantly”).

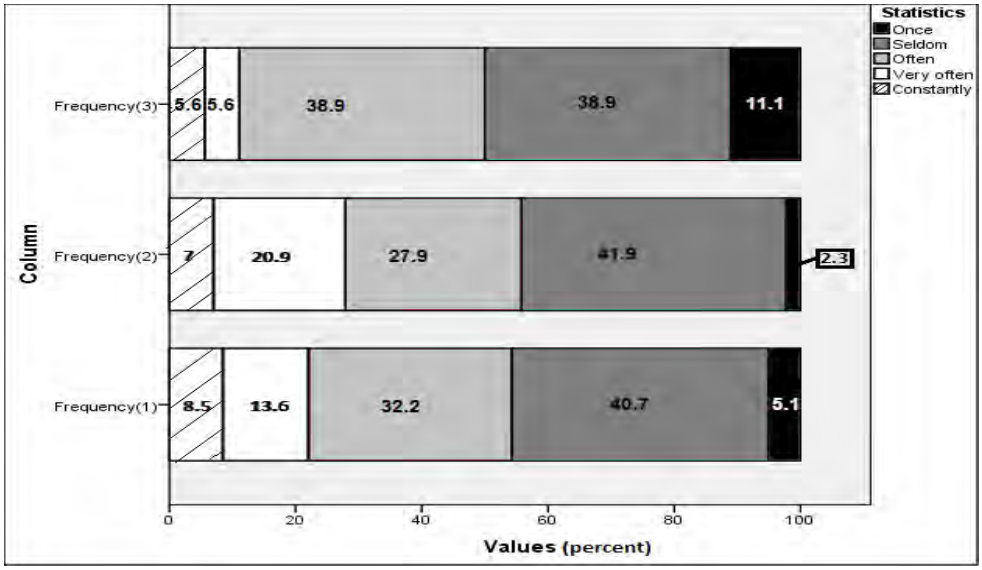

Figure 3.20: Distribution of frequency for each table filled out in the questionnaire

The values from the frequency and severity were cross-tabulated (Table 3.20) to get a better understanding of how musicians’ lives are affected by PRMDs. One discovers how regularly a PRMD of that severity occurs. The largest group of responses (22.5%) had a severity of 1 out of 5 (“Only occurs temporarily while/after playing, without having to shorten the playing session”,)

which occurred “Seldom”; however, 41 of the reported PRMDs (34.2%) fall in the 3 or higher category for frequency and severity.

Table 3.20: Relationship between the severity and the frequency of PRMDs

			Frequency					
			Once	Seldom	Often	Very often	Constantly	Total
Severity	Only occurs temporarily while/after playing, without having to shorten the playing session	Count	6	27	6	2	2	43
		% within Severity	14.0%	62.8%	14.0%	4.7%	4.7%	100.0%
	Starts while playing, lasting for only a short period after playing, without having to shorten the playing session	Count	0	7	9	3	2	21
		% within Severity	0.0%	33.3%	42.9%	14.3%	9.5%	100.0%
	Requires the playing session to be shortened, but stops shortly after playing	Count	0	9	13	3	1	26
		% within Severity	0.0%	34.6%	50.0%	11.5%	3.8%	100.0%
	Requires the playing session to be shortened, but does not totally stop between playing	Count	0	6	9	10	3	28
		% within Severity	0.0%	21.4%	32.1%	35.7%	10.7%	100.0%
	Prevents playing	Count	0	0	1	0	1	2
		% within Severity	0.0%	0.0%	50.0%	0.0%	50.0%	100.0%
Total		Count	6	49	38	18	9	120
		% within Severity	5.0%	40.8%	31.7%	15.0%	7.5%	100.0%

Although the majority of PRMDs (58.3%) recorded in the current study were mild, it is difficult to find direct comparisons to other studies as studies use different measures for severity. Despite this, comparable results were found in studies that looked at the severity of problems (Fry 1987; Hohls 2010). Studies that excluded mild complaints found a prevalence of 39% to 47% (Pratt, Jessop & Niemann 1992; Zaza & Farewell 1997; Zetterberg *et al.* 1998). Comparably, in the current study 46.3% of recorded PRMDs and 47.5% of respondents recorded a severity that noticeably interfered with the musicians’ ability to play or perform. Additionally, one third of the PRMDs fell into the category of 3 or higher for both the frequency and severity of problems – an alarming result, as these are not only problems severe enough to interfere with the playing time of the instrument but also occur “Often”, “Very often” or “Constantly”.

3.9 Prevention, consultation and treatment

Only 65 of the 67 respondents answered the question on movement awareness and somatic methods correctly. For unknown reasons, two respondents only ticked boxes for the prevention techniques they had heard of while leaving the rest blank. The students may have misunderstood the instruction or they may have purposefully omitted their answer, embarrassed by their lack of knowledge.

How well acquainted respondents are with various movement awareness and somatic methods is shown in Figure 3.20. The least known approach was the Feldenkrais technique, where 86.2% of

the respondents indicated that they had “Never heard of it”. Only one respondent indicated “Know it fairly well” and no respondents indicated that they made regular use of it or had tried it. Biofeedback showed a slightly clearer result with 83.1% of the respondents indicating that they had “Never heard of it”. Once again only one respondent indicated “Know it fairly well”, while none indicated “Have tried it” or “Make regular use of it”. In comparison the Alexander technique did better. Only 20% of respondents had never heard of it, while the majority (38.5%) had “Tried it”. Four point six percent (4.6%) of respondents said that they made “Regular use of it”.

The most commonly used techniques were yoga and Pilates. For each of these practices 9.2% of the respondents indicated that they “Make regular use of it”.

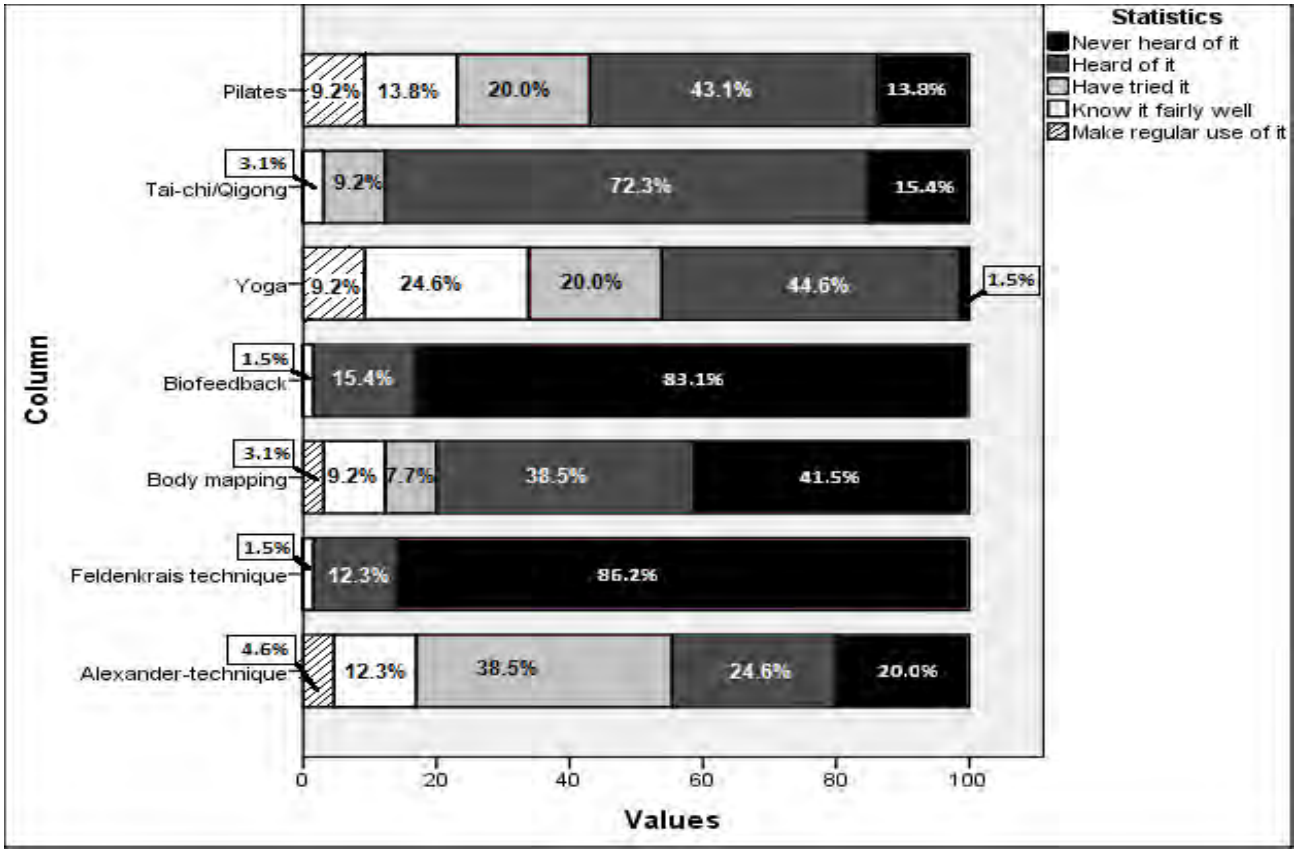

Figure 3.21: Relationship between the responses given for movement awareness and somatic methods

The sum of the answers from Figure 3.21, in other words indicating how familiar respondents are with all the methods, is shown in Table 3.21, while Figure 3.22 shows the percentage of respondents who indicated a category for at least one of the prevention strategies. From the graph one can see that 21.5% of respondents were making regular use of at least one of the movement awareness and somatic methods, while 92.3% of the respondents had not heard of one or more of the methods.

Table 3.21: Sum of the responses on all playing techniques

		Count	Column N %
All techniques	Never heard of it	170	37.4%
	Heard of it	163	35.8%
	Have tried it	62	13.6%
	Know it fairly well	43	9.5%
	Make regular use of it	17	3.7%
	Total	455	100.0%

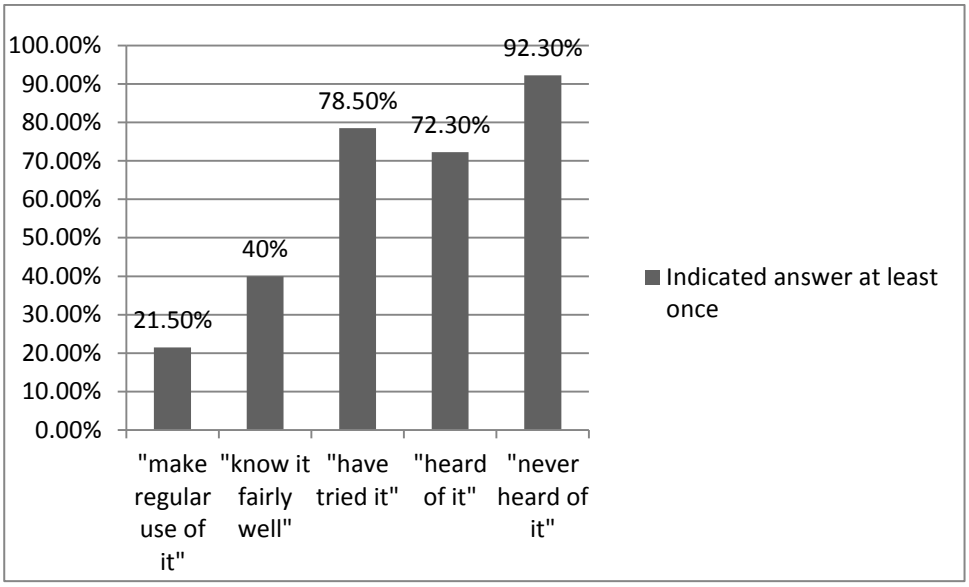

Figure 3.22: Percentage of students who indicated a category at least once

Various studies have looked at what students do to help prevent PRMDs. What is interesting in the current study is that one can gauge how well acquainted students are with the various techniques rather than just asking whether students are making use of them. The majority of respondents had "Never heard of" or just "Heard of" but not used the methods. The methods that were most frequently used or tried (Alexander technique, body mapping, yoga and Pilates) were generally available to the students. There are several Alexander teachers in the area as well as teachers interested in the technique at the SACM, UCT. There is a body mapping specialist teaching flute at the university and yoga and Pilates classes are available at various private studios as well as nearly all of the larger gyms and fitness studios. The fact that so few students (only 5.2% of the responses) make use of these techniques regularly is of concern as body awareness and sustaining a healthy body lay an important foundation for playing an instrument "pain free".

Zaza (1992:48) found that the Alexander technique (7%) and yoga (10%) were the most commonly used techniques. In contrast to the results of the current study, however, she found that 4% and 5% of respondents made use of the Feldenkrais method and tai-chi respectively (Zaza 1992:48). Barnes

et al. (2011:42) found that 40% of the Free State Symphony Orchestra members were aware of the Alexander technique as a means of preventing problems; however, only 11.1% of the musicians made use of it. It is not clear to what extent the FSSO musicians made use of the Alexander technique. It is difficult to distinguish when someone is actually making regular use of a movement awareness and somatic method rather than making use of it sporadically. For this reason, the present study distinguished between knowing a method "Fairly well" and making "Regular use of it". The musicians in the Barnes *et al.* study indicated that they applied the Alexander technique during their playing. While it is still not clear to what extent the technique is integrated into their playing, it could be positioned somewhere between the categories "Know it fairly well" and "Make regular use of it" used for the current study. Viewed from this perspective the results of Barnes *et al.* are comparable to the results found in the current study.

Both Spahn *et al.* (2002:24) and Van der Walt (2006:43) found that 35% of students were making use of so-called relaxation or body-orientation techniques.[46] It is once again unclear to what extent these techniques were used, but when positioned between the two categories "Know it fairly well" and "Make regular use of it" the results found in the studies of Spahn *et al.* and Van der Walt are comparable to results found in the current study.

Fifty-nine (59) respondents were eligible to answer the questions in section D. Fifty-eight (58) responded to the question on whether or not they have consulted a health professional. Just over half the respondents (51.7%) answered "Yes" to the question, while 48.3% answered "No" (see Table 3.22). Three respondents did not answer any of the questions in section D. One questionnaire was excluded from the sample using the criteria outlined earlier in this chapter. Another respondent indicated that (s)he had consulted a health professional and began writing an answer in the follow-up question before scratching it out along with the "Yes" answer from the previous question. (S)he did not tick the box that indicated (s)he had not consulted a health professional. It can be assumed that the respondent has not consulted a health professional and the answer was adjusted accordingly. The remaining respondent did not complete any of the questions in section D. The number of respondents for this question is therefore 58.

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[46] These terms are often used synonymously for movement awareness and somatic methods.

Table 3.22: Consultation of a health professional

		Frequency	Percent	Valid Percent
Valid	Yes	30	44.8	51.7
	No	28	41.8	48.3
	Total	58	86.6	100.0
Missing	System	9	13.4	
Total		67	100.0	

Other studies found that about 42% to 45% of students had consulted healthcare professionals (Zetterberg *et al.* 1998; Guptill, Zaza & Paul 2000; Spahn, Richter & Zschocke 2002). More recent studies show higher levels of health care consultation. Kok *et al.* (2015:167) found that 53.8% of respondent with current problems and 63.3% of respondents with chronic problems sought healthcare. Ioannou and Altenmüller (2015:137) found that as many as 64.8% of students at the Prague conservatoire sought healthcare. It is possible that the willingness of students to seek health advice increased over time, suggesting that the results of the current study are behind international trends. However, this is only conjecture and more research is needed to confirm this assumption.

The health professionals consulted are shown in Figure 3.23. Respondents were allowed to give multiple answers. The most commonly consulted health professionals are physiotherapists (36.7%) and Alexander technique teachers (36.7%), followed by chiropractors (30%) and body mapping specialists (8.6%). Three (3) respondents (10%) had consulted a general practitioner and 4 respondents had consulted a specialist (13.1%). Four (4) respondents had sought non-Western healing practices, which included Callenetics, Eastern medicine, Ayurverda and acupuncture. Another respondent listed a Pilates instructor. Two (2) respondents had changed their diet and one had consulted a biokineticist.

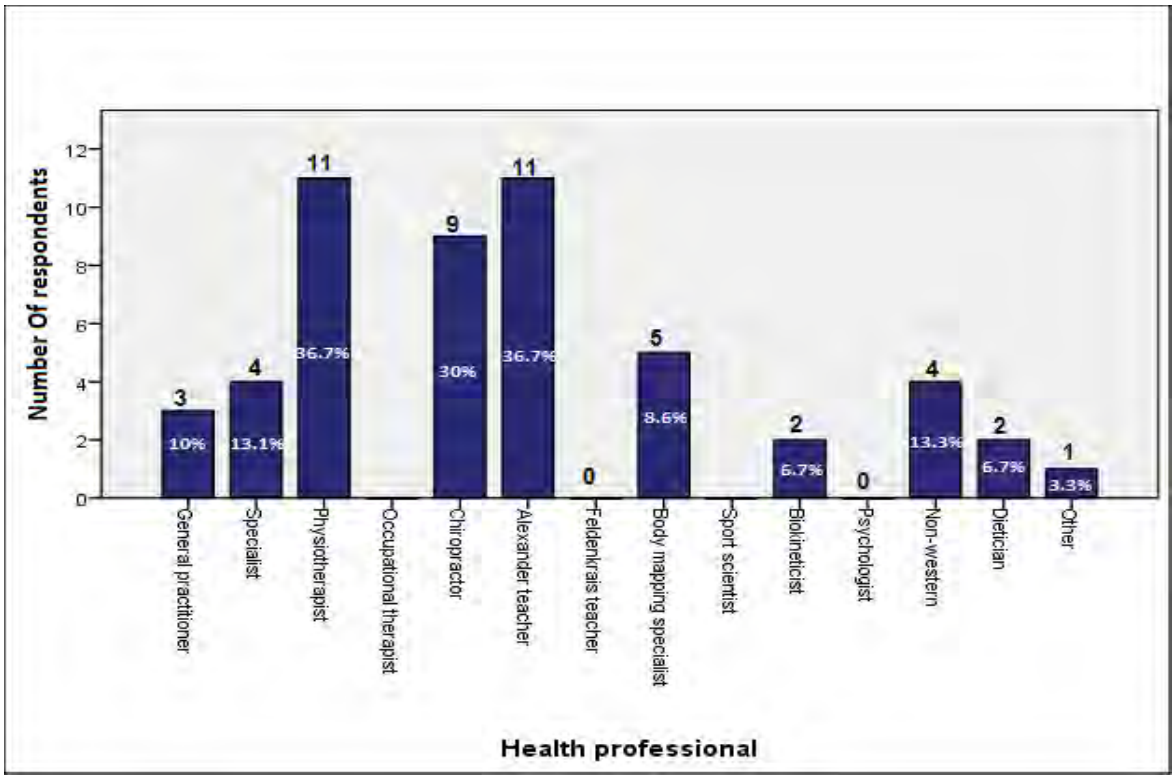

Figure 3.23: The distribution of health professionals consulted

In accordance with the findings of the current study, various studies found that physiotherapists (Hagglund 1996; Van der Walt 2006; Hohls 2010; Kok, Nelissen & Huisstede 2015) and Alexander technique teachers (Hagglund 1996; Ackermann, Kenny & Fortune 2011) were the most frequently consulted health professionals.

The results of the current study need to be compared to the results of the South African studies done in the five to nine years (Hohls 2010; Barnes *et al.* 2011; Van der Walt 2006) prior to the current study. Though Barnes *et al.* did not ask how many respondents consulted a health care professional, they indicated that 44.7% did not treat their symptoms in any way (2011:42). The majority of the respondents (55.3%) did something to alleviate their symptoms, but it cannot be assumed that all these respondents consulted a health professional. The researchers indicated that 49% of the injured musicians had sought physiotherapy treatment (Barnes *et al.* 2011:42). Only Hohls (2010:101) specifically investigated how many musicians consulted a health professional, finding that 84.2% of professional string players had consulted health professionals (Hohls 2010:101). Though the results of Hohl's study are much higher than the results found in the current study (51.7%), Barnes *et al.* found that up to 55.3% sought treatment of some kind, indicating that the explanation for the discrepancy in the results lies in different study populations.

Both Hohls (2010:101) and Van der Walt (2006:44) found that physiotherapists were the most commonly consulted health professionals. Van der Walt (2006:44) recorded that only 3% of the students made use of a chiropractor. This value is much lower than the values in the current study, where 30% of those who had consulted a health professional (13.4% of the total n = 67) [47], had made use of a chiropractor. The reason for this increase is not clear and may indicate a growing trust in the profession. Van der Walt (2006:44) found that 23% of the students had consulted a general practitioner (GP), while Hohls (2010:101) found that 18.5% of the total number of string players consulted a "family medical doctor". These findings are considerably higher than the results found in the current study, where 23.3% (10.4% of total n = 67) of students consulted a medical doctor of some kind.

Considering the fact that there were 30 reported PRMDs that were within the two highest severity categories, it is surprising that only four respondents consulted a specialist. These results correspond to the findings in Chapter Two, which highlights the distrust musicians often feel toward doctors and specialists, who do not understand musicians and their problems (Winspur & Warrington 2010:229), resulting in a preference for alternative treatment strategies (Dawson 2008:95–96). Though physiotherapists and Alexander technique teachers are often able to help treat and alleviate problems, it is always recommended that students with severe problems see a specialist (Ackermann, Kenny & Fortune 2011:258).

The most commonly used treatment strategies are shown in Figure 3.24. The most common treatment strategy was "Rest" (64.8%). Thirty-two (32) respondents (59.3%) indicated they had made use of massage, while 28 (51.9%) reduced their playing time. Seventeen (17) respondents (31.5%) used exercises from their own resources, while 9 made use of exercises from a professional. Fifteen (15) respondents (27.8%) made use of heat and ice packs and 12 (22.2%) made use of oral anti-inflammatory medication. Three (3) respondents (5.6%) made use of injections, 2 (3.7%) used a diet and 2 (3.7%) indicated they had done nothing. Six (6) ticked the box "Other". Asian powder, assessment of their own technique, verbal advice and changing practice routine to shorter more frequent sessions rather than sessions of 60 minute or more were given as specifications for "Other". Eight (8) respondents did not answer the question. Three (3) of these responses were from the excluded questionnaires discussed at the beginning of this chapter. It is not clear why the remaining two did not complete the questionnaire. Two of the five who did not

[47] Both the studies by Hohls and by Van der Walt seem to have worked out the percentage of health professionals consulted using the total students rather than those who had said they had consulted a health professional; therefore, the percentage of the total number of respondents (67) in the current study was calculated for comparison.

complete the question had not completed the previous question. The other three respondents all indicated that they had not consulted a health professional. It is possible that they did not complete the questionnaire as they did not see that there was a category for "None" in the treatment section. As their motives are not completely clear, they were not included in the calculations for the question, making $n = 54$ for this question.

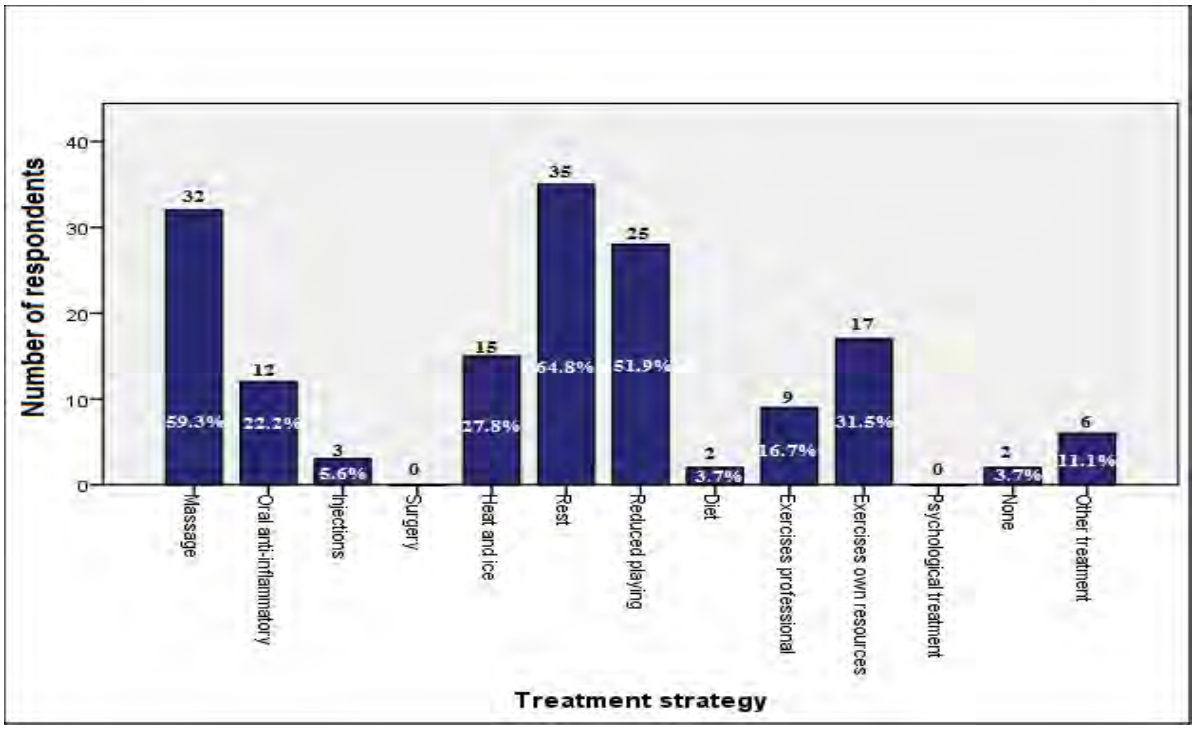

Figure 3.24: Treatment strategies used

The treatment strategies used most were generally non-invasive. Many of the treatment methods were available to respondents without the help of medical professionals. A relatively high number of students took oral anti-inflammatory medication and, considering how few people had consulted a GP or specialist, it can be assumed that these were over-the-counter medicines in low doses. Barnes *et al.* (2011:42) discovered that an even higher number of respondents in their study (31.6%) took medication to treat their symptoms. They also found that considerably fewer respondents (31.6%) reduced their play time in comparison to those in the current study (Barnes *et al.* 2011:42). Hohls (2010:104) found that the majority of respondents had used treatment strategies such as massage or other techniques often used by physiotherapists.

The importance of consulting a health professional becomes clear when looking at the 64.8% of students who indicated that they had completely rested the affected area (i.e. not played their instrument). It is presumed that most students would only have stopped playing for a few days; however, as discussed in Chapter Two, complete rest is not always recommended depending on the

type of PRMD experienced. If rest is prolonged, muscles used for playing the instrument can weaken or atrophy and joints stiffen, which can have more severe consequences for the musician (Winspur & Warrington 2010:233). Even if these effects are temporary, musicians who return to playing may not take this weakening into account and may then resume practise too soon. This rushed return to playing could result in a recurring problem, creating a vicious cycle rather than aiding healing. It is important that an experienced health professional oversees severe or protracted problems.

Respondents were asked to what extent they had found their treatment strategies effective. Twenty-four (24) respondents (45.3%) indicated that the treatment strategy they had used was temporarily effective. Twenty-one (21) respondents (39.6%) indicated that the treatment strategy had helped so far, while only 3 (5.7%) had indicated the treatment strategy had helped in the long term. One respondent (1.9%) indicated the treatment strategy had not helped, while 3 (5.7%) respondents felt the treatment strategy had not helped them yet. A further respondent (1.9%) was not sure how effective the treatment strategy was as (s)he was still undergoing treatment (see Figure 3.25).

The respondents who did not respond to the previous question similarly failed to respond to the question on the effectiveness of treatment strategies and the non-response was treated in the same manner. One further respondent did not answer the question because (s)he had indicated that (s)he had not made use of a treatment strategy in the previous question. Respondents who answered "None" for the question on treatment strategies were neither prompted to complete or omit the last question. The other respondent who indicated (s)he had not made use of any treatment strategy did respond to this question, indicating that doing nothing had helped them so far.

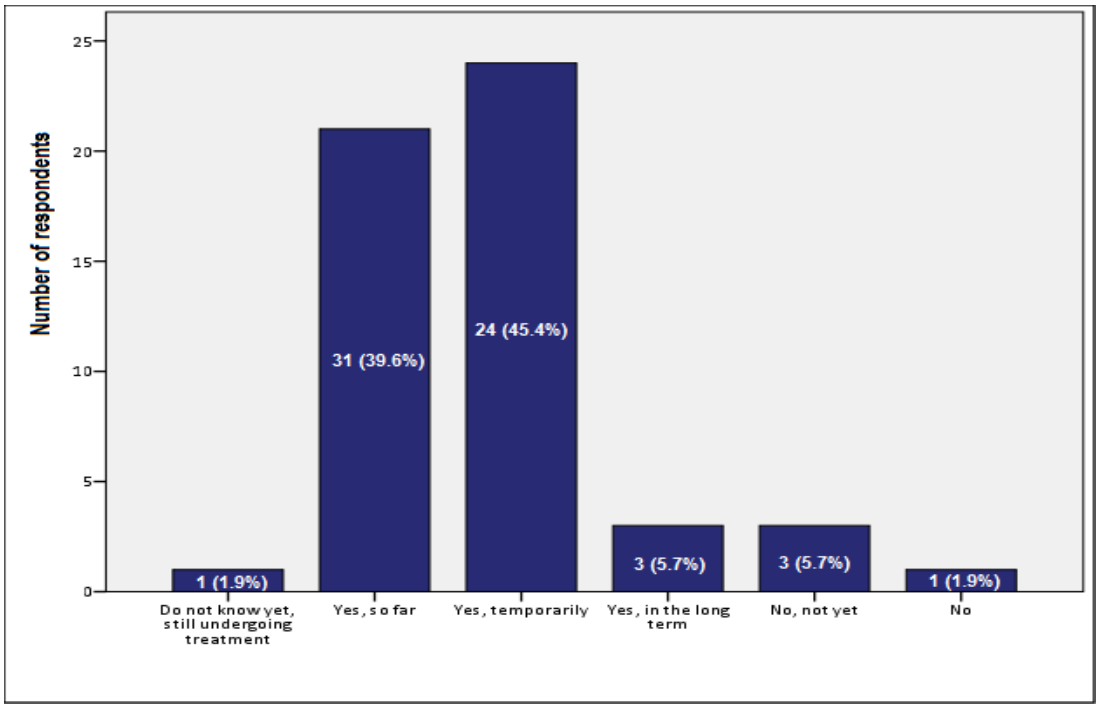

Figure 3.25: Effectiveness of treatment strategies used

Though respondents were predominantly "Temporarily" satisfied with the treatment there was a lack of permanent effectiveness of the treatment therapies. This dissatisfaction may point back to the fact that many respondents are often not seeking out the correct professional help (s)he need.

3.10 Conclusion

The prevalence of PRMDs found in the current study is high (88.1) but the findings are similar to various international studies on student musicians. Although the prevalence of PRMDs at the SACM, UCT is very high in comparison to the findings of several international studies, it cannot be assumed that students at the SACM, UCT are more vulnerable than their international fellow students. Some studies that used a similar definition of PRMDs to the current study had comparable results, especially for lifetime prevalence. What is noticeable is that a study done at the conservatoire in Prague, which does not have any body awareness or prevention courses, found an almost identical lifetime prevalence of 88.9% to the current study, making a possible case for the fact that students at universities who do not have preventative measures in place may be at an increased risk of developing a PRMD. While it is important to compare the findings of the current study to international studies, it is necessary to situate this discussion in a South African context.

The South African studies often showed differing results between them for prevalence because of their use of different definitions of PRMDs (Van der Walt 2006; Barnes *et al.* 2011), small sample sizes and different target groups (Ajidahun & Phillips 2013; Hohls 2010). However, the South

African studies similarly found a lack of statistical significance between PRMDs and age, gender, handedness and years of playing the main instrument.

The “average PRMD” in the current study was experienced in the shoulder, lasted for less than one week within the past 12 months, got better and worse, but never went away completely, only occurred briefly during or after playing, without the student having to shorten the playing time, and occurred seldom.

From this overview one can see that most PRMDs were very mild and would not have had a huge impact on this group of student musicians. This puts the very high prevalence rate found in the current study back into context. However, the study did find that around half the reported PRMDs had a severity of 3 out of 5 on the Likert scale and over a third had a severity and frequency of 3 out of 5, indicating that a significant number of students are affected by moderate to severe PRMDs.

The study revealed that only a few students were making adequate use of professional help, both in terms of prevention and treatment. Though treatment strategies were non-invasive, the students were largely self-reliant and satisfaction with these strategies was moderate.

Further studies on the prevalence of PRMDs are needed to provide conclusive confirmation of the relatively high prevalence found in the current study as well as the lack of statistical significance between the PRMDs and variables such as age and gender.

Chapter Four

Summary, conclusions and recommendations

4.1 Introduction

The need to expand the research base on the prevalence of PRMDs in student musicians in South Africa gave rise to the following research questions:

- How many students of the South African College of Music (SACM), University of Cape Town (UCT) are or have been affected by playing-related musculoskeletal disorders?
- How do PRMDs relate to age, gender, handedness, instrument types, number of years playing the instrument, playing another instrument, level of instrument, university programme, stream, academic year and years of playing the instrument?
- Using the location, duration, severity and frequency of PRMDs as measures of impact, to what extent do PRMDs interfere with students' ability to play their instruments at the level they are used to?
- How are students preventing and/or treating their PRMDs?

A quantitative epidemiological approach was chosen as the methodological framework within which these questions would be answered using a cross-sectional, descriptive study design. Seventy-two (72) undergraduate, Western classical keyboard, string and woodwind students at SACM, UCT were surveyed using a self-report measure in the form of a questionnaire-based survey; 67 of the questionnaires could be used and the response rate was 98.6%. Statistical analysis was conducted using SPSS (Version 22). The findings of the current study as well as a thorough comparison of the results of the current study to South African and international studies served to answer the above mentioned research questions and validate the results.

4.2 Findings and conclusions

Types, risk factors, prevention and treatment of PRMDs as discussed in the literature were presented in Chapter Two, which forms the background for analysing the findings of the questionnaire-based survey. Evidence- and experience-based sources agree that most musicians experience PRMDs in the upper extremities, with many experiencing problems in the shoulders, back and neck. Causes of PRMDs are believed to be influenced by the variables: gender, age, type of instrument played, years of playing the instrument, playing technique, bad practice habits, a sedentary lifestyle, genetic predisposition, hypermobility and psychological stressors. Most of these causal factors have been debated, revealing contradictions within evidence-based research as well as between evidence-based and experience-based research. Prevention includes the raising of awareness and prevention of PRMDs in musicians and their teachers, as well as the use of movement awareness and somatic methods such as the Alexander technique, the Feldenkrais

technique, body mapping, Pilates, yoga, tai-chi or qigong and biofeedback. Treatment of problems needs to be a collaborative process between medical practitioners, movement awareness specialists and music educators. There is a need for a combination of treatment approaches that deals with the musician holistically rather than merely addressing the physical symptoms.

Chapter Three presented the findings of the current study and discussed these results by putting them into the South African and international scholarly context. Using the results, research questions can be addressed in the ways outlined below.

- This study revealed that a very high number (88.1%) of respondents have suffered from playing-related musculoskeletal disorders (PRMDs). At the time of the study nearly half (46.3%) indicated that they were suffering from a PRMD and 82.1% had suffered from a problem in the preceding twelve months.
- Most of the variables (age, gender, handedness, instrument, number of years playing, university year, stream and programme) could not be statistically linked to the presence of a PRMD. The only exception was the instrument levels, where respondents studying an instrument at B3 level were most affected by PRMDs. However, trends in the data seemed to indicate that more females than males were affected and that particularly third-year students were at risk.
- Though most of these problems were mild, nearly half of the PRMDs reported (46.3%) were of a severity that could impact on students' ability to play their instrument at their highest level. This could interfere with students' ability to complete or continue their studies. Many of these PRMDs directly affected their playing apparatus (shoulder, hand, wrist and fingers) and nearly half the respondents had a problem that caused them to shorten their practice session. Over half (54%) of the PRMDs occurred "often", "very often" or "constantly" and 34.2% were rated at 3 or higher on a scale of 1 to 5 for both frequency and severity. In addition, there were a significant number of problems that had lasted for more than two years and 16.4% of these PRMDs were consistently present or did not go away completely during this time.
- Most respondents had very little knowledge of body-awareness techniques and only few made use of them. Though over half (51.7%) of the affected respondents had consulted a health professional, respondents tended to stay away from medical doctors and opt for more therapeutic approaches. Treatment strategies revealed a large amount of self-reliance rather than expert recommendations. Respondents were moderately satisfied with their treatment.

The results of this study were found to be comparable to results of studies done nationally and internationally. The prevalence of PRMDs was comparable to several studies that had used the same definition. The lack of correlation between the variables (age, gender, etc.) and the presence of a PRMD was similarly found in South African studies as well as some international studies. The types of health care professionals consulted were similar both to other South African as well as international studies.

This study is important for the performing arts and research community in South Africa, revealing a high prevalence of PRMDs at SACM, UCT. The PRMDs impact on students' ability to participate in their university education at an optimum level and there is a need for more effective management of these problems from the students, teachers and the institution. Research has shown that many problems are preventable through education, awareness and modifications to the work environment of students. Treatment of these problems is often unsatisfactory, both in terms of students' responses and expert opinions and more attention to treatment management would help reduce the impact that PRMDs have on these students' lives.

Though this study is small and restricted to SACM, UCT students, the question arises whether similarly high numbers of students are affected by PRMDs at other universities. Additionally, various causal factors of PRMDs such as practice habits, exercise habits and playing techniques need further investigation in order to find appropriate preventative responses within the South African context.

4.3 Limitations of study

The self-report method is inherently flawed in an empirical study as it relies on peoples' perceptions to report their feelings and experiences (Field & Hole 2003:48). In this study responses rely on people's perceptions of pain, severity and what constitutes a PRMD and it is therefore subject to a unavoidable degree of recall bias (Katzenellenbogen, Joubert & Abdool Karim 1997:127). Additionally, a great deal of the information relies on the memory of students, which may not be accurate, a process Katzenellenbogen *et al.* (1997:68) refer to as "measurement bias".

One of the most significant limitations to the study was the sample size. Many of the sub-groups were too small to analyse and to draw meaningful statistical conclusions. It is important to note that the study does not aim to make any projections about the South African music student population as a whole. A study incorporating Western classical music students from across the country could be done in future to verify results found in this study and contribute to more widely relevant conclusions.

4.4 Recommendations

Various aspects of this study field were not covered – or only insufficiently – and consequently the following recommendations for future studies are made.

- A study with a larger sample size that investigates students from all the universities in South Africa to confirm associations between the variables investigated in this study;

- A study looking at the other streams of music offered at the University of Cape Town, namely African music, jazz, opera or classical voice. It would be particularly interesting to compare these groups with one another;
- A comprehensive study investigating the behaviours and attitudes of student musicians that lead to PRMDs. These behaviours and attitudes include practice habits, exercise habits, stress and other psychological issues as well as a closer inspection of instrument-related playing techniques;
- A study that comprehensively investigates which health professionals and treatment strategies are used and which of these health professionals and treatment strategies are most effective.

Many PRMDs can be prevented or identified as soon as possible to reduce the consequences of such a problem. There are several stages of changes that could be made by the tertiary institution, the teachers, the students and society:

Teachers:

- need to help students develop healthy behaviours such as a healthy playing technique, posture and practice habits;
- need a basic training in PRMDs to help students prevent of manage such disorders. Courses similar to those described in Appendix C could be set up in order to train music teachers.

The University:

- needs to implement a permanent course on prevention, treatment and management of musicians' problems for all undergraduate programmes. This programme should ideally be implemented in the first two years of the undergraduate degree;
- needs to establish and improve the networks of health professionals by encouraging greater collaboration between the performing arts, sport science and medical faculties in conjunction with student medical services. The contact information of these professionals could be made available to all students and teachers, allowing for better and more effective access to treatment;
- needs to offer students one or more of the movement awareness or somatic methods discussed in Chapter Two;
- needs to develop an open and approachable environment in which students feel comfortable about approaching their lecturers and colleagues about their instrument-related health issues. Creating a clear protocol for teachers and students on what needs to happen once a PRMD arises could help create this environment.

Students:

- need to be willing to undergo courses that will help increase their awareness as well as give them skills to deal with problems as they arise;
- need to become aware of the physical and psychological problems that a career in music may present and be willing to change their playing-related health behaviours and attitudes that may induce these problems;

- need to be willing to seek help early.

Teachers, students, health care professionals and universities need to work together more closely to learn from one another and develop appropriate treatment approaches. Improved networks of health care professionals of all types need to be established in South Africa in order to treat musicians effectively. Networks are best set up by overarching performing arts organisations, such as Performing Arts Medicine Association (PAMA). The South African performing arts community could greatly benefit from the establishment of a performing arts medicine association. As the South African body of research in the field of performing arts medicine develops, there is the hope that widespread awareness and resultant actions will ensue.

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Appendix A

Informed consent

I, Tatiana Thaele, a Masters student at the University of Cape Town (South African College of Music) under the supervision of Assoc. Prof. Anri Herbst, have obtained ethics clearance from the Higher Degrees Committee, South African College of Music (University of Cape Town) for my research entitled: *The prevalence of performance-related musculoskeletal disorders in the western classical music students of the South African College of Music.*

You are invited to contribute to this study by completing a short questionnaire.

Objectives

The purpose of this study is to discover how many students are affected by playing-related problems such as pain, weakness, lack of control, numbness or tingling that reduce student's ability to play their instruments and perform at an optimum level.

The study will make use of a questionnaire designed to investigate musicians' experiences regarding playing-related problems. This research will help researchers and musicians understand how music students are affected by playing-related problems and can contribute to treating and preventing these problems in the future.

Participation

There are no identified risks from participating in this research. Participation in this survey is completely voluntary and you may refuse to participate without jeopardising your relationship with the researcher and the supervisor in any way. The survey will take approximately 5-10 minutes to complete. There are no costs for the participants and they will not receive compensation for participating. Upon request you will receive a PDF copy of the dissertation.

Confidentiality

Your identity will not be disclosed and the completion of the questionnaire is anonymous. However, due to the fact that it is a small community and certain combinations of information may give away your identity, please note that all information will be treated with utmost confidentiality and all data will be published in aggregate form.

Terms of agreement

By agreeing to take part in this study you indicate that you:

- have read and fully understood the above information;
- are 18 years or older;
- agree to participate voluntarily in the study;
- know that that your data will be treated confidentially and that your identity will not be disclosed;
- are aware that you may at any time withdraw your participation without consequence;
- are aware that all results will be published in aggregate form only for advancement of research in the field;

	Name	Date	Signature
Participant			
Researcher			

Contact details

Tatiana Thaele: tthaele@gmail.com

Appendix B

University of Cape Town
South African College of Music

Musicians' playing-related problems

Questionnaire

February 2015

Section A: *Personal and study profile*

1. Please provide the following information. Where applicable tick the relevant box.

1.1 Age (years):_____

1.2 Gender: male ☐ female ☐

1.3 You are: left handed ☐ right handed ☐

2. Please answer the following questions:

2.1 What is your main instrument of study?_____

2.2 How long have you been playing this instrument (years)?_____

2.3 Do you currently play any other instrument(s)? Yes ☐ No ☐

2.4 If yes, which other instrument(s) do you play?_____

2.5 What program are you currently registered for?

Degree ☐ Diploma ☐

2.6 What stream are you registered for?

General ☐ Performance ☐ Education ☐ Composition ☐ BA ☐ Other ☐

If other, please specify:_____

2.7 What year are you in?

1 ☐ 2 ☐ 3 ☐ 4 ☐ programme extended (more than 4 years) ☐

2.8 What level of your main instrument are you currently registered for?

B1 ☐ B2 ☐ B3 ☐ B4 ☐ A2 ☐ A3 ☐ A4 ☐

Section B: *Overview of playing-related problems*

For the purposes of this study, a *playing-related problem* is defined as:

> Pain, weakness, lack of control, numbness, tingling, or other symptoms that come from playing, and that interfere with playing your instrument *at the level you are used to.*
>
> NB: Pain or any other symptoms that are caused by an accident or other non-playing related events are NOT considered to be a playing-related problem.

Please tick the relevant boxes.

1. Are you currently suffering from a playing-related problem?

   Yes ☐ No ☐

2. Have you experienced a playing-related problem at any time in the past 12 months?

   Yes ☐ No ☐

3. Have you at any time in your life experienced a playing-related problem?

   Yes ☐ No ☐

   If YES, approximately how many different playing-related problems have you had in your life?

   1 ☐ 2 ☐ 3 ☐ more than 3 ☐

	Never heard of it	Heard of it	Have tried it	Know it fairly well	Make regular use of it
Alexander technique	☐	☐	☐	☐	☐
Feldenkrais technique	☐	☐	☐	☐	☐
Body Mapping	☐	☐	☐	☐	☐
Biofeedback	☐	☐	☐	☐	☐
Yoga	☐	☐	☐	☐	☐
Tai-Chi/Qi Gong	☐	☐	☐	☐	☐
Pilates	☐	☐	☐	☐	☐

If you have not experienced any playing-related problems in your life you have reached the end of this questionnaire. I greatly appreciate the time and effort you put into completing this questionnaire.

If you have experienced a playing-related problem, move on to Section C.

Section C: *Specific details of playing-related problems*

Using Addendum A, please complete a full table for each playing-related problem you have experienced. Do not list more than three of the most recent problems you have encountered.

Playing-related problem 1

Location:

Write down the letter name and the body part from the list on Addendum A of the area that was/is affected (for example, D – Neck front)

_____

Which side is it on (where applicable)?

Left ☐ Right ☐

Both ☐

Time:

How recently did the playing-related problem occur?

I am currently experiencing it ☐ Within the past 12 months ☐ More than 12 months ago ☐

Duration:

How long did the playing-related problem last?

Less than 1 week ☐ 1week–1 month ☐

1–3 months ☐ 3–12 months ☐

1 – 2 years ☐ More than 2 years ☐

Each time you played your instrument during this time period the playing-related problem:

☐ occurred consistently;

☐ fluctuated between better and worse but never went away completely;

☐ went away completely but returned periodically (recurring).

Severity:

Rate the severity of the playing-related problem on a scale from 1–5 using the descriptions given for each degree.

Pain, weakness, lack of control, numbness, tingling or other symptoms that *(Tick only one box):*

☐ **1** Only occurs temporarily while OR after playing, without having to shorten the playing session;

☐ **2** Starts while playing, lasting for only a short period after playing, without having to shorten the playing session;

☐ **3** Requires the playing session to be shortened, but stops shortly after playing;

☐ **4** Requires the playing session to be shortened, but does not totally stop between playing sessions;

☐ **5** Prevents playing.

Frequency:

Please circle a number below that best describes how frequently you suffer from this playing-related problem.

Once	Seldom	Often	Very often	Constantly
1	2	3	4	5

Playing-related problem 2

Location:

Write down the letter name and the body part from the list on Addendum A of the area that was/is affected (for example, D – Neck front)

_____

Which side is it on (where applicable)?

Left ☐ Right ☐

Both ☐

Time:

How recently did the playing-related problem occur?

I am currently experiencing it ☐ Within the past 12 months ☐ More than 12 months ago ☐

Duration:

How long did the playing-related problem last?

Less than 1 week ☐ 1week–1 month ☐

1–3 months ☐ 3–12 months ☐

1 – 2 years ☐ More than 2 years ☐

Each time you played your instrument during this time period the playing-related problem:

☐ occurred consistently;

☐ fluctuated between better and worse but never went away completely;

☐ went away completely but returned periodically (recurring).

Severity:

Rate the severity of the playing-related problem on a scale from 1–5 using the descriptions given for each degree.

Pain, weakness, lack of control, numbness, tingling or other symptoms that *(Tick only one box):*

☐ **1** Only occurs temporarily while OR after playing, without having to shorten the playing session;

☐ **2** Starts while playing, lasting for only a short period after playing, without having to shorten the playing session;

☐ **3** Requires the playing session to be shortened, but stops shortly after playing;

☐ **4** Requires the playing session to be shortened, but <u>does not</u> totally stop between playing sessions;

☐ **5** Prevents playing**.**

Frequency:

Please circle a number below that best describes how frequently you suffer from this playing-related problem.

Once	**Seldom**	**Often**	**Very often**	**Constantly**
1	**2**	**3**	**4**	**5**

Playing-related problem 3

Location:

Write down the letter name and the body part from the list on Addendum A of the area that was/is affected (for example, D – Neck front)

_____

Which side is it on (where applicable)?

Left ☐ Right ☐

Both ☐

Time:

How recently did the playing-related problem occur?

I am currently experiencing it ☐ Within the past 12 months ☐ More than 12 months ago ☐

Duration:

How long did the playing-related problem last?

Less than 1 week ☐ 1week–1 month ☐

1–3 months ☐ 3–12 months ☐

1 – 2 years ☐ More than 2 years ☐

Each time you played your instrument during this time period the playing-related problem:

☐ occurred consistently;

☐ fluctuated between better and worse but never went away completely;

☐ went away completely but returned periodically (recurring).

Severity:

Rate the severity of the playing-related problem on a scale from 1–5 using the descriptions given for each degree.

Pain, weakness, lack of control, numbness, tingling or other symptoms that *(Tick only one box):*

☐ **1** Only occurs temporarily while OR after playing, without having to shorten the playing session;

☐ **2** Starts while playing, lasting for only a short period after playing, without having to shorten the playing session;

☐ **3** Requires the playing session to be shortened, but stops shortly after playing;

☐ **4** Requires the playing session to be shortened, but <u>does not</u> totally stop between playing sessions;

☐ **5** Prevents playing**.**

Frequency:

Please circle a number below that best describes how frequently you suffer from this playing-related problem.

Once	**Seldom**	**Often**	**Very often**	**Constantly**
1	**2**	**3**	**4**	**5**

Section D: *Consultation and treatment*

1. Have you ever consulted any health professionals (i.e. Doctor, physiotherapist, Alexander technique teacher) for a playing-related problem?

   Yes ☐ No ☐

   If YES, which health professional, if any, did you consult? (If NO, continue to Question 2)

   Please tick the relevant box/boxes.

General Practitioner (GP)	
Specialist (e.g. orthopaedic specialist)	
Physiotherapist	
Occupational therapist	
Chiropractor	
Alexander technique teacher	
Feldenkrais technique teacher	
Body mapping specialist	
Sport scientist	
Biokineticist	
Psychologist	
Non-western healing practice *Please specify*_____	
Dietician	
Other *Please specify*:_____	

2. Which of these treatments strategies did you make use of?

Please tick the relevant box/boxes.

Massage	
Oral anti-inflammatory pain medication	
Injections (anti-inflammatory and/or cortisone)	
Surgery	
Applying heat and ice packs	
Rest	
Reduced playing	
Diet	
Exercises from a health professional	
Exercises from your own resources	
Psychological treatment	
None	
Other *Please specify:*_____	

2.1 Did any of the treatment strategies resolve the playing-related problem(s)?

Please tick the relevant box

Do not know yet, still undergoing treatment.... ☐

Yes, so far..... ☐

Yes, temporarily..... ☐

Yes, in the long term..... ☐

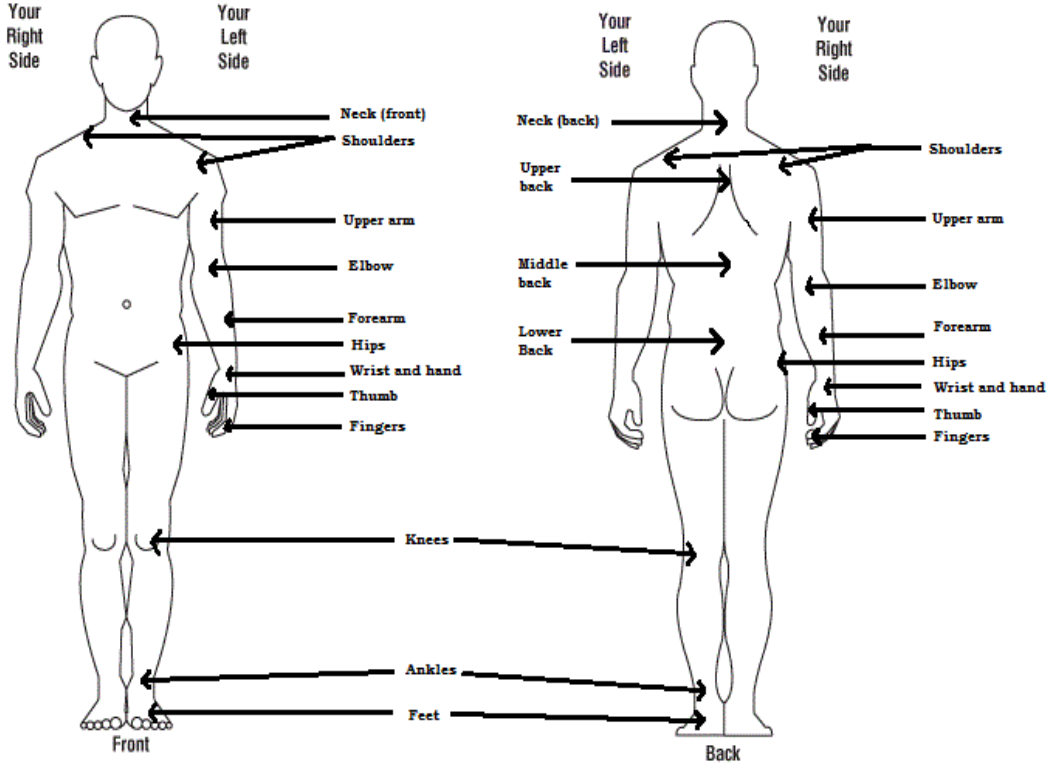
No, not yet..... ☐

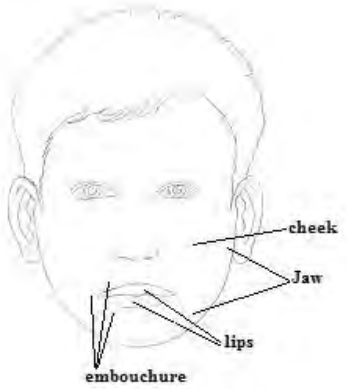
No..... ☐

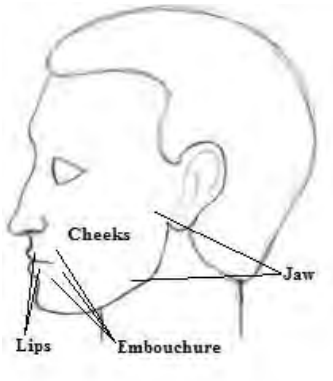
You have reached the end of this questionnaire. I greatly appreciate the time and effort you put into completing this questionnaire.

ADDENDUM A

A – Embouchure/lips	E – Neck (back)	I – Shoulder	M – Hand or wrist	R – Knee
B – Mouth/tongue	F – Lower back	J – Upper arm	N – Fingers	S - Ankle
C – Jaw/cheeks	G – Middle back	K – Elbow	O – Thumb	T – Foot
D – Neck (front)	H – Upper back	L – Forearm	P- Hip	







In these pictures you can see the approximate position of the parts of the body listed above. Areas are not always sharply defined, and certain parts overlap. You should decide for yourself in which part of the body you have had a playing-related problem (if any)

Appendix C

UNIVERSITY OF MUSIC AND PERFORMING ARTS VIENNA

Further training courses for Performing arts medicine

An investigation of European further training possibilities for musicians, educators and health professionals

Tatiana Thaele

3/24/2015

1. Introduction

Overview

As the field of performing arts medicine grows one needs to look how the information is filtering into both the health and music industry. Health professionals need insight into what treatment of a musician entails, likewise, musicians and educators need to be educated on the concepts of identification, prevention, management and treatment of various physical and psychological problems afflicting musicians. At most universities in Germany the music education programmes have courses included curriculum on musician's health (Spahn 2011:62). Several studies have shown the effectiveness of prevention courses at universities (Spahn, Hildebrandt & Seidenglanz 2001; López & Martínez 2013; Barton & Feinberg 2008; Zander, Voltmer & Spahn 2010). Less attention has been given to another education possibility available to musicians who wish to increase their knowledge in the field of performing arts medicine. There are various further training courses are available throughout Europe for both professional musicians and health professionals. These courses are aimed at varying levels of musicians and are useful for many reasons: they help health professionals gain insight into aspects of musicians' health; they help musicians who have not had any contact with aspects of musicians' health during their studies and they help musicians who have had contact with aspects of musicians' health deepen their knowledge of the field.

Traditionally, professionals working in the field of performance arts medicine as movement trainers, physiotherapists, psychologists and other medical specialties have a double qualification. They often have a music degree (or part of it) and another specialised qualification. The important question arises: to what extent can/should a further training educate musicians and health professionals and what capabilities do participants have that complete these courses?

In order to answer that question an investigation of the main programmes offered in Europe is needed.

Aim

This paper will aim to compare four further training courses available in Europe at the moment:

1. Master of science(MSc) /diploma in Performing Arts Medicine,
2. Mentorenausbildung "Gesunde Musikschule" Schloss Kapfenburg (Mentor programme "Healthy music school" Schloss Kapfenburg),
3. Musikphysiologie im künstlerischen Alltag (Music physiology in the daily life of the artist)
4. Music physiology courses at the University of Arts Zurich.

Research questions

Main questions:

- To what extent can or should a further training course educate musicians and health professionals and what is the scope of their competence upon completing these courses?

Sub-questions:

- How do the courses compare in duration, goals, type of qualification, target group, course structure, contents (time dedicated to each area) and costs?
- What elements are present in all the courses and form an essential part of such a further training programme?

1. Four programmes in Europe

2.1 Master of science (MSc)/diploma in performing arts medicine

All information in this table is taken directly from the website and from the brochures:

<http://www.iseh.co.uk/research-and-education/ucl-masters-courses/performing-arts-medicine-msc>

MSc/diploma in Performing arts medicine	
Duration	MSC: Full-time 1 year Part-time 2 years
Goals	The MSc aims to introduce you to the key areas relating to performing arts medicine, namely; musculoskeletal and neuromuscular injury, performance ergonomics, performance psychology, pharmacology related to performance, differential diagnosis, comparisons of fitness between performers and athletes, modes and types of dance, vocalisation and instrumental playing, impact of environmental factors touring and travelling, and health promotion aiming at preventing disease. There will be time given to practical assessment of performers' conditions and careful consideration of rehabilitation strategies and pain management programmes. There will be a strong emphasis on improving on understanding the aetiology and uniqueness of the often multi-factorial elements of health and injury of performers, with practical discussion as to the best management plans. (as written in the brochure)
Type of qualification	Master of science, Diploma or Certificate course (PGCert)
Target group	Medicine, manual therapy, physiotherapy, osteopathy, chiropracty, nursing and performance science (considerations made for other specialisations upon application)
Structure of course	*Core Modules (for MSc and Diploma)* • Musculoskeletal and Neuromuscular Performance Related Injury 10 *3 = 30 • Research Methods and Project Initiation • Environmental Issues, Travelling and Touring, Governance and the Law • Drugs and Disability within the Performing Arts World • Performance Psychology • Assessment and Wellness of the Performing Artists • Rehabilitation of Performance Related Injury • Medical Problems of dancers and Instrumentalists *Options* • There are no optional courses for this degree. *Dissertation/report (MSc only)* All MSc students undertake an independent research project which culminates in a dissertation of approximately 10,000 words, a presentation and individual viva (3000 dissertation and 4000-7000 literature) *Core Modules PGCert* First Term • Dance Science and Dance Medicine- collaboration with Trinity Laban Conservatoire • Clinical management of Vocal Disorders in Professional Voice Users Second Term • Environmental and lifestyle factors affecting performers • Medical Problems of Musicians - a collaboration with the Royal College of Music
Contents	Core modules – 120 credits Research project 60 credits Full time attend 2 full days (Tuesdays and Thursdays) Part-time attend 1 full day Have emailed for exact time spent on each module
Costs	• UK/EU Full-time: £10,800 • UK/EU Part-time: £5,400

	• Overseas Full-time: £21,700 • Overseas Part-time: £10,800
Entry requirements	Primary medical or allied health sciences degree e.g. medicine, physiotherapy, osteopathy, chiropractic, nursing, sports science.
Dates	Begins in September Courses run from Tuesday to Thursday over two 12 week semesters Some optional modules run on Mondays Remainder of year (April to August) used to undertake research (excluding Diploma students) Clinical sessions spread throughout the year
Programme tutors	Dr Mike Shipley Professor Rodney Grahame Dr. Carol Chapman Dr Ruth Epstein Mr John Rubin Mr Ian Winspur Dr Mukul Agarwal Professor Howard Bird Katherine Butler Dr Aaron Williamon Dr Emma Redding Ben Ashworth Professor David Marsh

The MSc in performing arts medicine offered at the University College London, is a Masters course directed at graduates in the health or sports sciences and is not aimed at professional musicians and educators as many of the other courses in Europe are. The program can be done full-time in one year or part-time over two. Lectures occur on two days a week for fulltime students and one day a week for part-time students. It is difficult to ascertain exactly how much time is given to each module as this information is not freely available. Correspondence with Jennie Morton, the lecturer of the module on Musculoskeletal and Neuromusculoskeletal Performance-Related Injury, revealed that 10 three hour lectures (total of 30 hours) are set aside for this module. The course, in comparison to its central European counterparts, is very expensive; however it is important to note that these prices are within the normal price bracket of UK universities (see <http://www.thecompleteuniversityguide.co.uk/media/674803/the_reddin_survey_of_university_tuition_fees2013-14.pdf >).

The question that arises with a course like this one is whether a one year program can aptly prepare a health professional for the complex and very broad field of performing arts medicine. There is currently no medical specialisation (such as specialisations for neurology or cardiology etc.) for the music medicine in countries such as Germany. Though it has been discussed, experts are cautious to create a specialisation that is so broad that the results may become watered down. The same could be said for this MSc program. However, as the goals of the program clearly state, the course is aimed at introducing participants to the fundamental concepts within performing arts medicine

rather than providing thorough and detailed education. From this point of view it is a valuable course that can help health professionals treat musicians more effectively.

Further information was received from correspondence with Jennie Morton, one of the lecturers of the course.

2.2 Mentorenausbildung "Gesunde Musikschule" Schloss Kapfenburg (Mentor programme "Healthy music school" Schloss Kapfenburg)

Information translated from the website and from the brochures: <http://fit-mit-musik.de/gesunde-musikschule.12.0.html> .

Mentorenausbildung "Gesunde Musikschule" Schloss Kapfenburg NB part of a bigger project see <http://fit-mit-musik.de/gesunde-musikschule.12.0.html>	
Duration	Courses run intermittently over a 6 months period
Goals	Qualification of mentors whom parents, teachers and pupils can speak with. This is a part of the greater project "Fit mit Musik! An der Musikschule" (Fit with music at the music school)
Type of qualification	Mentor training
Target group	Instrumental music teachers (particularly teachers of children and young adults)
Structure of course	*Module 1* Body awareness and somatics Time: 4 days =32 hours *Module 2* Physiological foundations of making music time: 4 days =32 hours *Module 3* The mental demands of music making (psychological aspects) Time: 2 Days =16 hours *Module 4* Scholar orientated application of the course contents in practical lessons Time: 4 days =32 hours *Module 5* Prevention at music schools Time: 3 days =24 hours Total = 136 hours
Contents	*Module 1* Body awareness and somatics • Discover the relationship between movement and sound • Feel the effort needed for movements • Preparing the body for music making (Cool up and warm down) • Relaxation techniques (eg. PME, Autogenic Training etc.) • Get to know somatic techniques: Feldenkrais, Alexander Technique, Dispokinesis, Ideokinese and breathing training Learning outcomes: - Personal experience of movement - Identify and question one's own movements - Integrate personal experience in one's own music making - Know relaxation and somatic techniques and make use of elements from them in music lessons - Employ exercises for warming up before making music and cooling down afterwards.

	Module 2 Physiological foundations of making music • Physiology: Functions of muscles, joints, tendons and ligaments • Anatomy: more detailed view of the Body from head to foot and its relevance for music making • Sitting • Standing • Erection of the spine, balance, symmetry • Ergonomics and setting up the work place: useful tools such as shoulder rests, sitting cushions and effective use chairs. • Breathing Learning outcomes: - Getting a basic knowledge of physiology and anatomy - Learning about the particular characteristics of each region of the body, the possible problems of these areas and relevance this knowledge has for music making - Identify and correct individual postural problems - Incorporate breathing into playing - Working with ergonomic tools *Module 3* The mental demands of music making (psychological aspects) • The relationship between the mind and body • Performance anxiety (psychological relationships of performance anxiety phenomena) • Risk factors in the development of stage fright • Dealing with performance anxiety of different age groups (e.g. Giving constructive criticism) ->possibly invite pupils Learning outcomes: - Reflect on personal experiences with performance anxiety - Learn to use nervousness in a positive way - Learn to react and identify signs of stress and fear in pupils and students - Individually prepare students for performance - Resource orientation - Give constructive criticism *Module 4* Pupil orientated application of the course contents in practical lessons • Criteria for application of concepts on pupils: Instrument, Age, living circumstances, musical goals, personal development goals and further inquiry (posture, performance anxiety, playing technique etc.) • Criteria which determine to what extent teachers can apply concepts learned: previous experience, competence and available time. • Environmental criteria for application of concepts: available room and materials. • As a result of criteria: setting up the lesson. • Identification and classification of problems in instrumental lessons: o Prevention o Problem indicators in the physical and psychological areas o Assessment of problems and assignment of relevant management strategies - Using own competence to solve problems arising within the lesson - Exchanging with colleagues in order to solve problems arising within the lessons. - Solve health problems with external health professionals and support from the healthcare system (Introducing pupils to a medical doctor specialized in musicians then a physiotherapist or

	at an institute for music and medicine such as the FIM) Learning outcomes: - Select lesson contents and exercises according the pedagogical situation (needs of the pupils, instrument, place and time); - Identify individual problems of pupils; - Know which mediation and referral possibilities there are and make use of them; - Complementing teaching and leadership activities by orientating these activities with greater body awareness; - Pedagogical background knowledge; - Identify and create own limits in terms of knowledge and competence. *Module 5* Prevention at music schools • Application of basic prevention strategies in one's own lessons o Warm up and cool down; o Incorporation of the entire body in self-awareness and awareness of others while playing; o Pay attention to psychological correlations. • Systematic application of prevention strategies in one's own music school o Motivating colleagues; o Organising programmes/development of concepts; o Conducting prevention projects at the music school (PR work and raising funds); o Networking (setting up networks with other music schools etc.). • Communicating prevention strategies and aspects of musician's health at one's own music school o Setting up and conducting the above mentioned 3 hour workshop with the specified contents. • Presentation of the mentor training programme at music schools. Learning outcomes: - Foundations of health management; - Organisation of further training and information seminars at music schools; - Know contacts for ergonomic teaching materials.
Costs	For teacher from VdM (Verband der Baden-Württemberg) 800 Euro, 1500 Euro
Examination	Write an essay and put together a day for musician health (the latter has been taken out of the programme)
Dates	4 sessions (2-7 days each) over a +/- 6 month period *Dates for 2014/2015* 21 – 24 November 2014 Module 1 (Schloss Kapfenburg): 11 – 14 December.2014 Module 2 (Schloss Kapfenburg): 07 – 08 March.2015 Module 3 (FIM Freiburg): 29 – 04 April.2015 Module 4 und 5 (Schloss Kapfenburg):
Programme tutors	Prof. Dr. Claudia Spahn Barbara Noé Dirk Hausen Dr. Mark Zander Alexander Türk-Espitalier

The “Mentorenausbildung” (mentor training) offered by the Freiburger Institute for music medicine and Schloss Kapfenburg is part of the bigger project “Fit mit Musik! an der Musikschule” (fit with music! at the music school) and “Gesunde Musikschulen” (healthy music schools). The program aims to train music teachers in 4 to 5 weekend or holiday sessions. Music schools receive a certificate declaring them a “gesunde Musickschule” (healthy music school) once the following steps have been completed. First, one staff member has to complete the mentor program. Then they need to pass on the information to their colleagues at the music school. This is done by organising information sessions or awareness days at the music school. Once this has been done the school is awarded the certificate. There are possibilities to get further certificates and the mentors are encouraged to motivate other music schools in the area to participate in the program. This develops a sustainable and self-perpetuating system that infiltrates the earliest stages of music education.

The first two modules are focussed on the physical and physiological aspects. Participants are given an understanding of how the anatomy of the body, movement and music making relate to one another. They are also introduced to some of the important relaxation and somatic techniques.

The third module deals with the psychological aspects of music making. Performance anxiety is a central part of this module but the relationship between the physical and psychological is also discussed.

The fourth and fifth modules deal with the application of the knowledge in individual lessons and in the music school as a whole. Great emphasis is given in the fourth module to the importance of knowing ones limitations and working together with specialist in the field, whether somatic or relaxation technique specialists or medical professionals to solve problems. The fifth module teaches participants the basics of health management. Participants learn how to integrate the information into the individual lesson and at school, while being given hands on guidance on how to relay information to colleagues and other music schools.

The costs of this course are very reasonable considering the fact that it includes accommodation and food. As it is spread throughout the year on weekends and during holidays, it is practical and feasible for music teachers to attend. The space between the modules also allows participants to digest and integrate information into the lessons as a continuous learning process.

Further information was gained from correspondence with Alexandra Türk-Espitalier, one of the programme organisers and lecturers. A detailed PDF of the course contents was shared.

2.3 Musikphysiologie im künstlerischen Alltag (Music physiology in the daily life of the artist)

Information translated directly from the website and from the brochures: <http://www.ksi-berlin.de/?cat=39>. Further information received from correspondence with Hedi Milek, a former participant of the course.

Musikphysiologie im künstlerischen Alltag (Music physiology in the daily life of the artist)	
Duration	7 months
Goals	The course is designed to give a practical and theoretical overview of prevention strategies for health problems of professional musicians, educators and their students. The course is designed to accompany the existing profession. It will comprehensively inform participants of how to constructively deal with the physical and mental demands of music making. Solutions to these demands will be taught so that they can be integrated into the daily profession. Participants will learn the foundations as well as look at research from the areas of music physiology, pedagogy and didactic. The practical application of this will be in the foreground. A further aspect will be the exchange of experiences with regards to health risks and sustainable prevention possibilities of musicians in different professional fields.
Type of qualification	Certificate
Target group	- Instrumental and voice educators - Practicing and performing musicians.
Structure of course	*Module I* Physical and mental foundations of music making, body awareness and body training Time: 63 hours *Module II* Practicing and learning techniques Time: 42 hours *Module III* Stress management, performance training and communication Time: 27 hours Total: 132

Contents	*Module I*
	The physical-mental foundations of music making, body awareness and body training
	
	Themes:
	• Functions of the moving apparatus;
	• Breathing;
	• Sensory organs and the nervous system;
	• Learning through experimentation and exercises to:
	  ○ Increased body awareness;
	  ○ Discovering the connections between the bodily, the mental and the psychological aspects of music making.
	• Discovering through analysis of performance situations and one's own playing the relationships between posture, movement, expression and sound;
	• Body training for the improvement of the body's condition while making music with the goal of actively preventing physical problems;
	• Learning to incorporate body awareness and musicians health in the teaching environment;

	• Identifying individual problems of pupils/students and gaining the skills to respond to them from using didactic and methodological approaches. *Lecturers* Prof. Dr. Eckart Altenmüller Annette Goeres Prof. Kristin Guttenberg Alexandra Müller Dr. Hartmut Puls Dr. Anke Steinmetz *Module II* *Practicing and learning techniques* • Introduction to neuro-physiological foundations of sensomotoric learning; • Discover the relationship between the nervous system , the sensory organs and muscle function while practicing; • Discovering the neuro-biological foundations of the sensomotoric memory; • Looking at the active neurological paths during music making; • Practice hygiene, mental practice, observational learning and the role of feedback in learning and teaching; • Exercise will accompany the theory. *Lecturers* Prof. Dr. Eckart Altenmüller Prof. Dr. Hans-Christian Jabusch Johannes Tappert *Module III* *Stress management, performance training and communication* • Different stress and performance situations will be presented and different possibilities for the management of these situations will be discussed and worked out; • Insight and coaching are a part of this module with the goal of gaining trust and courage in one's own communication. • Learning to identify early signs of performance anxiety and stress in scholars/students and to implement appropriate prevention strategies. *Lecturer* Prof. Dr. Helmut Möller
Costs	1 460 Euro
Dates	6 weekends from May to November Dates for 2014/2015 08 – 10 May.2015 Hochschule für Musik Hanns Eisler Berlin 12 – 14 June 2015 Hochschule für Musik Hanns Eisler Berlin 10 – 12 July 2015 Hochschule für Musik, Theater und Medien, Hannover 18 – 20 September 2015 Hochschule für Musik Hanns Eisler Berlin 23 – 25 October 2015 Hochschule für Musik Hanns Eisler Berlin 20 – 22 November.2015 Hochschule für Musik Hanns Eisler Berlin Fridays 16.00 – 20.00 Saturdays 9.30 – 19.00 Sundays 9.30 – 16.00
Programme tutors	Prof. Dr. Eckart Altenmüller

	Annette Goeres Prof. Kristin Guttenberg Alexandra Müller Dr. Hartmut Puls PD Dr. Anke Steinmetz

"Musikphysiologie im künsterischen Alltag" (music physiology in the daily life of the artist) is a certificate course offered to performing and teaching musicians by the University of Arts Berlin, the Hans Eisler University of Music Berlin, the University of Music, Theatre and Media Hannover and the Kurt-Singer Institute for Music Physiology and Musicians' Health. The course runs over six weekends from May to November and is relatively affordably costing 1460 euros (without accommodation). The course is structured into three modules: physical and mental foundations of music making, body awareness and body training (63 hours); practicing and learning techniques (42 hours) and stress management, performance training and communication (27 hours). In total the course has 132 hours of content.

The course aims to give an overview of the field that can accompany the existing profession rather than serve as an independent qualification. To what extent this is emphasized in the course is not clear, however, there is a very strong emphasis on the practical application of knowledge indicating a "hands-on" approach rather than a theoretical one. This is useful for musicians who can directly apply this practical knowledge in their own playing and teaching.

2.4 Music physiology courses at the University of Arts Zurich

The following table has been derived and translated from a table in an article written in the Österreichische Gesellschaft für Musik und Medizin (ÖGfMM) newsletter by Schwartz (2012).

Module 1: Certificate in Advanced studies (CAS) music physiology basic	
Duration	1 year (2 semesters)
Goals	Completion of the module should enable the participants to: • Identify work specific health risks and develop a foundation in order to apply functional anatomy to the playing of their own instrument (or singing). • To make use of preventative strategies in one's own playing using exercises from relaxation, movement, posture and breathing training techniques.
Type of qualification	Certificate
Target group	Professional musicians especially music teachers with teaching experience
Structure of course	*Module/ Certificate course music physiology for music educators(basic)* Individual lessons for main subject applied music physiology Lecture: contact lessons 16 h Self-study 164 h Total 180 h Foundations music physiology Lecture: contact lessons 32 h Self-study 28 h Total 60 h

	Functional anatomy Lecture: contact lesson 16 h Self-study 29 h Total 45 h Work shadowing (hospitation) Lecture: contact lesson 16 h Self-study 14 h Total 30 h Self-discovery Lecture: contact lesson 32 h Self-study 13 h Total 45 h
Contents	/
Costs	CHF 5200 (around 4 330 euro)
Entry requirements	/
Dates	September – June/July (University semester)
Programme tutors	/
	Module 2: CAS music physiology intermediate
Duration	1 Year (2 semesters)
Goals	Completion of the module should enable the participants to: - Apply preventative measures in music pedagogy - Apply fundamental preventative elements and problem solving strategies for music physiology in the music lesson
Type of qualification	Certificate
Target group	Participants who have completed the first module
Structure of course	2. Module: Certificate course music physiology for music educators (intermediate) Individual lessons for main subject applied music physiology and teaching practice part 1 Lecture: contact lessons 16 h Self-study 194 h Total 210 h Music physiology on the stage part 1 Lecture: contact lessons 24 h Self-study 21 h Total 45 h Brain physiology Lecture: contact lesson 16 h Self-study 14 h Total 26 h Work shadowing intermediate (hospitation) Lecture: contact lesson 16 h Self-study 14 h Total 30 h Self-discovery intermediate Lecture: contact lesson 32 h Self-study 13 h Total 45 h
Contents	/
Costs	CHF 5200 (around 4 330 euro)

Entry requirements	Completion of module 1
Dates	September – June/July (university semester)
Programme tutors	/
	Module 3: CAS music physiology advanced
Duration	1 year (2 semesters)
Goals	Completion of the module should enable the participants to: • Run pedagogic-physiological courses as well as give consultations with the emphasis the their own instrument or voice • Work together with health professionals for prevention and finding solutions for work specific health problems
Type of qualification	Certificate
Target group	Participants who have completed the second module
Structure of course	3. Module: Certificate course music physiology for music educators (advanced) Individual lessons for main subject applied music physiology and teaching practice part 2 Lecture: contact lessons 16 h Self-study 194 h Total 210 h Music physiology on the stage part 2 Lecture: contact lessons 24 h Self-study 21 h Total 45 h Work shadowing advanced (hospitation) Lecture: contact lesson 16 h Self-study 14 h Total 30 h Self-discovery intermediate Lecture: contact lesson 32 h Self-study 13 h Total 45 h Self-discovery – no details given 1.5 ECTS credits
Contents	/
Costs	CHF 5200 (around 4 330 euro)
Entry requirements	Completion of module 2
Dates	September – June/July (university semester)
Programme tutors	/
	Master in advanced studies (MAS) music physiology
Duration	1 semester
Goals	Participants are able to summarize their knowledge from the previous modules and use this knowledge to complete a music physiology project as well as writing a theoretical paper and presenting it.
Type of qualification	/
Target group	Those who have completed all the modules (including the elective module)
Structure of course	Masters module from the field of music practice and music pedagogy Project management Lecture: contact lesson 12 h Self-study 18 h Total 30h Supervisor meetings 5 Supervisor meetings 5 h Self-study 25 h Total 30 h

Contents	/
Costs	CHF 1 800 (around 1 500 euro)
Entry requirements	48 ECTS points in the previous modules and study performance. An interview with the head of the programme.
Dates	Begins September or Feb/March
Programme tutors	/

The University of Arts in Zurich offers a three year, full time diploma course and a six month Masters course for performing musicians and teachers. A diploma is awarded after each year of the three year program. It is possibly the most comprehensive of its kind, giving musicians a comprehensive knowledge base in all physiological and psychological aspects of music making. Musicians can not only apply this knowledge to themselves and their students but eventually educate others (within limitations). The course is relatively expensive for central European standards costing 1800 Swiss Francs (approx. 4 330 euros) per year. The structure of the programme allows participants to build on their knowledge, expertise and competences in successive years, without being bound to a three year programme. In the first year, for example, one is only able to integrate the knowledge into one's own playing or singing while in the third year one is able to give consultations to other musicians and professionals. The consultation is limited to instrumentalist or singers who play the same instrument as the consultant. It is emphasized that participants should work together with health professionals and other educators to find solutions to problems.

Further information from the website and from the brochures:
<https://www.zhdk.ch/index.php?id=musikphysiologie>.

3. References

Barton, R. & J. R. Feinberg. 2008. "Effectiveness of an Educational Program in Health Promotion and Injury Prevention for Freshman Music Majors." *Medical Problems of Performing Artists*, 23 (2): 47–53.

López, T. M. & J. F. Martínez. 2013. "Strategies to Promote Health and Prevent Musculoskeletal Injuries in Students from the High Conservatory of Music of Salamanca, Spain." *Medical Problems of Performing Artists,* 18 (2): 100–106.

Spahn, C. 2011. "Prävention und Gesundheitsförderung." In *Musikermedizin: Diagnostik, Therapie und Prävention von Musikerspezifischen Erkrankungen*, edited by C. Spahn, B. Richter & E. Altenmüller, 50–79. Stuttgart: Schattauer.

Spahn, C., H. Hildebrandt & K. Seidenglanz. 2001. "Effectiveness of a Prophylactic Course to Prevent Playing-Related Health Problems of Music Students." *Medical Problems of Performing Artists,* 16 (1): 24–31.

Schwarz, G. 2012 "Musikphysiologie als Weiterbildungsstudium in der Schweiz" in *Österreichische Gesellschaft für Musik und Medizin (ÖGfMM) Newsletter*, edited by M. Bertsch, 3 (3):46–63.

Zander, M. F., E. Voltmer & C. Spahn. 2010. “Health Promotion and Prevention in Higher Music Education: Results of a Longitudinal Study.” *Medical Problems of Performing Artists*, 25 (2): 54–65.

Appendix D

This appendix presents all questions of the questionnaire interspersed with findings organised in tables and graphs

Section A: Personal and study profile

1. Please provide the following information. Where applicable tick the relevant box.

1.1 Age (years):

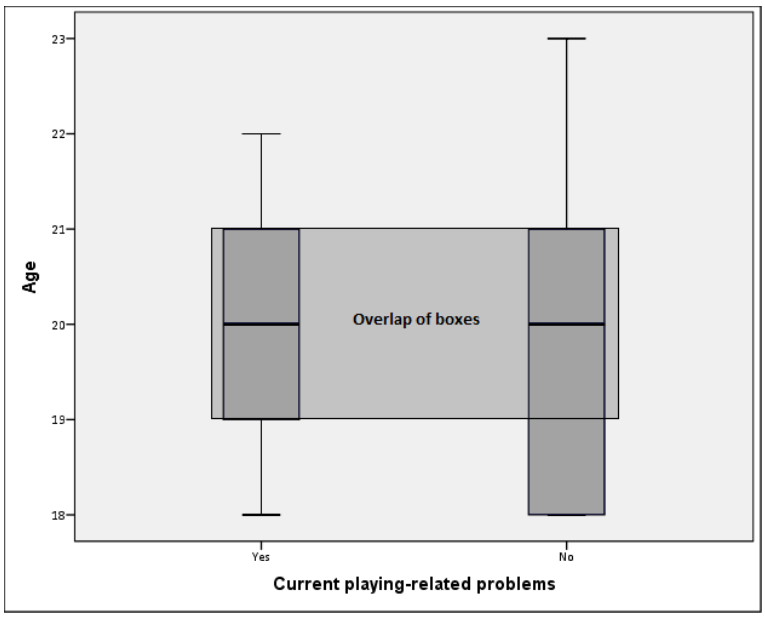
Descriptive statistic reflecting, means, medians and standard deviation

	Minimum	Percentile 25	Median	Percentile 75	Maximum	Mean	Standard Deviation
Age	18	19	20	21	23	20	1

The following three tables and graphs present the relationship between age and current, 12-month and lifetime prevalence of PRMDs:[48]

Age and current PRMDs reflecting, means, medians and standard deviation

		Age						
		Minimum	Percentile 25	Median	Percentile 75	Maximum	Mean	Standard Deviation
Current playing-related problems	Yes	18	19	20	21	22	20	1
	No	18	18	20	21	23	20	2

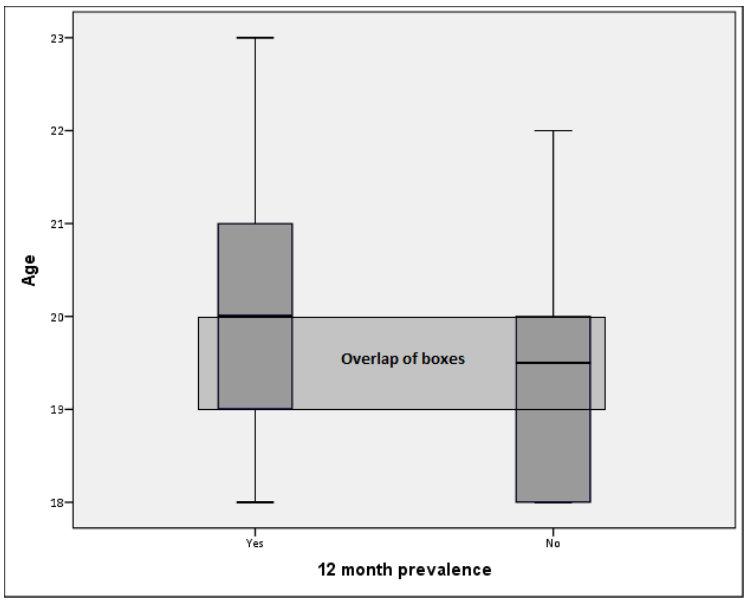


The graph above shows the that 50% of the respondents who ticked “Yes” were between the ages of 19–22, (symmetrical about the mean) while respondents who ticked “No” are between the ages of 18–22 (asymmetrical, positively skewed). The overlap of the boxes are indicative of a lack of statistical significance between those who do and those who do not have a current PRMD.

[48] Tests for statistical significance have been performed on all variables against current, 12-month and lifetime prevalance of PRMDs. The term “Lifetime” refers to the entire life of a respondent prior to the study. Current refers to a problem present at the time of the study.

Age and 12-month prevalence of PRMDs reflecting, means, medians and standard deviation

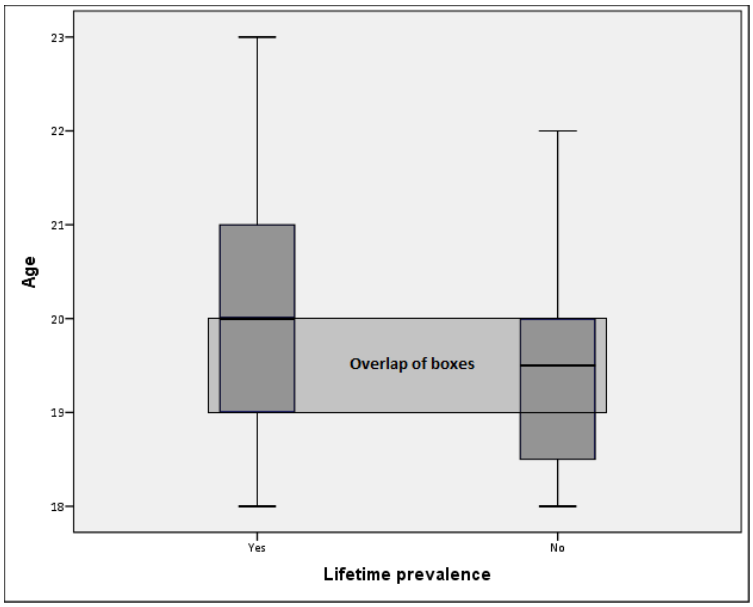
		Age						
		Minimum	Percentile 25	Median	Percentile 75	Maximum	Mean	Standard Deviation
12 month prevalence	Yes	18	19	20	21	23	20	1
	No	18	18	20	20	22	19	1



The graph above shows the that 50% of the respondents who ticked "Yes" were between the ages of 19–22, (symmetrical about the mean) while respondents who ticked "No" are between the ages of 18–20 (asymmetrical, positively skewed). The overlap of the boxes is indicative of a lack of statistical significance between those who do and those who do not have a current PRMD.

Age and lifetime PRMDs reflecting, means, medians and standard deviation

		Age						
		Minimum	Percentile 25	Median	Percentile 75	Maximum	Mean	Standard Deviation
Lifetime prevalence	Yes	18	19	20	21	23	20	1
	No	18	19	20	20	22	20	1



The graph above shows the that 50% of the respondents who ticked "Yes" were between the ages of 19–21, (symmetrical about the mean) while respondents who ticked "No" are between the ages of 18–22 (asymmetrical, positively skewed). The overlap of the boxes is indicative of a lack of statistical significance between those who do and those who do not have a current PRMD. Statistical test between age and PRMDs

Statistical test between age and PRMDs: The null hypothesis is that there is no correlation between age and prevalence of PRMDS.

Null Hypothesis	Test	p-value	Decision
Distribution of age is the same across categories of current PRMDs	Independent samples Mann-Whitney U-test	0.459	Fail to reject the null hypothesis
Distribution of age is the same across categories of 12-month prevalence of PRMDs	Independent samples Mann-Whitney U-test	0.245	Fail to reject the null hypothesis
Distribution of age is the same across categories of lifetime prevalence of PRMDs	Independent samples Mann-Whitney U-test	0.440	Fail to reject the null hypothesis

1.2 Gender: male ☐ female ☐

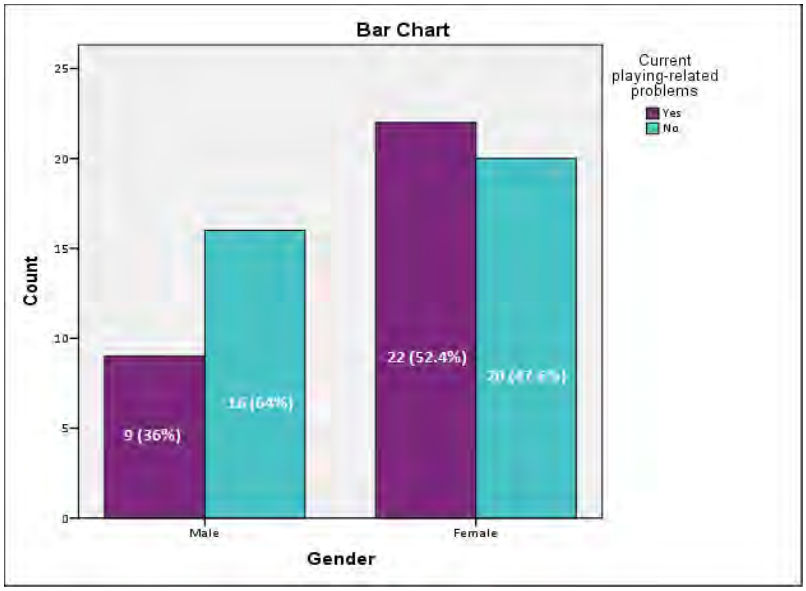
Gender distribution

n=67		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	25	37.3	37.3	37.3
	Female	42	62.7	62.7	100.0
	Total	67	100.0	100.0	

The following three tables and graphs present the relationship between gender and current, 12-month and lifetime prevalence of PRMDs:

Gender and current PRMDs

n=67			Current playing-related problems		Total
			Yes	No	
Gender	Male	Count	9	16	25
		% within Gender	36.0%	64.0%	100.0%
	Female	Count	22	20	42
		% within Gender	52.4%	47.6%	100.0%
Total		Count	31	36	67
		% within Gender	46.3%	53.7%	100.0%



The bar chart above shows the relationship between male and female respondents and the presence of a current PRMD.[49]

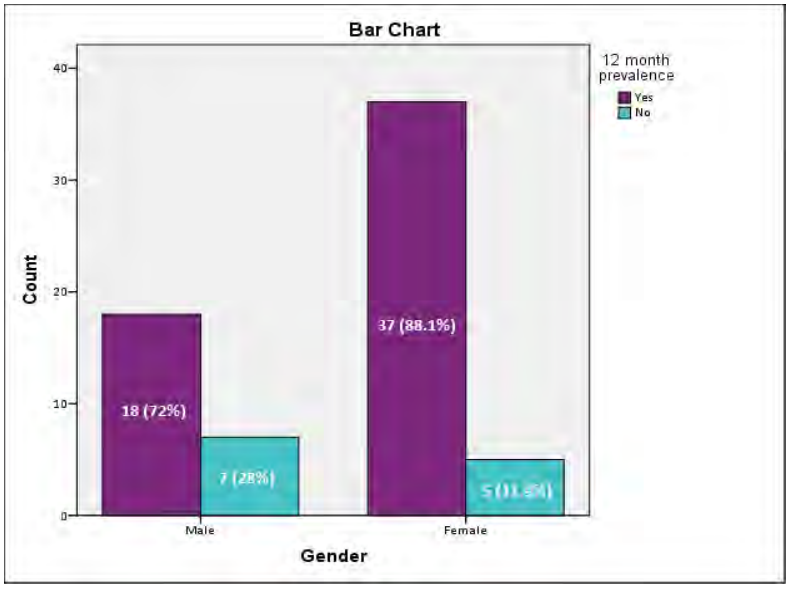
Statistical test for gender and current PRMDs

n=67	Value	df	P-value
Pearson Chi-Square	1.692[a]	1	0.193
Fisher's Exact Test			0.216

Gender and 12-month PRMDs

n=67			12-month prevalence		Total
			Yes	No	
Gender	Male	Count	18	7	25
		% within Gender	72.0%	28.0%	100.0%
	Female	Count	37	5	42
		% within Gender	88.1%	11.9%	100.0%
Total		Count	55	12	67
		% within Gender	82.1%	17.9%	100.0%

[49] In all relevant graphs, "Count" refers to the number of respondents or responses.



The bar chart above shows the relationship between male and female respondents and the presence of a PRMD in the past 12 months.

Statistical test for gender and 12-month PRMDs

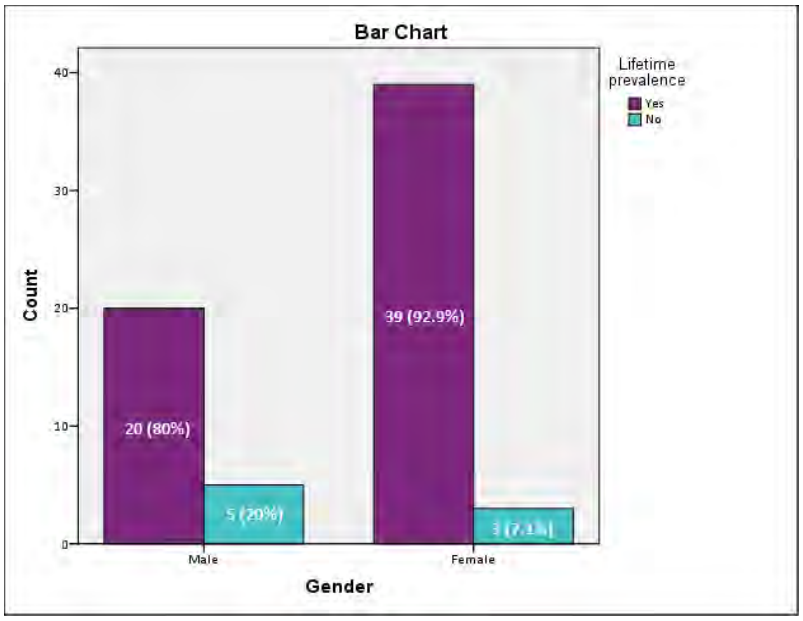
n=67	Value	df	P-value
Pearson Chi-Square	2.761[a]	1	0.097
Fisher's Exact Test			0.112

[a] One of the cells of the cross-tabulation table (25.0%) has an expected count less than 5. The minimum expected count is 4.48.[50]

Gender and lifetime PRMDs

			Lifetime prevalence		Total
			Yes	No	
Gender	Male	Count	20	5	25
		% within Gender	80.0%	20.0%	100.0%
	Female	Count	39	3	42
		% within Gender	92.9%	7.1%	100.0%
Total		Count	59	8	67
		% within Gender	88.1%	11.9%	100.0%

[50] For all cells in the cross-tabulation tables of categorical variables with an expected cell count that is less than 5 the value for the Fisher's exact test was used. The expected cell count is calculated by multiplying the sum of the corresponding row of the cell by the sum of the corresponding column of the cell and dividing the product by the total n.



The bar chart above shows the relationship between male and female respondents and the presence of a PRMD in the respondents lifetime.

Statistical test for gender and lifetime PRMDs

n=67	Value	df	P-value
Pearson Chi-Square	2.464[a]	1	0.116
Fisher's Exact Test			0.138

[a] One of the cells of the crosstabulation table (25.0%) has an expected count less than 5. The minimum expected count is 2.99.

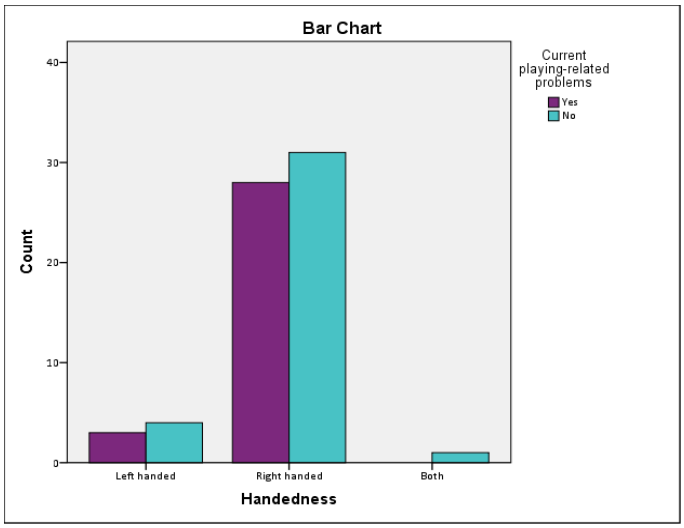
1.3 You are: left handed ☐ right handed ☐

Distribution of handedness

n=66		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Left handed	7	10.4	10.4	10.4
	Right handed	59	88.1	88.1	98.5
	Both	1	1.5	1.5	100.0
	Total	67	100.0	100.0	

Handedness and Current playing-related PRMDs

n=66			Current playing-related problems		Total
			Yes	No	
Handedness	Left handed	Count	3	4	7
		% within Current playing-related problems	9.7%	11.4%	10.6%
	Right handed	Count	28	31	59
		% within Current playing-related problems	90.3%	88.6%	89.4%
Total		Count	31	35	66
		% within Current playing-related problems	100.0%	100.0%	100.0%



The bar chart above shows the relationship between handedness and the presence of a current PRMD.

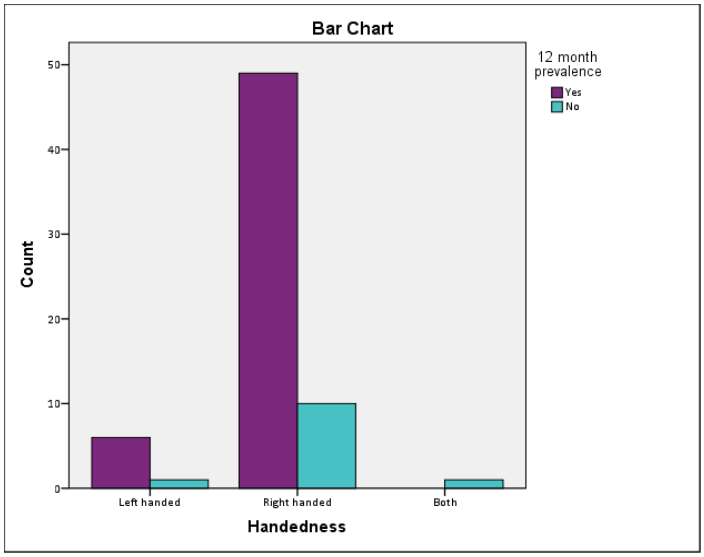
Statistical test for handedness and current PRMDs

n=66	Value	df	P-value
Pearson Chi-Square	0.053[a]	1	0.818
Fisher's Exact Test			1.000

[a]Two cells of the cross-tabulation table (50.0%) have an expected count less than 5. The minimum expected count is 3.29.

Handedness and 12 month prevalence

			12 month prevalence		Total
			Yes	No	
Handedness	Left handed	Count	6	1	7
		% within 12-month prevalence	10.9%	9.1%	10.6%
	Right handed	Count	49	10	59
		% within 12-month prevalence	89.1%	90.9%	89.4%
Total		Count	55	11	66
		% within 12-month prevalence	100.0%	100.0%	100.0%



The bar chart above shows the relationship between male and female and the presence of a PRMD in the past 12 months.

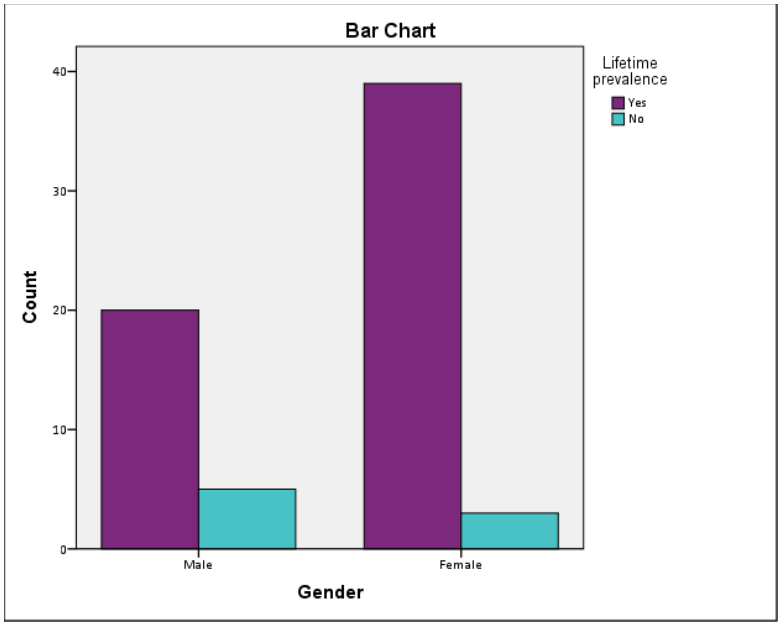
Statistical test for handedness and 12 month PRMDs

n=66	Value	df	P-value
Pearson Chi-Square	.032[a]	1	.858
Fisher's Exact Test			1.000

[a]One cell of the cross-tabulation table (25.0%) has an expected count less than 5. The minimum expected count is 1.17.

Handedness and Lifetime prevalence

			Lifetime prevalence		Total
			Yes	No	
Handedness	Left handed	Count	7	0	7
		% within Lifetime prevalence	11.9%	0.0%	10.6%
	Right handed	Count	52	7	59
		% within Lifetime prevalence	88.1%	100.0%	89.4%
Total		Count	59	7	66
		% within Lifetime prevalence	100.0%	100.0%	100.0%



The bar chart above shows the relationship between male and female and the presence of a PRMD in the respondents' lifetime

Statistical test for handedness and lifetime PRMDs

n=66	Value	df	P-value
Pearson Chi-Square	0.929[a]	1	0.335
Fisher's Exact Test			1.000

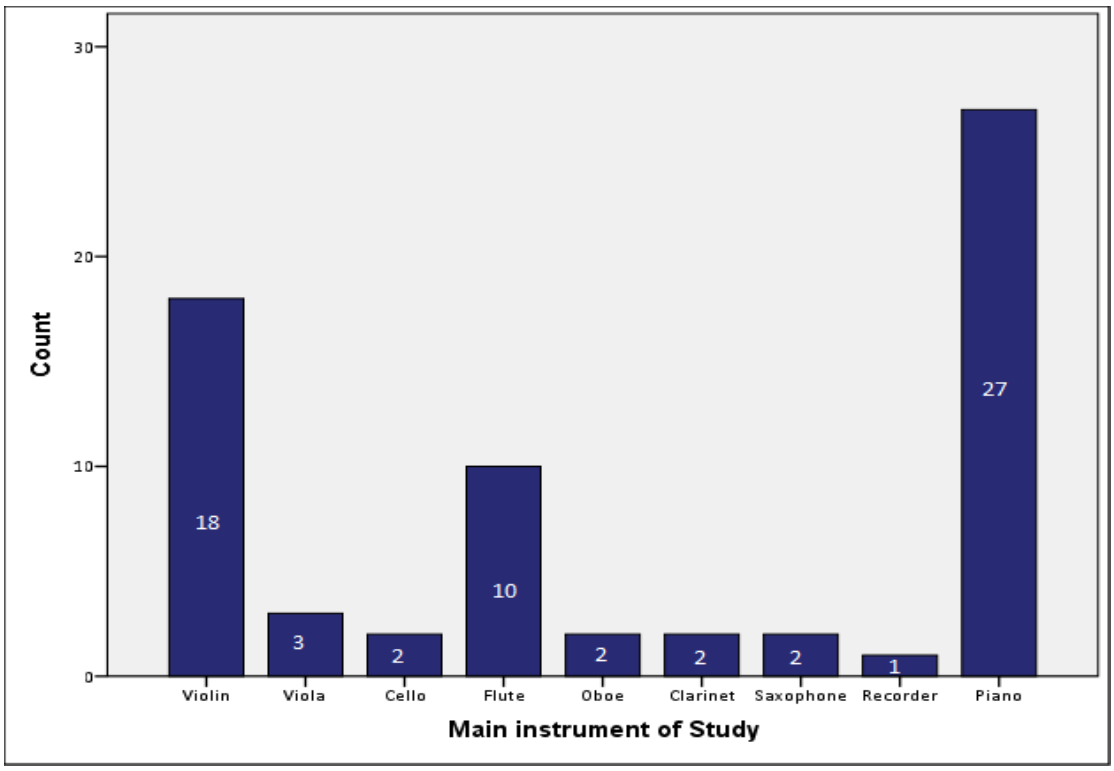
[a]One cell of the cross-tabulation table (25.0%) has an expected count less than 5. The minimum expected count is 0.74.

2. Please answer the following questions:

2.1 What is your main instrument of study?_____

Distribution of main instruments played

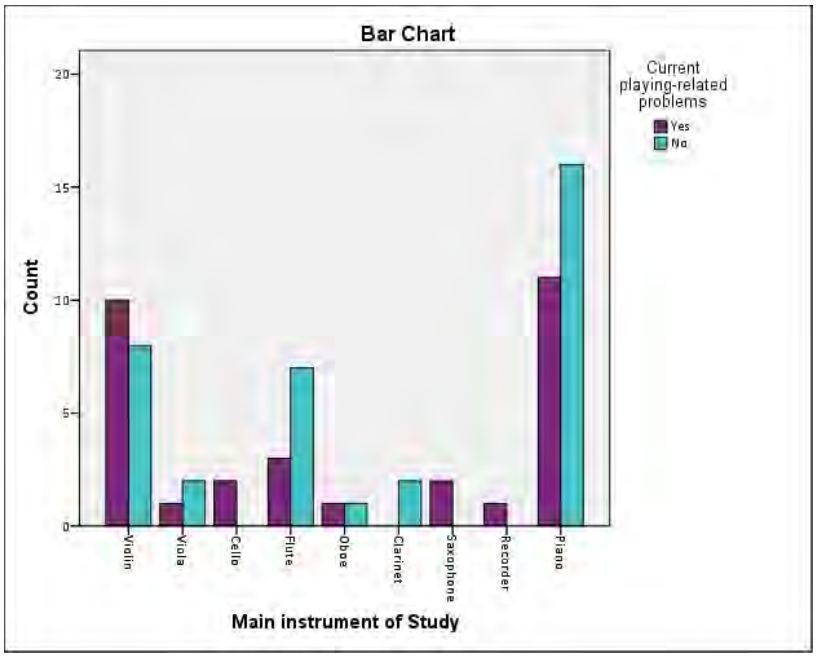
n=67		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Violin	18	26.9	26.9	26.9
	Viola	3	4.5	4.5	31.3
	Cello	2	3.0	3.0	34.3
	Flute	10	14.9	14.9	49.3
	Oboe	2	3.0	3.0	52.2
	Clarinet	2	3.0	3.0	55.2
	Saxophone	2	3.0	3.0	58.2
	Recorder	1	1.5	1.5	59.7
	Piano	27	40.3	40.3	100.0
	Total	67	100.0	100.0	



Bar chart showing the distribution of the main instruments played by respondents

Main instrument played and current PRMDs

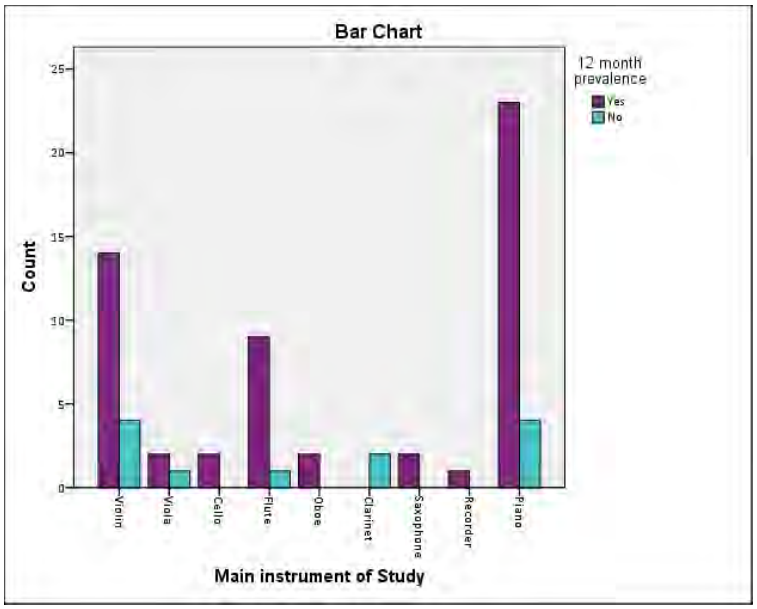
			Current playing-related problems		
			Yes	No	Total
Main instrument of Study	Violin	Count	10	8	18
		% within Main instrument of Study	55.6%	44.4%	100.0%
	Viola	Count	1	2	3
		% within Main instrument of Study	33.3%	66.7%	100.0%
	Cello	Count	2	0	2
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Flute	Count	3	7	10
		% within Main instrument of Study	30.0%	70.0%	100.0%
	Oboe	Count	1	1	2
		% within Main instrument of Study	50.0%	50.0%	100.0%
	Clarinet	Count	0	2	2
		% within Main instrument of Study	0.0%	100.0%	100.0%
	Saxophone	Count	2	0	2
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Recorder	Count	1	0	1
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Piano	Count	11	16	27
		% within Main instrument of Study	40.7%	59.3%	100.0%
Total		Count	31	36	67
		% within Main instrument of Study	46.3%	53.7%	100.0%



The bar chart above shows the relationship between main instrument played and the presence of a current PRMD.

Main instrument played and 12 month prevalence

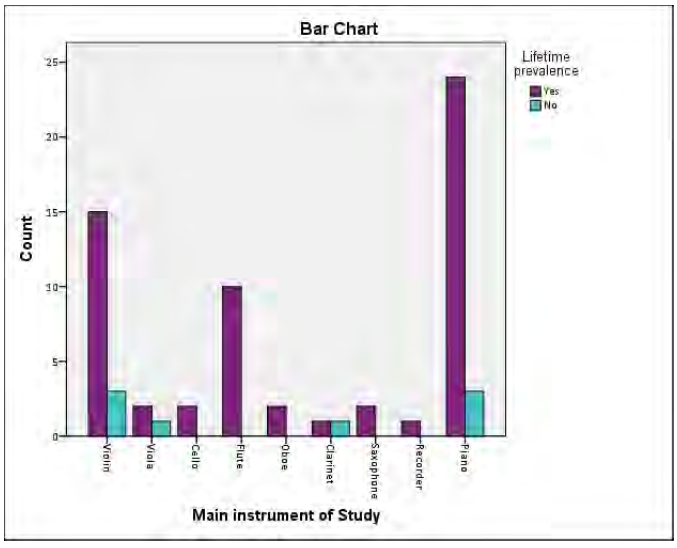
			12 month prevalence		Total
			Yes	No	
Main instrument of Study	Violin	Count	14	4	18
		% within Main instrument of Study	77.8%	22.2%	100.0%
	Viola	Count	2	1	3
		% within Main instrument of Study	66.7%	33.3%	100.0%
	Cello	Count	2	0	2
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Flute	Count	9	1	10
		% within Main instrument of Study	90.0%	10.0%	100.0%
	Oboe	Count	2	0	2
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Clarinet	Count	0	2	2
		% within Main instrument of Study	0.0%	100.0%	100.0%
	Saxophone	Count	2	0	2
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Recorder	Count	1	0	1
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Piano	Count	23	4	27
		% within Main instrument of Study	85.2%	14.8%	100.0%
Total		Count	55	12	67
		% within Main instrument of Study	82.1%	17.9%	100.0%



The bar chart above shows the relationship between main instrument played and the presence of a PRMD within the past 12 months.

Main instrument played and lifetime prevalence of PRMDs

			Lifetime prevalence		Total
			Yes	No	
Main instrument of Study	Violin	Count	15	3	18
		% within Main instrument of Study	83.3%	16.7%	100.0%
	Viola	Count	2	1	3
		% within Main instrument of Study	66.7%	33.3%	100.0%
	Cello	Count	2	0	2
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Flute	Count	10	0	10
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Oboe	Count	2	0	2
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Clarinet	Count	1	1	2
		% within Main instrument of Study	50.0%	50.0%	100.0%
	Saxophone	Count	2	0	2
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Recorder	Count	1	0	1
		% within Main instrument of Study	100.0%	0.0%	100.0%
	Piano	Count	24	3	27
		% within Main instrument of Study	88.9%	11.1%	100.0%
Total		Count	59	8	67
		% within Main instrument of Study	88.1%	11.9%	100.0%



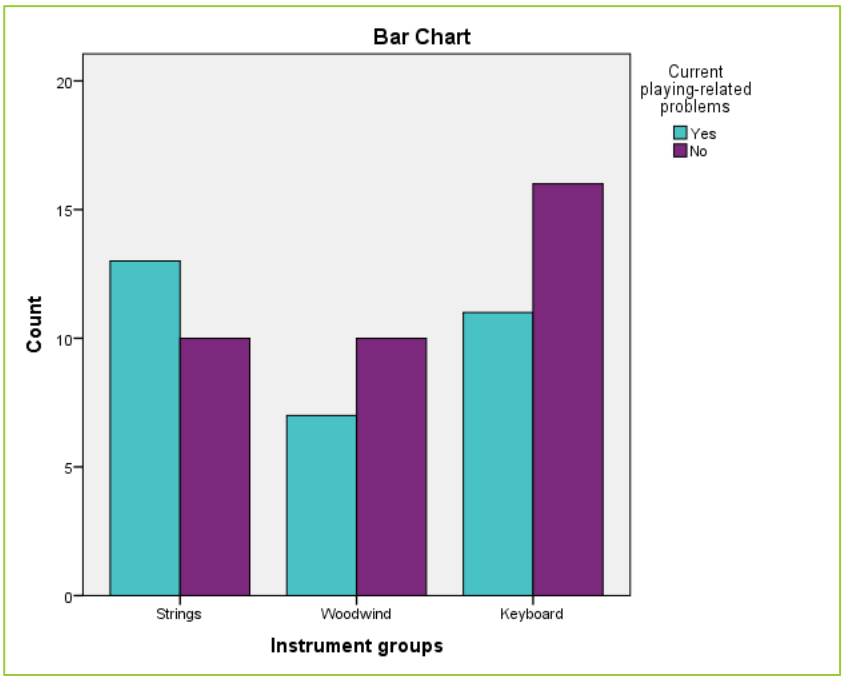
The bar chart above shows the relationship between main instrument played and the presence of a PRMD within a respondent's lifetime.

Grouping together the instruments into their instrumental families:

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Strings	23	34.3	34.3	34.3
	Woodwind	17	25.4	25.4	59.7
	Keyboard	27	40.3	40.3	100.0
	Total	67	100.0	100.0	

Instrument groups and current PRMDs

			Current playing-related problems		
			Yes	No	Total
Instrument groups	Strings	Count	13	10	23
		% within Current playing-related problems	41.9%	27.8%	34.3%
	Woodwind	Count	7	10	17
		% within Current playing-related problems	22.6%	27.8%	25.4%
	Keyboard	Count	11	16	27
		% within Current playing-related problems	35.5%	44.4%	40.3%
Total		Count	31	36	67
		% within Current playing-related problems	100.0%	100.0%	100.0%



Bar char showing the relationship between the instrument groups and the presence of a current PRMDs

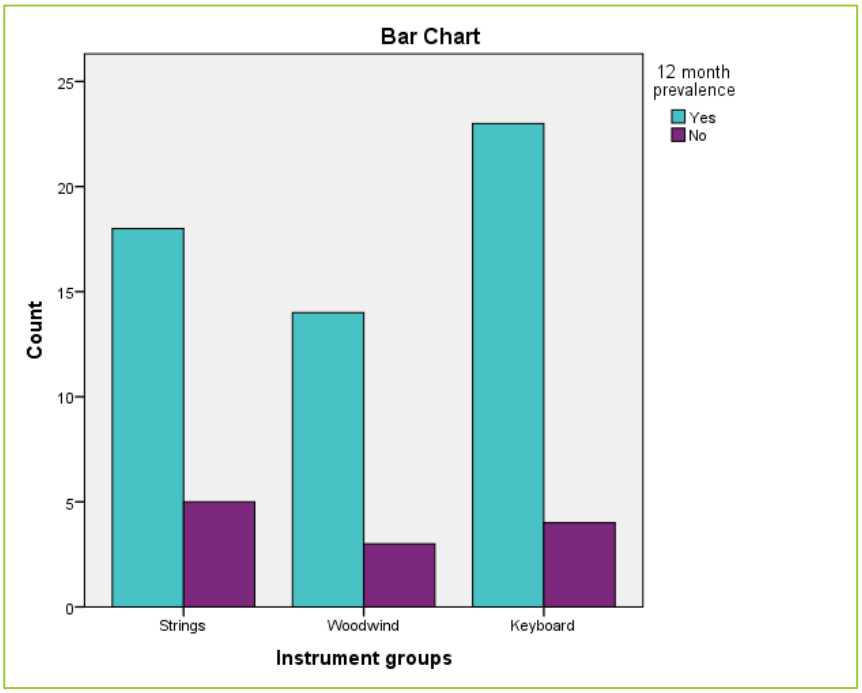
Statistical test for and current PRMDs

n=66	Value	df	P-value
Pearson Chi-Square	.053[a]	1	.818
Fisher's Exact Test			1.000

[a]Two cells of the cross-tabulation table (50.0%) have an expected count less than 5. The minimum expected count is 3.29.

Instrument groups and 12 month PRMDs

			12 month prevalence		
			Yes	No	Total
Instrument groups	Strings	Count	18	5	23
		% within 12 month prevalence	32.7%	41.7%	34.3%
	Woodwind	Count	14	3	17
		% within 12 month prevalence	25.5%	25.0%	25.4%
	Keyboard	Count	23	4	27
		% within 12 month prevalence	41.8%	33.3%	40.3%
Total		Count	55	12	67
		% within 12 month prevalence	100.0 %	100.0 %	100.0 %



Bar chart showing the relationship between the instrument groups and 12 month PRMDs

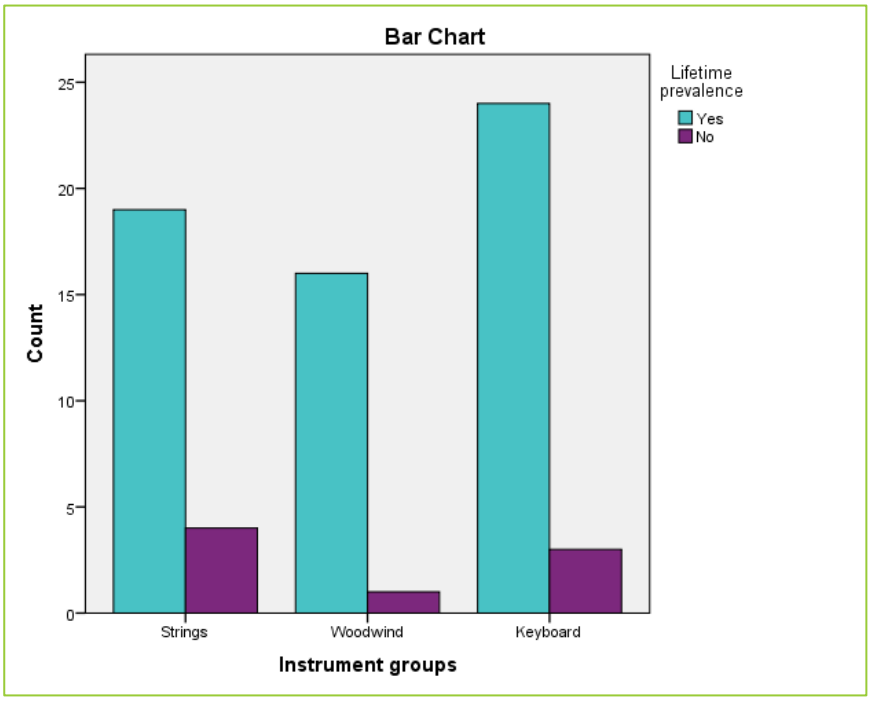
Statistical test for instrument groups and 12 month PRMDs

n=66	Value	df	P-value
Pearson Chi-Square	.032[a]	1	.858
Fisher's Exact Test			1.000

[a]One cell of the cross-tabulation table (25.0%) has an expected count less than 5. The minimum expected count is 1.17.

Instrument groups and lifetime prevalence

			Lifetime prevalence		
			Yes	No	Total
Instrument groups	Strings	Count	19	4	23
		% within Lifetime prevalence	32.2%	50.0%	34.3%
	Woodwind	Count	16	1	17
		% within Lifetime prevalence	27.1%	12.5%	25.4%
	Keyboard	Count	24	3	27
		% within Lifetime prevalence	40.7%	37.5%	40.3%
Total		Count	59	8	67
		% within Lifetime prevalence	100.0 %	100.0 %	100.0 %



Bar chart showing the relationship between the instrumental groups and lifetime prevalence

Statistical test for instrumental groups and lifetime PRMDs

n=66	Value	df	P-value
Pearson Chi-Square	0.929[a]	1	0.335
Fisher's Exact Test			1.000

[a]One cell of the cross-tabulation table (25.0%) has an expected count less than 5. The minimum expected count is 0.74.

2.2 How long have you been playing this instrument (years)?

Summary of the continuous variables:

	Minimum	Percentile 25	Median	Percentile 75	Maximum	Mean	Standard Deviation
No. of years playing the main instrument	0.5	9.0	11.0	13.0	17.0	10.8	3.1

Exclusion of the person with the 0.5 years of playing

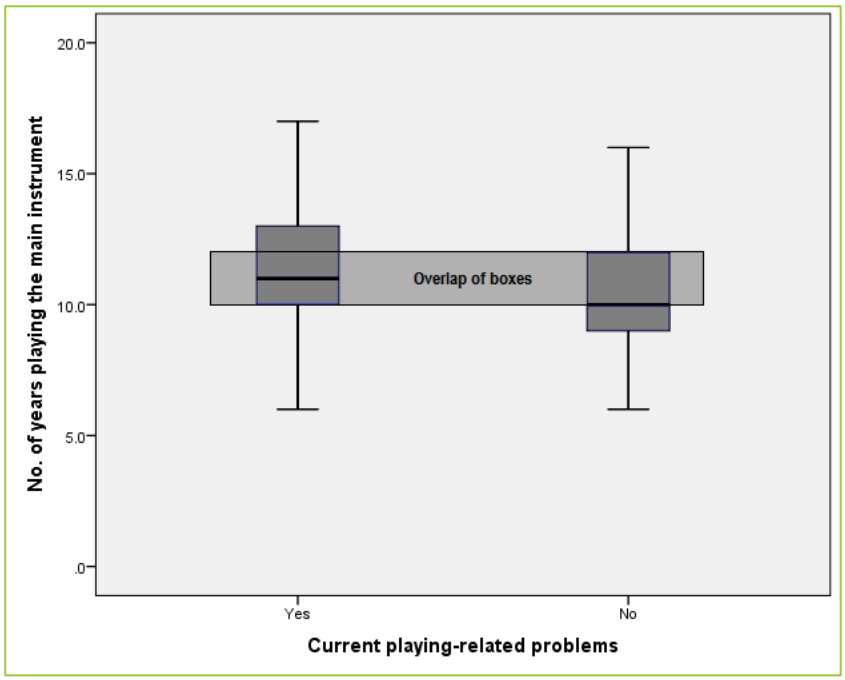
	Minimum	Percentile 25	Median	Percentile 75	Maximum	Mean	Standard Deviation
No. of years playing the main instrument	4.0	9.0	11.0	13.0	17.0	11.0	2.9

As the mean is not significantly affected, the low value is kept in the data set

Number of years playing the main instrument and current PRMDs

Case Processing Summary

	Current playing-related problems	Cases					
		Valid		Missing		Total	
		N	Percent	N	Percent	N	Percent
No. of years playing the main instrument	Yes	31	100.0%	0	0.0%	31	100.0%
	No	35	97.2%	1	2.8%	36	100.0%



Boxplots of the number of years playing for those with current problems and those without

Statistical test for the number of years playing and current PRMDs

This first table summarises the data for number of years playing and presence of a PRMD

Group Statistics

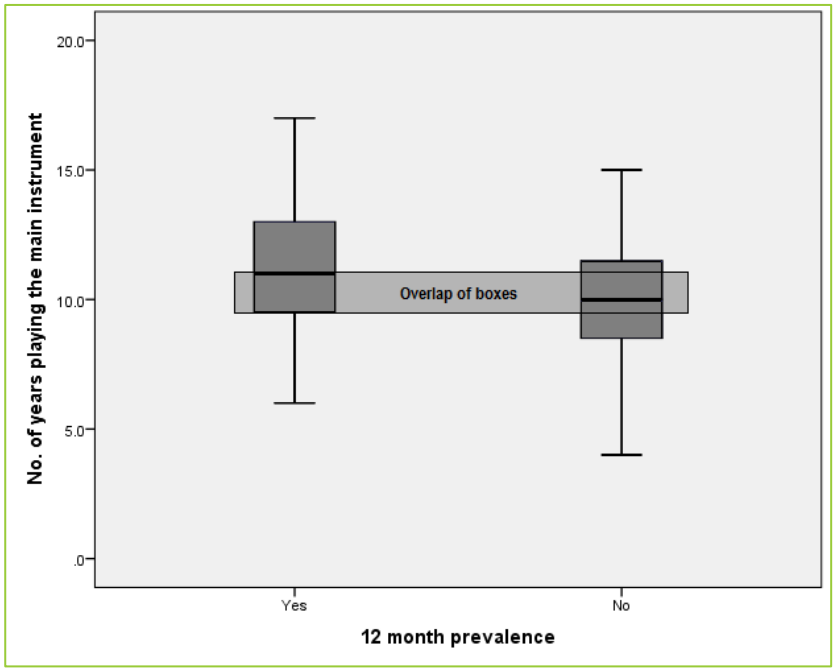
	Current playing-related problems	N	Mean	Std Deviation	Std Error Mean
No. of years playing the main instrument	Yes	31	11.226	3.3162	0.5956
	No	35	10.457	2.9240	0.4942

The table below shows the results of the t-test, which assumes unequal variances in the two groups:

t-test for Equality of Means				
			95% Confidence Interval of the Difference	
P-value	Mean Difference	Std. Error Difference	Lower	Upper
0.325	0.7687	0.7740	-0.7793	2.3167

Number of years playing and presence of a current PRMD

Case Processing Summary							
N=66		Cases					
		Valid		Missing		Total	
	12 month prevalence	N	Percent	N	Percent	N	Percent
No. of years playing the main instrument	Yes	55	100.0%	0	0.0%	55	100.0%
	No	11	91.7%	1	8.3%	12	100.0%



Boxplots of the number of years playing for those with PRMDs within the past 12 month and those without.

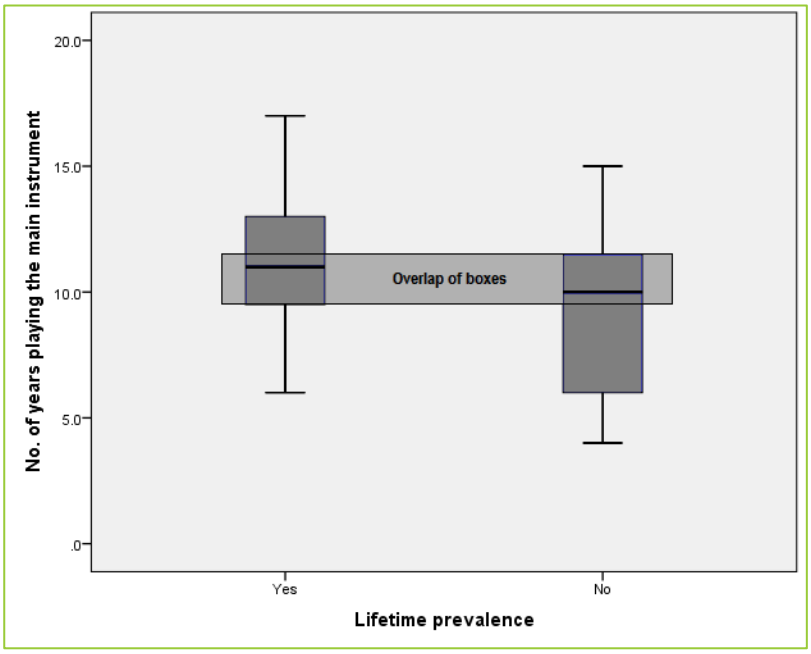
Statistical test for the number of years playing and 12 month PRMD prevalence

Group Statistics					
	12 month prevalence	N	Mean	Std Deviation	Std Error Mean
No. of years playing the main instrument	Yes	55	11.073	3.0435	0.4104
	No	11	9.545	3.2974	0.9942

Degrees of freedom	*p*-value	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
				Lower	Upper
64	0.139	1.5273	1.0188	-0.5080	3.5626
13.625	0.178	1.5273	1.0756	-0.7856	3.8401

Number of years playing the main instrument and lifetime prevalence of PRMDs

Case Processing Summary							
		Cases					
		Valid		Missing		Total	
	Lifetime prevalence	N	Percent	N	Percent	N	Percent
No. of years playing the main instrument	Yes	59	100.0%	0	0.0%	59	100.0%
	No	7	87.5%	1	12.5%	8	100.0%



Boxplots of the number of years playing for those with a PRMDs within the lifetime and those without.

Statistical test for the number of years playing and lifetime PRMD prevalence

Group Statistics					
	Lifetime prevalence	N	Mean	Std. Deviation	Std. Error Mean
No. of years playing the main instrument	Yes	59	11.017	2.9580	.3851
	No	7	9.143	4.0999	1.5496

t-test for Equality of Means						
					95% Confidence Interval of the Difference	
t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
1.521	64	0.133	1.8741	1.2325	-0.5881	4.3363
1.174	6.761	0.280	1.8741	1.5968	-1.9289	5.6770

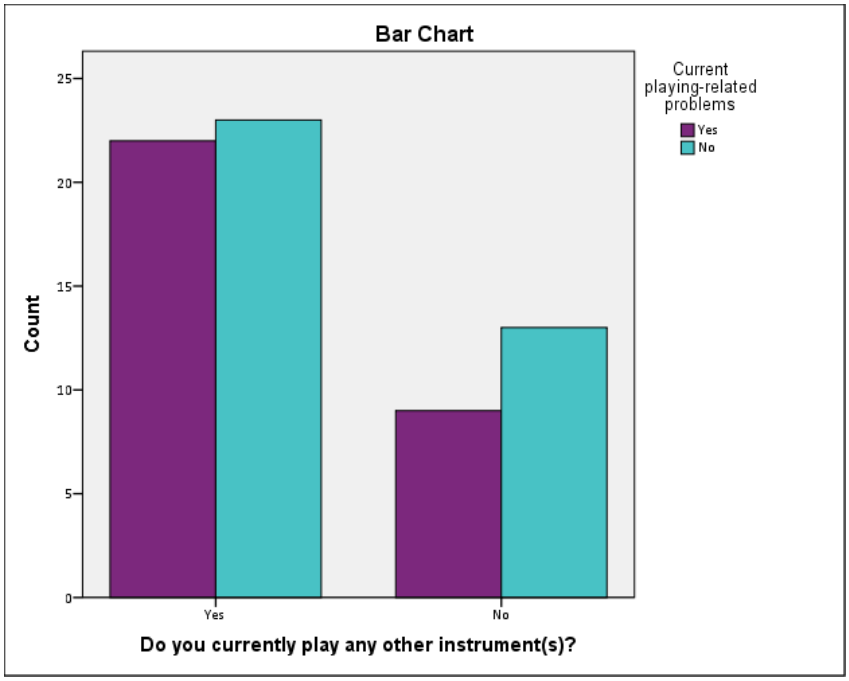
2.3 Do you currently play any other instrument(s)? Yes ☐ No ☐

"Yes" and "No" answers for playing another instrument

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	45	67.2	67.2	67.2
	No	22	32.8	32.8	100.0
	Total	67	100.0	100.0	

Playing another instrument and presence of current PRMDs

			Current playing-related problems		
			Yes	No	Total
Do you currently play any other instrument(s)?	Yes	Count	22	23	45
		% within Do you currently play any other instrument(s)?	48.9%	51.1%	100.0%
	No	Count	9	13	22
		% within Do you currently play any other instrument(s)?	40.9%	59.1%	100.0%
Total		Count	31	36	67
		% within Do you currently play any other instrument(s)?	46.3%	53.7%	100.0%



Bar chart showing the relationship between playing another instrument and current PRMDs

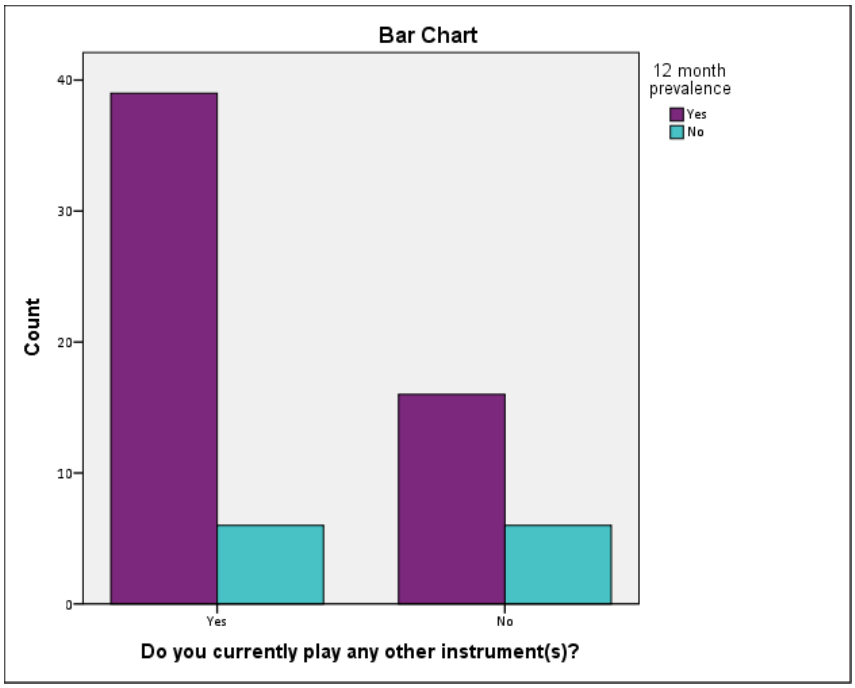
Statistical test for playing another instrument and current PRMDs

n=67	Value	df	P-value
Pearson Chi-Square	0.378[a]	1	0.538
Fisher's Exact Test			0.608

[a]No cells of the cross-tabulation table (0.0%) have expected count less than 5. The minimum expected count is 10.18.

Playing another instrument and 12 month prevalence of PRMDs

			12 month prevalence		Total
			Yes	No	
Do you currently play any other instrument(s)?	Yes	Count	39	6	45
		% within Do you currently play any other instrument(s)?	86.7%	13.3%	100.0%
	No	Count	16	6	22
		% within Do you currently play any other instrument(s)?	72.7%	27.3%	100.0%
Total		Count	55	12	67
		% within Do you currently play any other instrument(s)?	82.1%	17.9%	100.0%



Bar chart showing the relationship between playing another instrument and 12 month prevalence

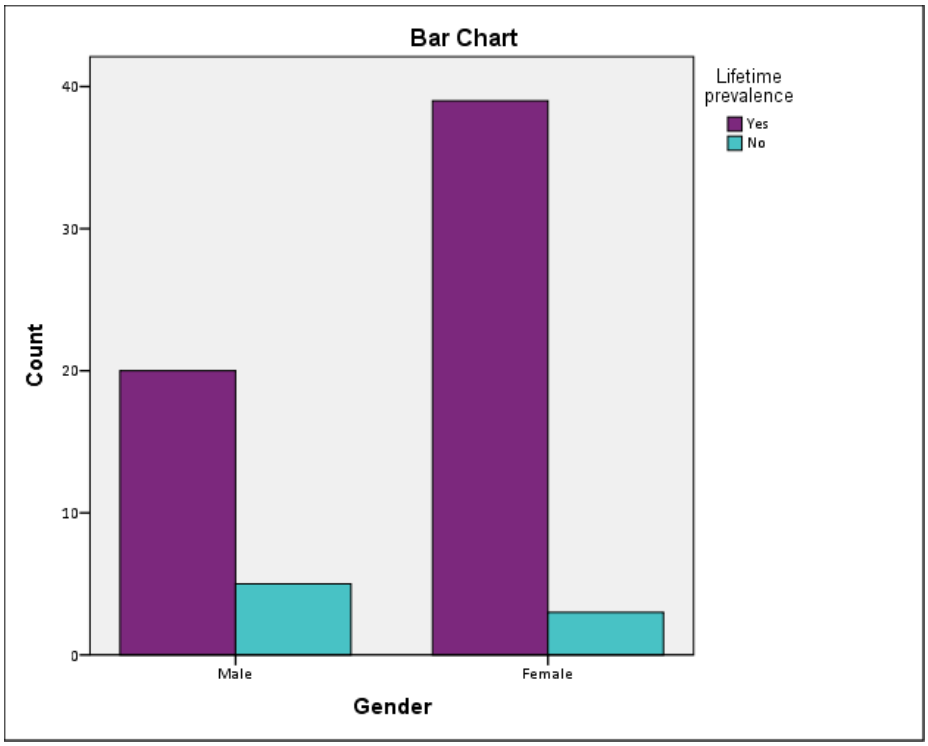
Statistical test for playing another instrument and 12 month prevalence

n=67	Value	df	P-value
Pearson Chi-Square	1.953[a]	1	0.162
Fisher's Exact Test			0.187

[a]One cell of the cross-tabulation table (25.0%) has an expected count less than 5. The minimum expected count is 3.94.

Playing another instrument and lifetime prevalence of PRMDs

			Lifetime prevalence		Total
			Yes	No	
Do you currently play any other instrument(s)?	Yes	Count	42	3	45
		% within Do you currently play any other instrument(s)?	93.3%	6.7%	100.0%
	No	Count	17	5	22
		% within Do you currently play any other instrument(s)?	77.3%	22.7%	100.0%
Total		Count	59	8	67
		% within Do you currently play any other instrument(s)?	88.1%	11.9%	100.0%



Bar chart showing the relationship between playing another instrument and lifetime prevalence

Statistical test for playing another instrument and lifetime prevalence

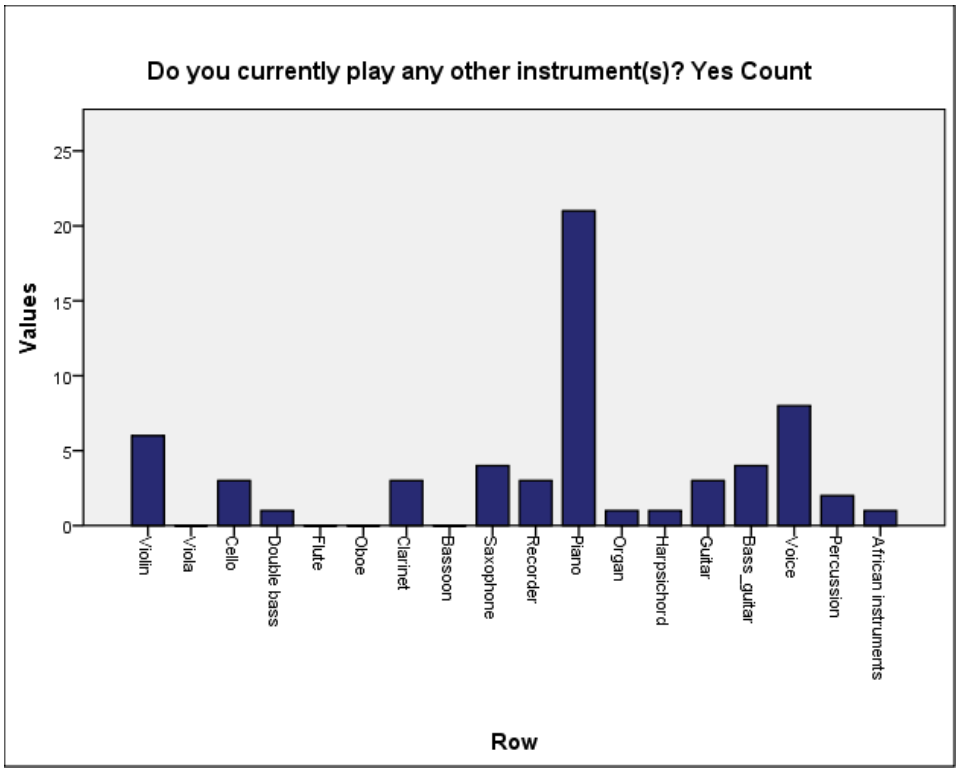
n=67	Value	df	P-value
Pearson Chi-Square	3.625[a]	1	0.057
Fisher's Exact Test			0.103

[a]One cell of the cross-tabulation table (25.0%) has an expected count less than 5. The minimum expected count is 2.63.

2.4 If yes, which other instrument(s) do you play?_____

Distribution of "other" instruments played

n = 45		Do you currently play any other instrument(s)?			
		Yes		No	
		Count	Column N %	Count	Column N %
Violin	No	39	86.7%	0	0.0%
	Yes	6	13.3%	0	0.0%
Viola	No	45	100.0%	0	0.0%
	Yes	0	0.0%	0	0.0%
Cello	No	42	93.3%	0	0.0%
	Yes	3	6.7%	0	0.0%
Double bass	No	44	97.8%	0	0.0%
	Yes	1	2.2%	0	0.0%
Flute	No	45	100.0%	0	0.0%
	Yes	0	0.0%	0	0.0%
Oboe	No	45	100.0%	0	0.0%
	Yes	0	0.0%	0	0.0%
Clarinet	No	42	93.3%	0	0.0%
	Yes	3	6.7%	0	0.0%
Bassoon	No	45	100.0%	0	0.0%
	Yes	0	0.0%	0	0.0%
Saxophone	No	41	91.1%	0	0.0%
	Yes	4	8.9%	0	0.0%
Recorder	No	42	93.3%	0	0.0%
	Yes	3	6.7%	0	0.0%
Piano	No	24	53.3%	0	0.0%
	Yes	21	46.7%	0	0.0%
Organ	No	44	97.8%	0	0.0%
	Yes	1	2.2%	0	0.0%
Harpsichord	No	44	97.8%	0	0.0%
	Yes	1	2.2%	0	0.0%
Guitar	No	42	93.3%	0	0.0%
	Yes	3	6.7%	0	0.0%
Bass guitar	No	41	91.1%	0	0.0%
	Yes	4	8.9%	0	0.0%
Voice	No	37	82.2%	0	0.0%
	Yes	8	17.8%	0	0.0%
Percussion	No	43	95.6%	0	0.0%
	Yes	2	4.4%	0	0.0%
African instruments	No	44	97.8%	0	0.0%
	Yes	1	2.2%	0	0.0%



Bar chart showing the distribution of "other" instruments played

2.5 What program are you currently registered for?

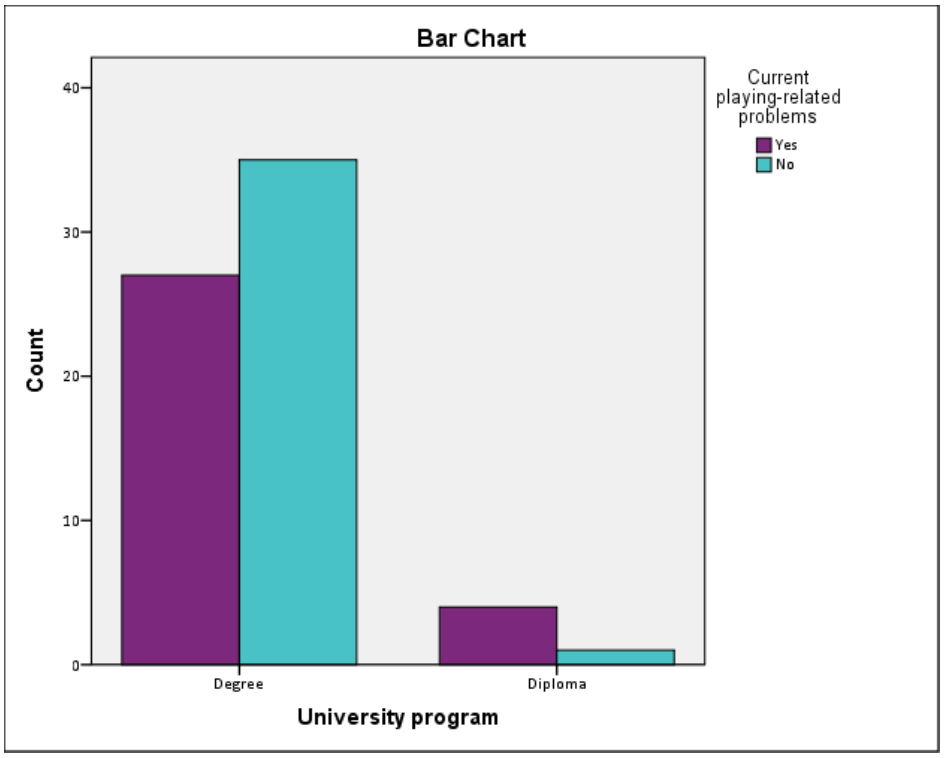
Degree ☐ Diploma ☐

Distribution of university programme

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Degree	62	92.5	92.5	92.5
	Diploma	5	7.5	7.5	100.0
	Total	67	100.0	100.0	

University programme and current PRMDs

			Current playing-related problems		
			Yes	No	Total
University program	Degree	Count	27	35	62
		% within University program	43.5%	56.5%	100.0%
	Diploma	Count	4	1	5
		% within University program	80.0%	20.0%	100.0%
Total		Count	31	36	67
		% within University program	46.3%	53.7%	100.0%



Bar chart showing the relationship between the university programmes and current PRMDs

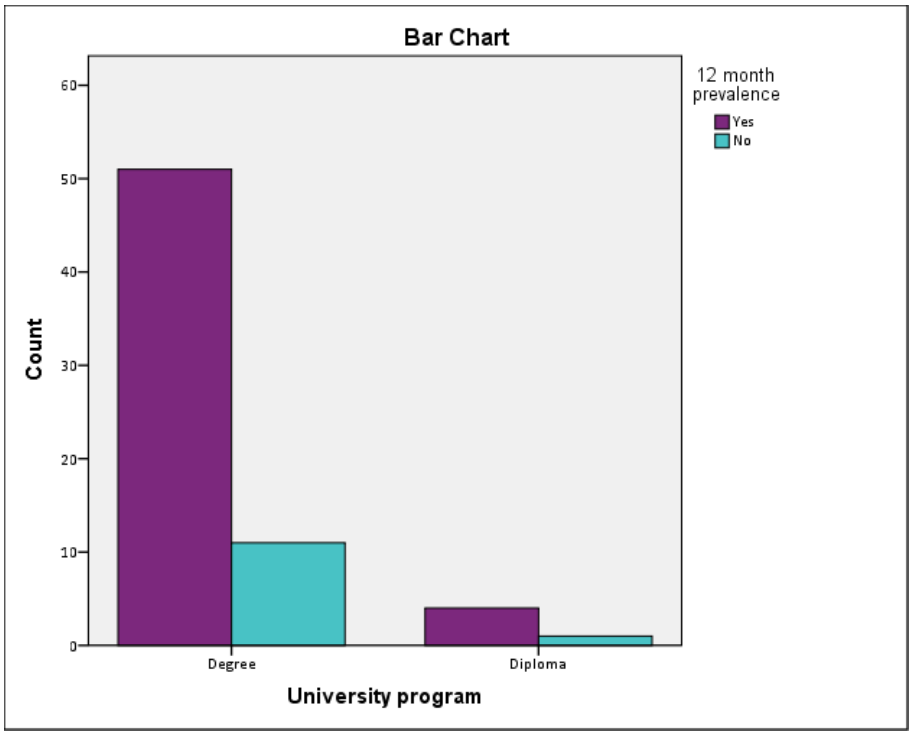
Statistical test for the university programme and current PRMDs

n=67	Value	df	P-value
Pearson Chi-Square	2.473[a]	1	0.116
Fisher's Exact Test			0.174

[a]Two cells of the cross-tabulation table (50.0%) have an expected count less than 5. The minimum expected count is 2.31.

University programme and 12 month prevalence of PRMDs

			12 month prevalence		Total
			Yes	No	
University program	Degree	Count	51	11	62
		% within University program	82.3%	17.7%	100.0%
	Diploma	Count	4	1	5
		% within University program	80.0%	20.0%	100.0%
Total		Count	55	12	67
		% within University program	82.1%	17.9%	100.0%



Bar chart showing the relationship between the university programme and12 month prevalence

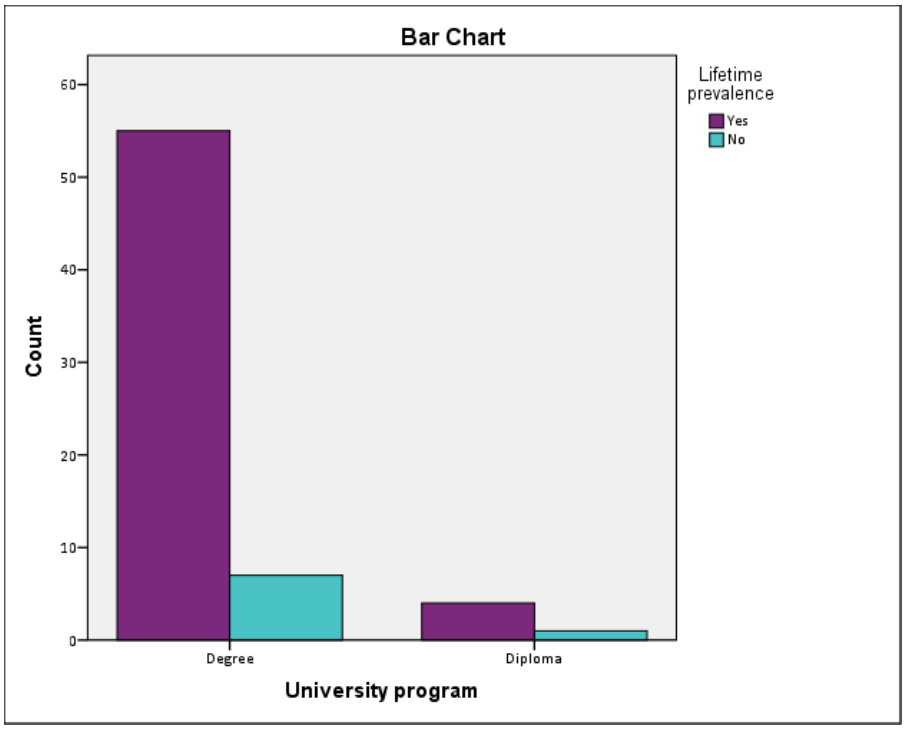
Statistical test for the university programme and 12 month prevalence of PRMDs

n=67	Value	df	P-value
Pearson Chi-Square	.016[a]	1	.899
Fisher's Exact Test			1.000

[a]Two cells of the cross-tabulation table (50.0%) have an expected count less than 5. The minimum expected count is 0.90.

University programme and lifetime prevalence of PRMDs

			Lifetime prevalence		Total
			Yes	No	
University program	Degree	Count	55	7	62
		% within University program	88.7%	11.3%	100.0%
	Diploma	Count	4	1	5
		% within University program	80.0%	20.0%	100.0%
Total		Count	59	8	67
		% within University program	88.1%	11.9%	100.0%



Bar chart showing the relationship between the university programme and lifetime prevalence

Statistical test for the university programme and lifetime prevalence

n=67	Value	df	P-value
Pearson Chi-Square	0.334[a]	1	0.563
Fisher's Exact Test			0.482

[a]Two cells of the cross-tabulation table (50.0%) have an expected count less than 5. The minimum expected count is 0.60.

2.6 What stream are you registered for?

General ☐ Performance ☐ Education ☐ Composition ☐ BA ☐ Other ☐

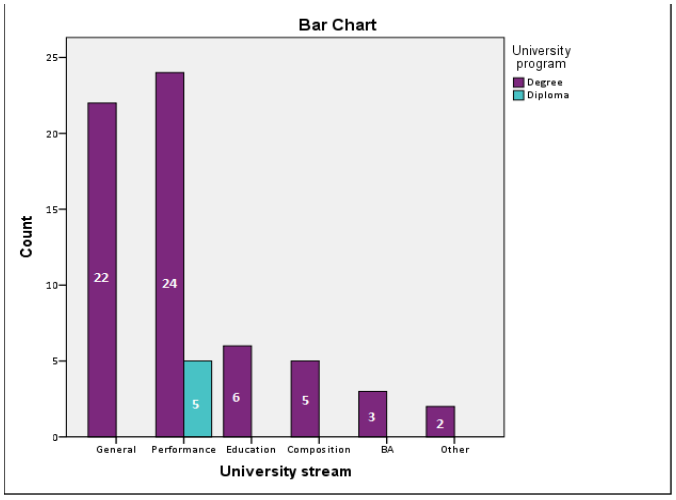
If other, please specify:_____

Distribution of university stream

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	General	22	32.8	32.8	32.8
	Performance	29	43.3	43.3	76.1
	Education	6	9.0	9.0	85.1
	Composition	5	7.5	7.5	92.5
	BA	3	4.5	4.5	97.0
	Other	2	3.0	3.0	100.0
	Total	67	100.0	100.0	

University programme and university stream

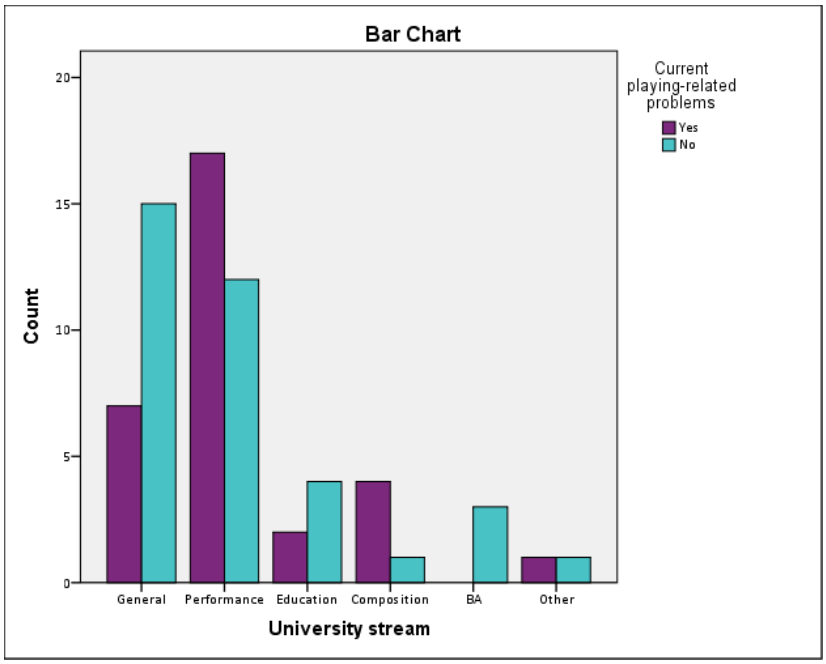
	University program		Total
University stream	Degree	Diploma	
General	22	0	22
Performance	24	5	29
Education	6	0	6
Composition	5	0	5
BA	3	0	3
Other	2	0	2
Total	62	5	67



Bar chart showing the relationship between the university programme and university strea

University stream and current PRMDs

			Current playing-related problems		
			Yes	No	Total
University stream	General	Count	7	15	22
		% within University stream	31.8%	68.2%	100.0%
	Performance	Count	17	12	29
		% within University stream	58.6%	41.4%	100.0%
	Education	Count	2	4	6
		% within University stream	33.3%	66.7%	100.0%
	Composition	Count	4	1	5
		% within University stream	80.0%	20.0%	100.0%
	BA	Count	0	3	3
		% within University stream	0.0%	100.0%	100.0%
	Other	Count	1	1	2
		% within University stream	50.0%	50.0%	100.0%
Total		Count	31	36	67
		% within University stream	46.3%	53.7%	100.0%



Bar chart showing the relationship between university stream and current PRMDs

Statistical test for university stream and current PRMDs

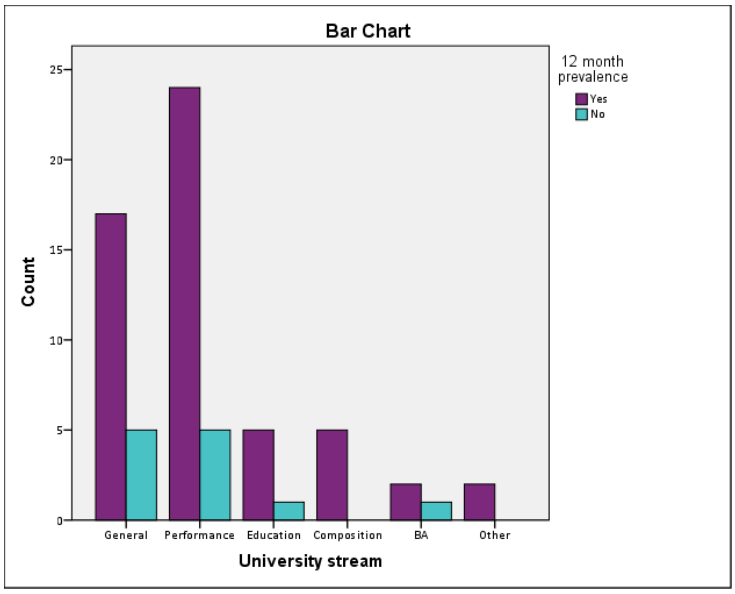
University stream * Current playing-related problems

n=67	Value	df	P-value
Pearson Chi-Square	8.914[a]	5	0.113
Fisher's Exact Test	8.529		0.096

[a]Eight cells of the cross-tabulation table (66.7%) have an expected count less than 5. The minimum expected count is 0.93.

University stream and 12 month prevalence PRMDs

			12 month prevalence		
			Yes	No	Total
University stream	General	Count	17	5	22
		% within University stream	77.3%	22.7%	100.0%
	Performance	Count	24	5	29
		% within University stream	82.8%	17.2%	100.0%
	Education	Count	5	1	6
		% within University stream	83.3%	16.7%	100.0%
	Composition	Count	5	0	5
		% within University stream	100.0%	0.0%	100.0%
	BA	Count	2	1	3
		% within University stream	66.7%	33.3%	100.0%
	Other	Count	2	0	2
		% within University stream	100.0%	0.0%	100.0%
Total		Count	55	12	67
		% within University stream	82.1%	17.9%	100.0%



Bar chart showing the relationship between university stream and 12 month prevalence

Statistical test for university stream and 12 month prevalence

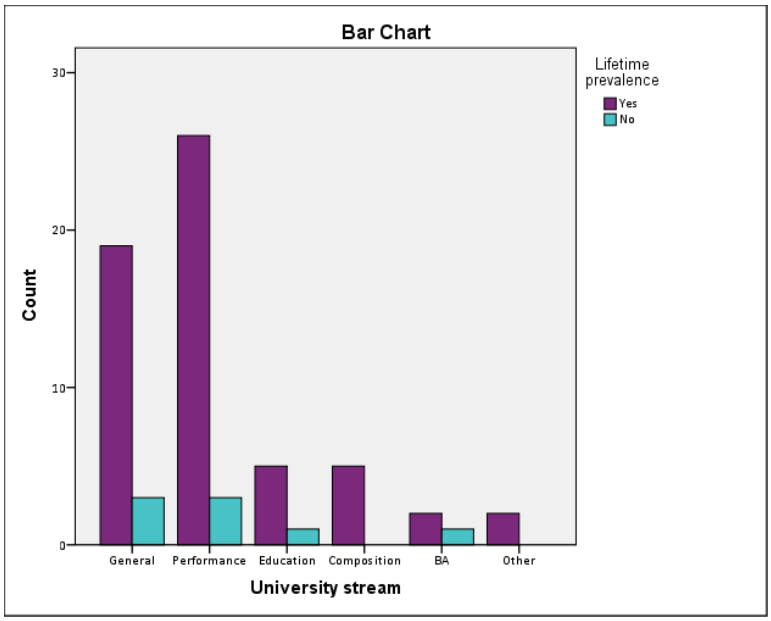
University stream * 12 month prevalence

n=67	Value	df	P-value
Pearson Chi-Square	2.375[a]	5	0.795
Fisher's Exact Test	2.287		0.866

[a]Nine cells of the cross-tabulation tbale (75.0%) have expected count less than 5. The minimum expected count is 0.36.

University stream and lifetime prevalence of PRMDs

			Lifetime prevalence		
			Yes	No	Total
University stream	General	Count	19	3	22
		% within University stream	86.4%	13.6%	100.0%
	Performance	Count	26	3	29
		% within University stream	89.7%	10.3%	100.0%
	Education	Count	5	1	6
		% within University stream	83.3%	16.7%	100.0%
	Composition	Count	5	0	5
		% within University stream	100.0%	0.0%	100.0%
	BA	Count	2	1	3
		% within University stream	66.7%	33.3%	100.0%
	Other	Count	2	0	2
		% within University stream	100.0%	0.0%	100.0%
Total		Count	59	8	67
		% within University stream	88.1%	11.9%	100.0%



Bar chart showing the relationship between university stream and lifetime prevalence

Statistical test for university stream and lifetime prevalence

University stream * Lifetime prevalence

n=67	Value	df	P-value
Pearson Chi-Square	2.513[a]	5	0.775
Fisher's Exact Test	2.956		0.708

[a]Nine cells of the cross-tabulation table (75.0%) have an expected count less than 5. The minimum expected count is 0.24.

2.7 What year are you in?

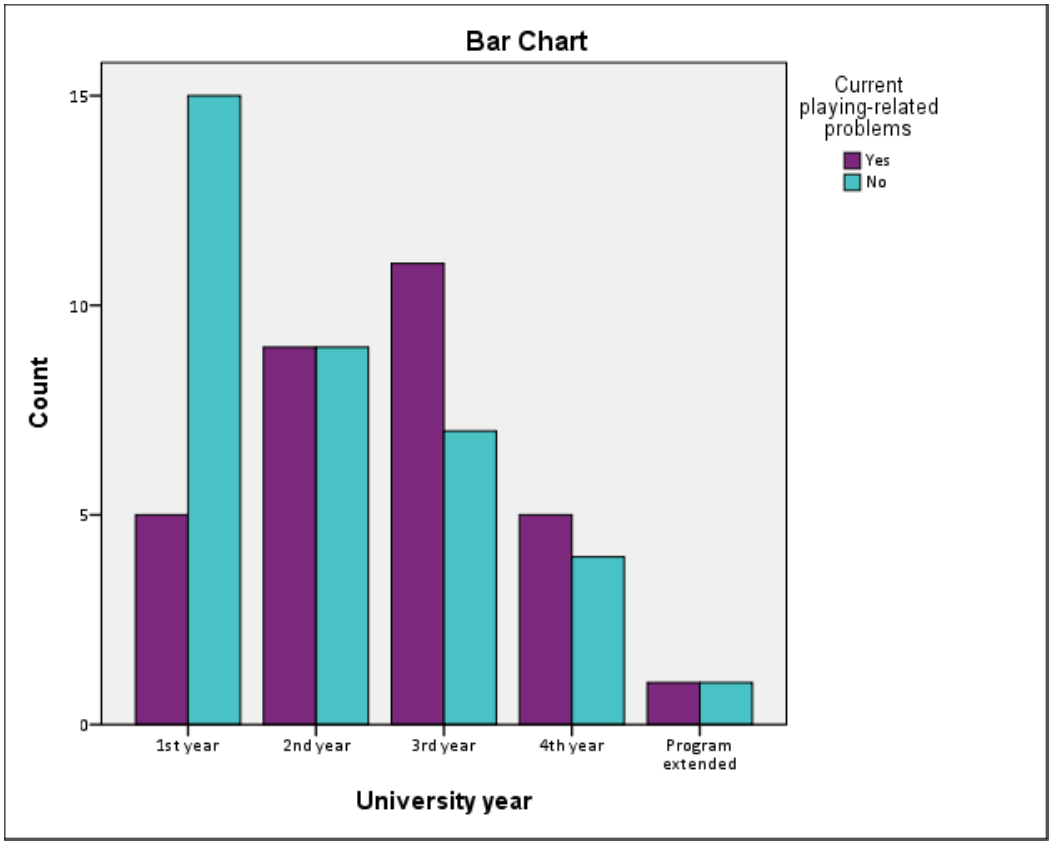
1 ☐ 2 ☐ 3 ☐ 4 ☐ programme extended (more than 4 years) ☐

Distribution of year of study

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1st year	20	29.9	29.9	29.9
	2nd year	18	26.9	26.9	56.7
	3rd year	18	26.9	26.9	83.6
	4th year	9	13.4	13.4	97.0
	Program extended	2	3.0	3.0	100.0
	Total	67	100.0	100.0	

Year of study and current PRMDs

			Current playing-related problems		
			Yes	No	Total
University year	1st year	Count	5	15	20
		% within University year	25.0%	75.0%	100.0%
	2nd year	Count	9	9	18
		% within University year	50.0%	50.0%	100.0%
	3rd year	Count	11	7	18
		% within University year	61.1%	38.9%	100.0%
	4th year	Count	5	4	9
		% within University year	55.6%	44.4%	100.0%
	Program extended	Count	1	1	2
		% within University year	50.0%	50.0%	100.0%
Total		Count	31	36	67
		% within University year	46.3%	53.7%	100.0%



Bar chart showing the relationship between university year and current PRMDs

Statistical test for university year and current PRMDs

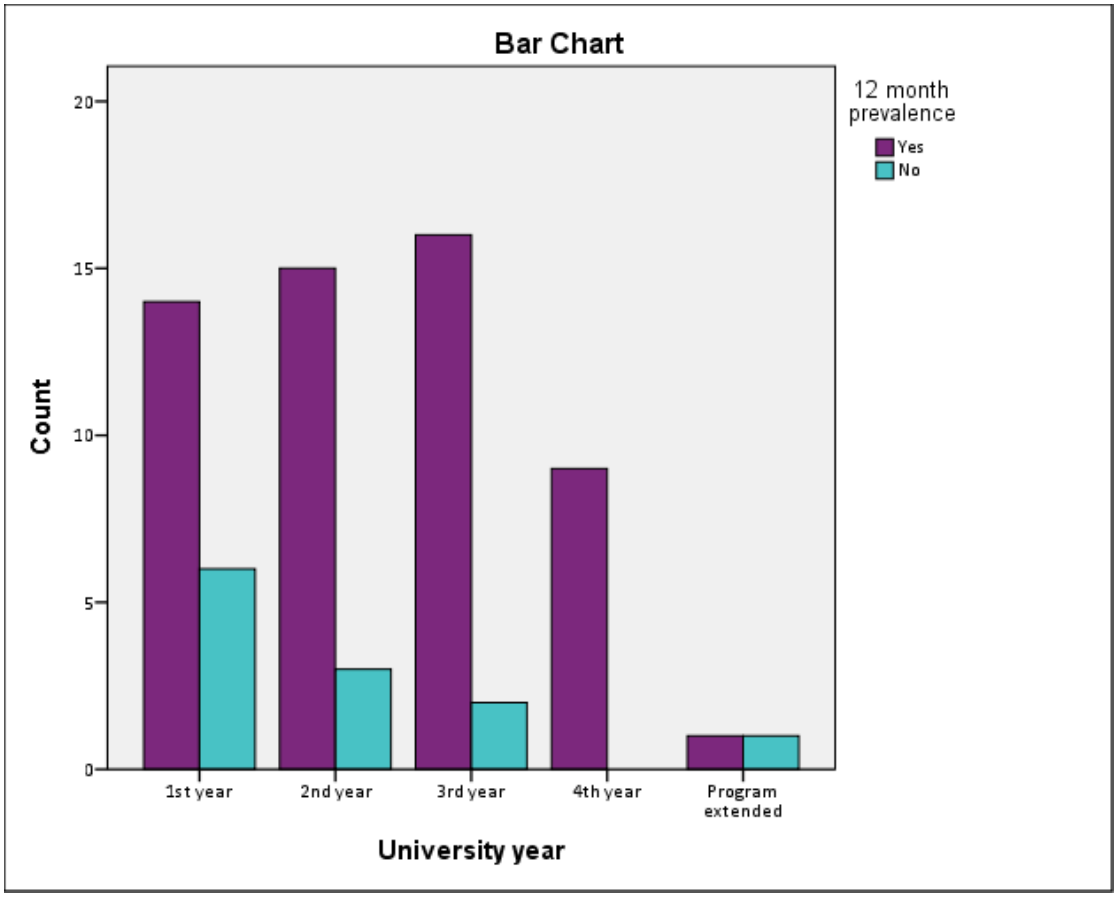
University year * Current playing-related problems

n=67	Value	df	P-value
Pearson Chi-Square	5.658[a]	4	0.226
Fisher's Exact Test	5.928		0.186

[a]Four cells of the cross-tabulation table (40.0%) have an expected count less than 5. The minimum expected count is 0.93.

Year of study and 12 month prevalence of PRMDs

			12 month prevalence		Total
			Yes	No	
University year	1st year	Count	14	6	20
		% within University year	70.0%	30.0%	100.0%
	2nd year	Count	15	3	18
		% within University year	83.3%	16.7%	100.0%
	3rd year	Count	16	2	18
		% within University year	88.9%	11.1%	100.0%
	4th year	Count	9	0	9
		% within University year	100.0%	0.0%	100.0%
	Program extended	Count	1	1	2
		% within University year	50.0%	50.0%	100.0%
Total		Count	55	12	67
		% within University year	82.1%	17.9%	100.0%



Bar chart showing the relationship between university year and 12 month prevalence

Statistical test for university year and 12 month prevalence

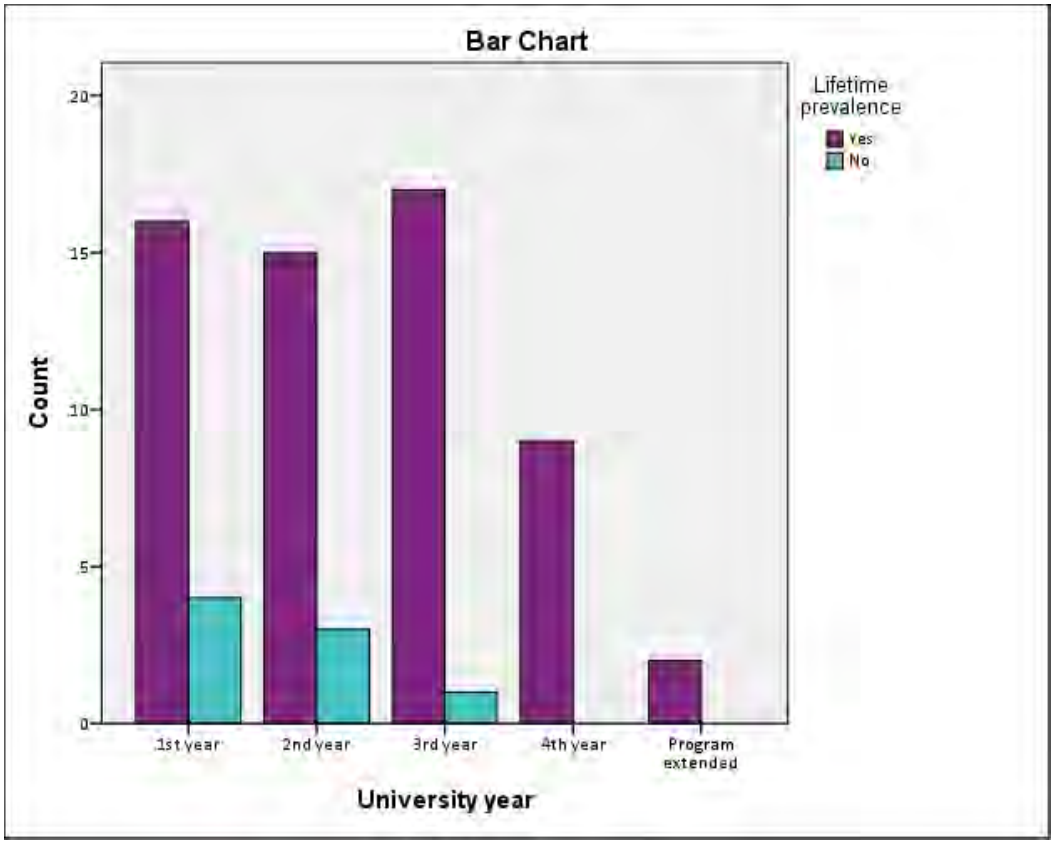
University year * 12 month prevalence

n=67	Value	df	P-value
Pearson Chi-Square	5.938[a]	4	0.204
Fisher's Exact Test	5.713		0.172

[a]Six cells of the cross-tabulation table (60.0%) have an expected count less than 5. The minimum expected count is 0.36.

Year of study and lifetime prevalence of PRMDs

			Lifetime prevalence		Total
			Yes	No	
University year	1st year	Count	16	4	20
		% within University year	80.0%	20.0%	100.0%
	2nd year	Count	15	3	18
		% within University year	83.3%	16.7%	100.0%
	3rd year	Count	17	1	18
		% within University year	94.4%	5.6%	100.0%
	4th year	Count	9	0	9
		% within University year	100.0%	0.0%	100.0%
	Program extended	Count	2	0	2
		% within University year	100.0%	0.0%	100.0%
Total		Count	59	8	67
		% within University year	88.1%	11.9%	100.0%



Bar chart showing the relationship between university year and lifetime prevalence

Statistical test for university year and lifetime prevalence

University year * Lifetime prevalence

n=67	Value	df	P-value
Pearson Chi-Square	3.807[a]	4	0.433
Fisher's Exact Test	3.232		0.504

[a]Six cells of the cross-tabulation table (60.0%) have an expected count less than 5. The minimum expected count is 0.24.

2.8 What level of your main instrument are you currently registered for?

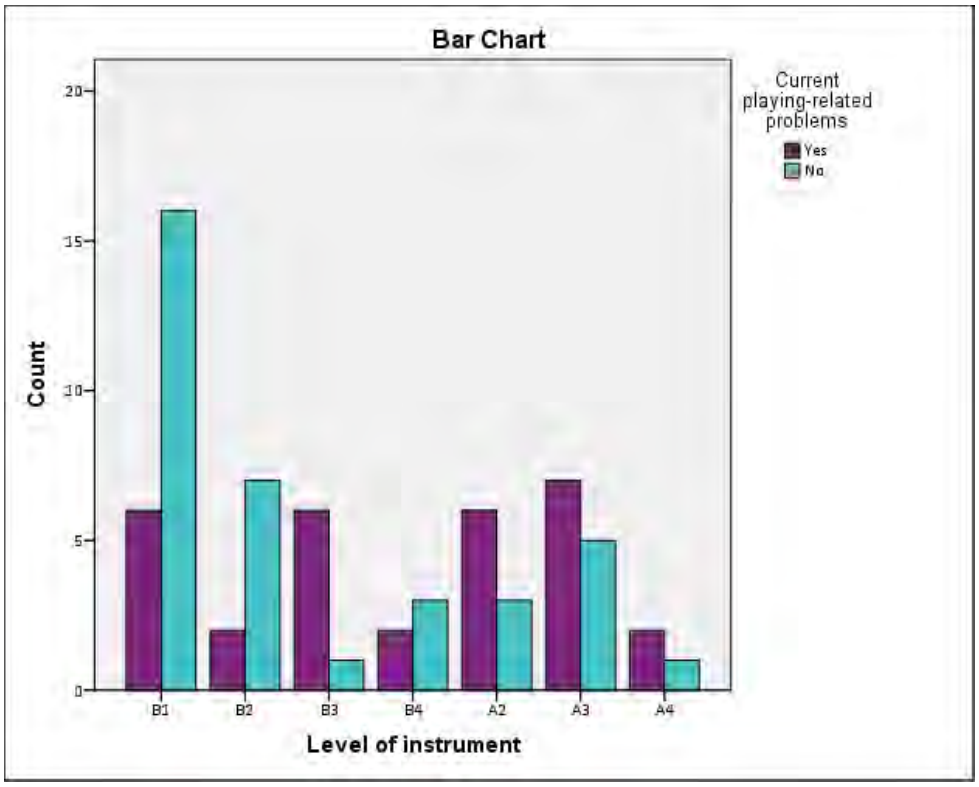
B1 ☐ B2 ☐ B3 ☐ B4 ☐ A2 ☐ A3 ☐ A4 ☐

Distribution of instrument levels

Level of instrument					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	B1	22	32.8	32.8	32.8
	B2	9	13.4	13.4	46.3
	B3	7	10.4	10.4	56.7
	B4	5	7.5	7.5	64.2
	A2	9	13.4	13.4	77.6
	A3	12	17.9	17.9	95.5
	A4	3	4.5	4.5	100.0
	Total	67	100.0	100.0	

Instrument levels and current PRMDs

			Current playing-related problems		
			Yes	No	Total
Level of instrument	B1	Count	6	16	22
		% within Level of instrument	27.3%	72.7%	100.0%
	B2	Count	2	7	9
		% within Level of instrument	22.2%	77.8%	100.0%
	B3	Count	6	1	7
		% within Level of instrument	85.7%	14.3%	100.0%
	B4	Count	2	3	5
		% within Level of instrument	40.0%	60.0%	100.0%
	A2	Count	6	3	9
		% within Level of instrument	66.7%	33.3%	100.0%
	A3	Count	7	5	12
		% within Level of instrument	58.3%	41.7%	100.0%
	A4	Count	2	1	3
		% within Level of instrument	66.7%	33.3%	100.0%
Total		Count	31	36	67
		% within Level of instrument	46.3%	53.7%	100.0%



Bar chart showing the relationship between the instrument level and current PRMDs

Statistical test for instrument level and current PRMDs

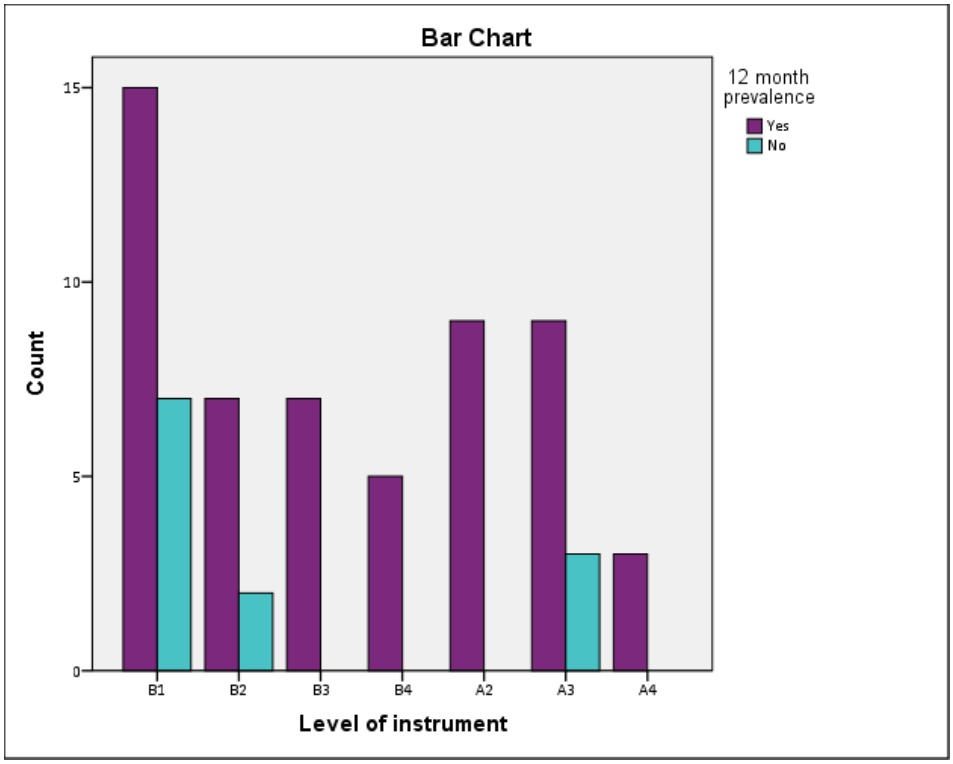
Level of instrument * Current playing-related problems

n=67	Value	df	*p*-value
Pearson Chi-Square	12.458[a]	6	0.053
Fisher's Exact Test	12.242		0.043

[a]Ten cells of the cross-tabulation table (71.4%) have an expected count less than 5. The minimum expected count is 1.39.
Significance found using Fisher's exact test

Instrument levels and 12 month prevalence of PRMDs

			12 month prevalence		
			Yes	No	Total
Level of instrument	B1	Count	15	7	22
		% within Level of instrument	68.2%	31.8%	100.0%
	B2	Count	7	2	9
		% within Level of instrument	77.8%	22.2%	100.0%
	B3	Count	7	0	7
		% within Level of instrument	100.0%	0.0%	100.0%
	B4	Count	5	0	5
		% within Level of instrument	100.0%	0.0%	100.0%
	A2	Count	9	0	9
		% within Level of instrument	100.0%	0.0%	100.0%
	A3	Count	9	3	12
		% within Level of instrument	75.0%	25.0%	100.0%
	A4	Count	3	0	3
		% within Level of instrument	100.0%	0.0%	100.0%
Total		Count	55	12	67
		% within Level of instrument	82.1%	17.9%	100.0%



Bar chart showing the relationship between the instrument level and 12 month prevalence

Statistical test for instrument level and12 month prevalence

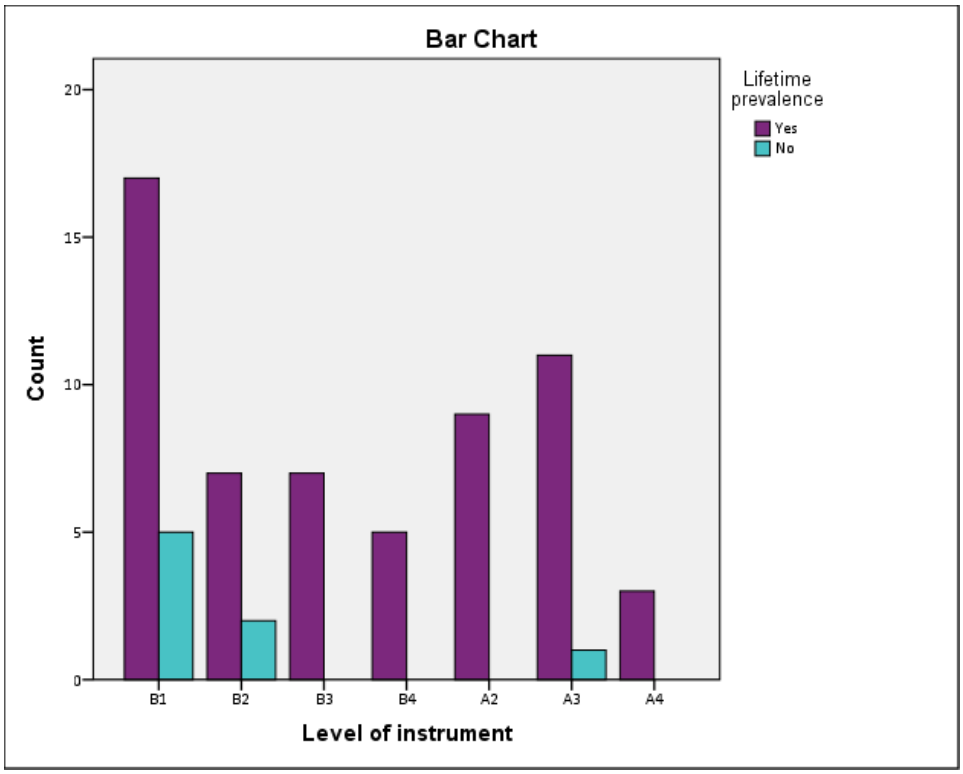
Level of instrument * 12 month prevalence

n=67	Value	df	P-value
Pearson Chi-Square	8.655[a]	6	0.194
Fisher's Exact Test	6.853		0.264

[a]Nine cells of the cross-tabulation table (64.3%) have an expected count less than 5. The minimum expected count is 0.54.

Instrument levels and lifetime prevalence of PRMDs

			Lifetime prevalence		
			Yes	No	Total
Level of instrument	B1	Count	17	5	22
		% within Level of instrument	77.3%	22.7%	100.0%
	B2	Count	7	2	9
		% within Level of instrument	77.8%	22.2%	100.0%
	B3	Count	7	0	7
		% within Level of instrument	100.0%	0.0%	100.0%
	B4	Count	5	0	5
		% within Level of instrument	100.0%	0.0%	100.0%
	A2	Count	9	0	9
		% within Level of instrument	100.0%	0.0%	100.0%
	A3	Count	11	1	12
		% within Level of instrument	91.7%	8.3%	100.0%
	A4	Count	3	0	3
		% within Level of instrument	100.0%	0.0%	100.0%
Total		Count	59	8	67
		% within Level of instrument	88.1%	11.9%	100.0%



Bar chart showing the relationship between the instrument level and lifetime prevalence

Statistical test for instrument level and lifetime prevalence

Level of instrument * Lifetime prevalence

n=67	Value	df	P-value
Pearson Chi-Square	6.742[a]	6	0.345
Fisher's Exact Test	4.770		0.517

[a]Nine cells of the cross-tabulation table (64.3%) have an expected count less than 5. The minimum expected count is 0.36.

For the university stream, year and instrument level above, there are too many categories and too few observations in each so tests are not reliable.

Section B: Overview of playing-related problems

For the purposes of this study, a *playing-related problem* is defined as:

> Pain, weakness, lack of control, numbness, tingling, or other symptoms that come from playing, and that interfere with playing your instrument *at the level you are used to.*
>
> NB: Pain or any other symptoms that are caused by an accident or other non-playing related events are NOT considered to be a playing-related problem.

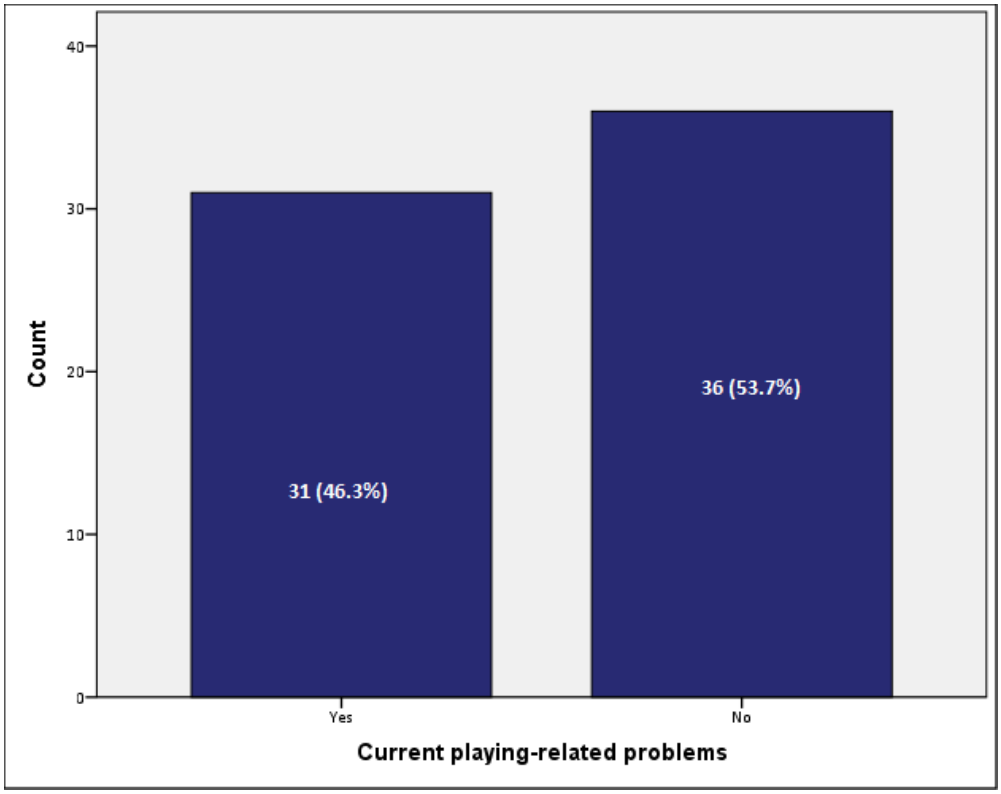
Please tick the relevant boxes.

1. Are you currently suffering from a playing-related problem?

Yes ☐ No ☐

Distribution of current PRMD prevalence

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	31	46.3	46.3	46.3
	No	36	53.7	53.7	100.0
	Total	67	100.0	100.0	



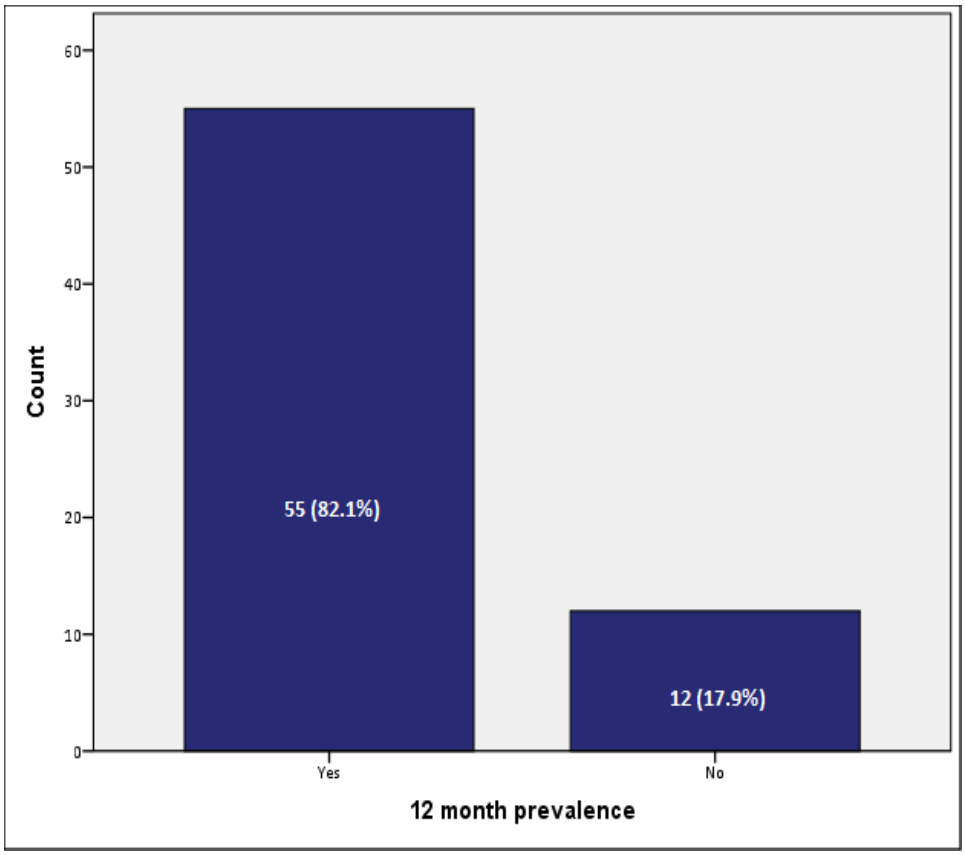
Bar chart showing the distribution of current PRMDs

2. Have you experienced a playing-related problem at any time in the past 12 months?

Yes ☐ No ☐

Distribution of 12 month prevalence of PRMDs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	55	82.1	82.1	82.1
	No	12	17.9	17.9	100.0
	Total	67	100.0	100.0	



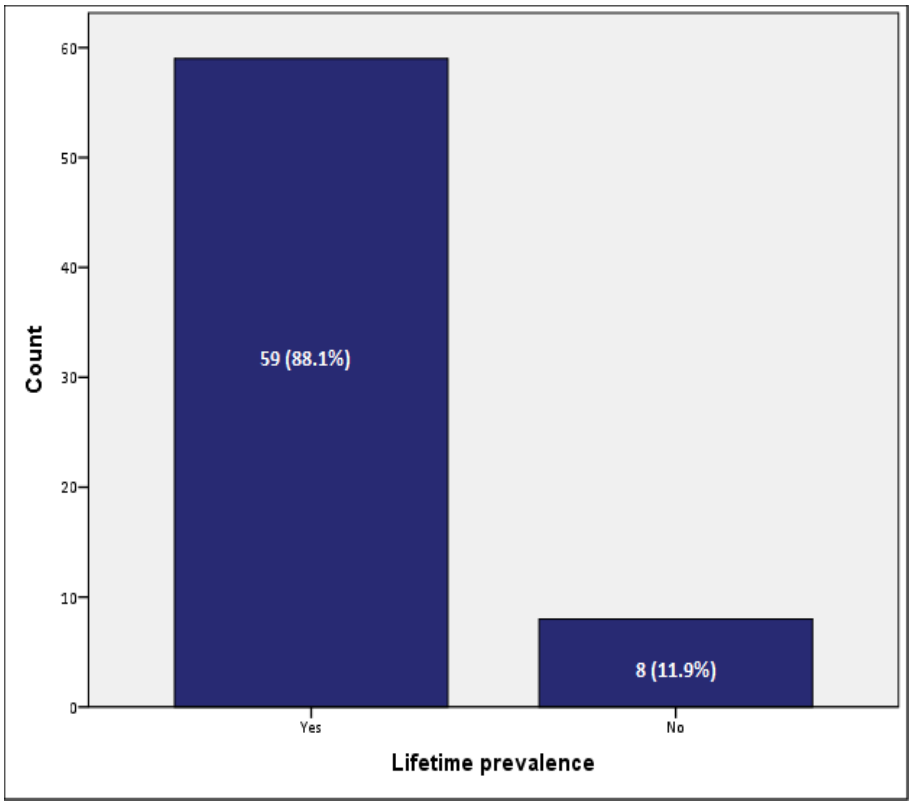
Bar chart showing the distribution of 12month prevalence

3. Have you at any time in your life experienced a playing-related problem?

Yes ☐ No ☐

Distribution of lifetime prevalence of PRMDs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	59	88.1	88.1	88.1
	No	8	11.9	11.9	100.0
	Total	67	100.0	100.0	



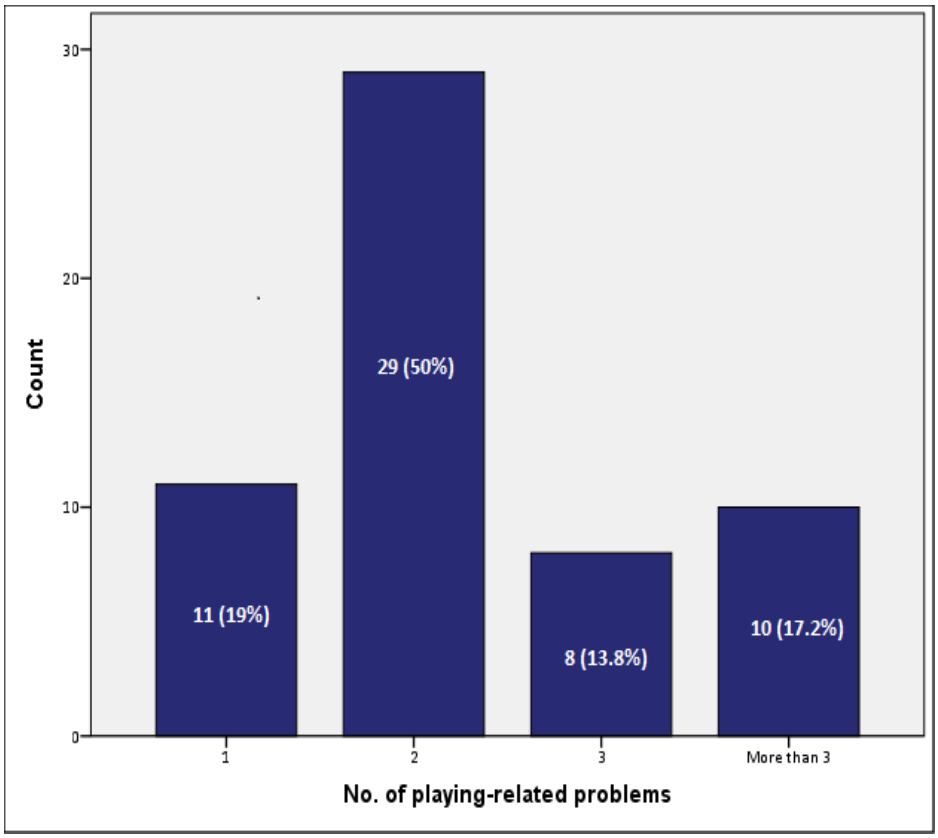
Bar chart showing the distribution of lifetime prevalence

If YES, approximately how many different playing-related problems have you had in your life?

1 ☐ 2 ☐ 3 ☐ more than 3 ☐

Distribution of number of PRMDs experienced

n = 58		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	11	16.4	19.0	19.0
	2	29	43.3	50.0	69.0
	3	8	11.9	13.8	82.8
	More than 3	10	14.9	17.2	100.0
	Total	58	86.6	100.0	
Missing	System	9	13.4		
Total		67	100.0		



Bar chart shoing the distribution of the number of PRMDs experienced

4. How much contact have you had with the following techniques?

	Never heard of it	Heard of it	Have tried it	Know it fairly well	Make regular use of it
Alexander technique	☐	☐	☐	☐	☐
Feldenkrais technique	☐	☐	☐	☐	☐
Body Mapping	☐	☐	☐	☐	☐
Biofeedback	☐	☐	☐	☐	☐
Yoga	☐	☐	☐	☐	☐
Tai-Chi/Qi Gong	☐	☐	☐	☐	☐
Pilates	☐	☐	☐	☐	☐

Distribution of knowledge on body awareness and body conditioning techniques

n = 65	Alexander-technique	Feldenkrais technique	Body mapping	Biofeedback	Yoga	Tai-chi /Qigong	Pilates
Never heard of it	20.0%	86.2%	41.5%	83.1%	1.5%	15.4%	13.8%
Heard of it	24.6%	12.3%	38.5%	15.4%	44.6%	72.3%	43.1%
Have tried it	38.5%	0.0%	7.7%	0.0%	20.0%	9.2%	20.0%
Know it fairly well	12.3%	1.5%	9.2%	1.5%	24.6%	3.1%	13.8%
Make regular use of it	4.6%	0.0%	3.1%	0.0%	9.2%	0.0%	9.2%

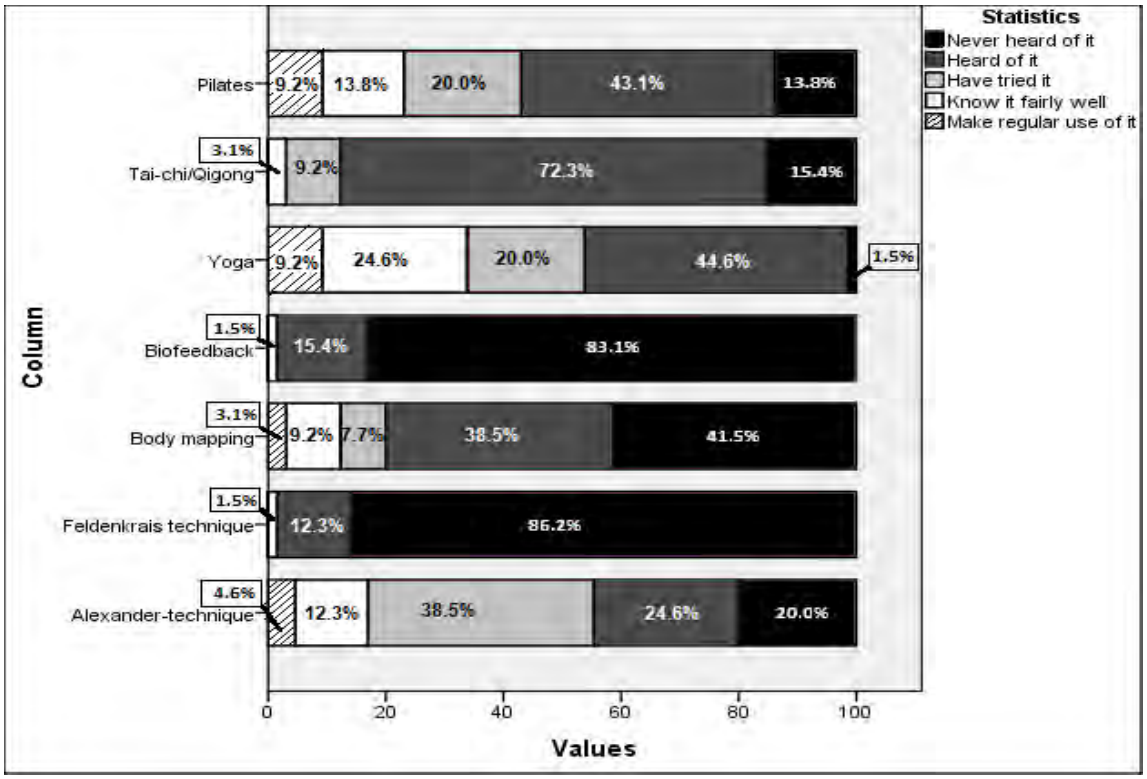


Chart showing the relationship between the level of knowledge of the body awareness and conditioning techniques

Sum of the responses on all playing techniques

		Count	Column N %
All techniques	Never heard of it	170	37.4%
	Heard of it	163	35.8%
	Have tried it	62	13.6%
	Know it fairly well	43	9.5%
	Make regular use of it	17	3.7%
	Total	455	100.0%

Section C: Specific details of playing-related problems

Using Addendum A, please complete a full table for each playing-related problem you have experienced. Do not list more than three of the most recent problems you have encountered.

Location

Write down the letter name and the body part from the list on Addendum A of the area that was/is affected (for example, D – Neck front)

Which side is it on (where applicable)? Left ☐ Right ☐ Both ☐

Distribution of location and side for the first completed table

		Side(1)					
		Left		Right		Both	
		Count	Row N %	Count	Row N %	Count	Row N %
Embouchure/lips(1)	Not affected	11	19.6%	7	12.5%	38	67.9%
	Affected	0	0.0%	0	0.0%	2	100.0%
Mouth/tongue(1)	Not affected	11	20.0%	7	12.7%	37	67.3%
	Affected	0	0.0%	0	0.0%	3	100.0%
Jaw/cheek(1)	Not affected	11	20.0%	7	12.7%	37	67.3%
	Affected	0	0.0%	0	0.0%	3	100.0%
Neck(front)(1)	Not affected	11	19.3%	7	12.3%	39	68.4%
	Affected	0	0.0%	0	0.0%	1	100.0%
Neck(back)(1)	Not affected	10	20.4%	7	14.3%	32	65.3%
	Affected	1	11.1%	0	0.0%	8	88.9%
Lower back(1)	Not affected	11	20.8%	7	13.2%	35	66.0%
	Affected	0	0.0%	0	0.0%	5	100.0%
Middle back(1)	Not affected	11	20.0%	7	12.7%	37	67.3%
	Affected	0	0.0%	0	0.0%	3	100.0%
Upper back(1)	Not affected	10	19.6%	7	13.7%	34	66.7%
	Affected	1	14.3%	0	0.0%	6	85.7%
Shoulder(1)	Not affected	6	14.0%	2	4.7%	35	81.4%
	Affected	5	33.3%	5	33.3%	5	33.3%
Upper arm(1)	Not affected	11	19.0%	7	12.1%	40	69.0%
	Affected	0	0.0%	0	0.0%	0	0.0%
Elbow(1)	Not affected	11	19.3%	7	12.3%	39	68.4%
	Affected	0	0.0%	0	0.0%	1	100.0%
Forearm(1)	Not affected	11	19.6%	6	10.7%	39	69.6%
	Affected	0	0.0%	1	50.0%	1	50.0%
Hand or wrist(1)	Not affected	8	16.3%	7	14.3%	34	69.4%
	Affected	3	33.3%	0	0.0%	6	66.7%
Fingers(1)	Not affected	10	18.5%	6	11.1%	38	70.4%
	Affected	1	25.0%	1	25.0%	2	50.0%
Thumb(1)	Not affected	11	19.6%	7	12.5%	38	67.9%
	Affected	0	0.0%	0	0.0%	2	100.0%
Hip(1)	Not affected	11	19.0%	7	12.1%	40	69.0%
	Affected	0	0.0%	0	0.0%	0	0.0%
Knee(1)	Not affected	11	19.0%	7	12.1%	40	69.0%
	Affected	0	0.0%	0	0.0%	0	0.0%
Ankle(1)	Not affected	11	19.0%	7	12.1%	40	69.0%
	Affected	0	0.0%	0	0.0%	0	0.0%
Foot(1)	Not affected	11	19.0%	7	12.1%	40	69.0%
	Affected	0	0.0%	0	0.0%	0	0.0%

Distribution of location and side for the second completed table

		Side(2)					
		Left		Right		Both	
		Count	Row N %	Count	Row N %	Count	Row N %
Embouchure/lips(2)	Not affected	8	19.5%	7	17.1%	26	63.4%
	Affected	0	0.0%	0	0.0%	1	100.0%
Mouth/tongue(2)	Not affected	8	19.0%	7	16.7%	27	64.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Jaw/cheek(2)	Not affected	8	20.0%	7	17.5%	25	62.5%
	Affected	0	0.0%	0	0.0%	2	100.0%
Neck(front)(2)	Not affected	7	17.5%	7	17.5%	26	65.0%
	Affected	1	50.0%	0	0.0%	1	50.0%
Neck(back)(2)	Not affected	7	18.4%	7	18.4%	24	63.2%
	Affected	1	25.0%	0	0.0%	3	75.0%
Lower back(2)	Not affected	8	21.6%	7	18.9%	22	59.5%
	Affected	0	0.0%	0	0.0%	5	100.0%
Middle back(2)	Not affected	8	20.0%	5	12.5%	27	67.5%
	Affected	0	0.0%	2	100.0%	0	0.0%
Upper back(2)	Not affected	8	21.6%	7	18.9%	22	59.5%
	Affected	0	0.0%	0	0.0%	5	100.0%
Shoulder(2)	Not affected	6	17.1%	7	20.0%	22	62.9%
	Affected	2	28.6%	0	0.0%	5	71.4%
Upper arm(2)	Not affected	7	17.1%	7	17.1%	27	65.9%
	Affected	1	100.0%	0	0.0%	0	0.0%
Elbow(2)	Not affected	8	19.0%	7	16.7%	27	64.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Forearm(2)	Not affected	7	17.5%	6	15.0%	27	67.5%
	Affected	1	50.0%	1	50.0%	0	0.0%
Hand or wrist(2)	Not affected	7	18.9%	6	16.2%	24	64.9%
	Affected	1	20.0%	1	20.0%	3	60.0%
Fingers(2)	Not affected	7	18.9%	5	13.5%	25	67.6%
	Affected	1	20.0%	2	40.0%	2	40.0%
Thumb(2)	Not affected	8	19.5%	6	14.6%	27	65.9%
	Affected	0	0.0%	1	100.0%	0	0.0%
Hip(2)	Not affected	8	19.0%	7	16.7%	27	64.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Knee(2)	Not affected	8	19.0%	7	16.7%	27	64.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Ankle(2)	Not affected	8	19.0%	7	16.7%	27	64.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Foot(2)	Not affected	8	19.0%	7	16.7%	27	64.3%
	Affected	0	0.0%	0	0.0%	0	0.0%

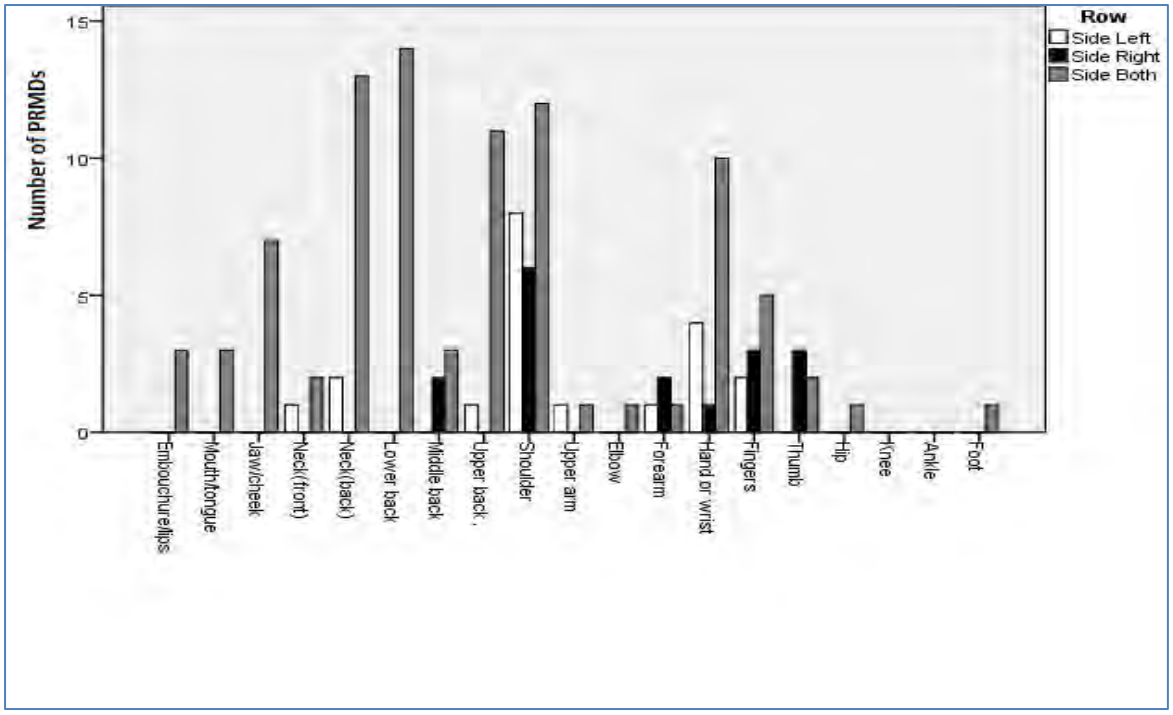
Distribution of location and side for the third completed table

		Side(3)					
		Left		Right		Both	
		Count	Row N %	Count	Row N %	Count	Row N %
Embouchure/lips(3)	Not affected	0	0.0%	3	16.7%	15	83.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Mouth/tongue(3)	Not affected	0	0.0%	3	16.7%	15	83.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Jaw/cheek(3)	Not affected	0	0.0%	3	18.8%	13	81.3%
	Affected	0	0.0%	0	0.0%	2	100.0%
Neck(front)(3)	Not affected	0	0.0%	3	16.7%	15	83.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Neck(back)(3)	Not affected	0	0.0%	3	18.8%	13	81.3%
	Affected	0	0.0%	0	0.0%	2	100.0%
Lower back(3)	Not affected	0	0.0%	3	21.4%	11	78.6%
	Affected	0	0.0%	0	0.0%	4	100.0%
Middle back(3)	Not affected	0	0.0%	3	16.7%	15	83.3%

	Affected	0	0.0%	0	0.0%	0	0.0%
Upper back(3)	Not affected	0	0.0%	3	16.7%	15	83.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Shoulder(3)	Not affected	0	0.0%	2	13.3%	13	86.7%
	Affected	0	0.0%	1	33.3%	2	66.7%
Upper arm(3)	Not affected	0	0.0%	3	17.6%	14	82.4%
	Affected	0	0.0%	0	0.0%	1	100.0%
Elbow(3)	Not affected	0	0.0%	3	16.7%	15	83.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Forearm(3)	Not affected	0	0.0%	3	16.7%	15	83.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Hand or wrist(3)	Not affected	0	0.0%	3	17.6%	14	82.4%
	Affected	0	0.0%	0	0.0%	1	100.0%
Fingers(3)	Not affected	0	0.0%	3	17.6%	14	82.4%
	Affected	0	0.0%	0	0.0%	1	100.0%
Thumb(3)	Not affected	0	0.0%	1	6.3%	15	93.8%
	Affected	0	0.0%	2	100.0%	0	0.0%
Hip(3)	Not affected	0	0.0%	3	17.6%	14	82.4%
	Affected	0	0.0%	0	0.0%	1	100.0%
Knee(3)	Not affected	0	0.0%	3	16.7%	15	83.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Ankle(3)	Not affected	0	0.0%	3	16.7%	15	83.3%
	Affected	0	0.0%	0	0.0%	0	0.0%
Foot(3)	Not affected	0	0.0%	3	17.6%	14	82.4%
	Affected	0	0.0%	0	0.0%	1	100.0%

Distribution of the locations and side of PRMDs for all three completed tables

	Side			
	Left	Right	Both	Total
Embouchure/lips	0	0	3	3
Mouth/tongue	0	0	3	3
Jaw/cheek	0	0	7	7
Neck(front)	1	0	2	3
Neck(back)	2	0	13	15
Lower back	0	0	14	14
Middle back	0	2	3	5
Upper back	1	0	11	12
Shoulder	8	6	12	26
Upper arm	1	0	1	2
Elbow	0	0	1	1
Forearm	1	2	1	4
Hand or wrist	4	1	10	15
Fingers	2	3	5	10
Thumb	0	3	2	5
Hip	0	0	1	1
Knee	0	0	0	0
Ankle	0	0	0	0
Foot	0	0	1	1



Bar chart showing the location and side of the PRMDs from all three completed tables

Time

How recently did the playing-related problem occur?

I am currently experiencing it ☐ Within the past 12 months ☐ More than 12 months ago ☐

Distribution of the point in time in which the PRMD occurred for the first completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I am currently experiencing it	18	26.9	30.5	30.5
	Within the past 12 months	30	44.8	50.8	81.4
	More than 12 months ago	11	16.4	18.6	100.0
	Total	59	88.1	100.0	
Missing	System	8	11.9		
Total		67	100.0		

Distribution of the point in time in which the PRMD occurred for the second completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I am currently experiencing it	12	17.9	27.9	27.9
	Within the past 12 months	23	34.3	53.5	81.4
	More than 12 months ago	8	11.9	18.6	100.0
	Total	43	64.2	100.0	
Missing	System	24	35.8		
Total		67	100.0		

Distribution of the point in time in which the PRMD occurred for the third completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I am currently experiencing it	4	6.0	23.5	23.5
	Within the past 12 months	11	16.4	64.7	88.2
	More than 12 months ago	2	3.0	11.8	100.0
	Total	17	25.4	100.0	
Missing	System	50	74.6		
Total		67	100.0		

Distribution of the point in time that respondents had the PRMD for all three completed tables

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	I am currently experiencing it	34	28.3	28.6	28.6
	Within the past 12 months	64	53.3	53.8	82.4
	More than 12 months ago	21	17.5	17.6	100.0
	Total	119	99.2	100.0	
Missing	System	1	.8		
Total		120	100.0		

Duration

How long did the playing-related problem last?

Less than 1 week ☐ 1week–1 month ☐

1–3 months ☐ 3–12 months ☐

1 – 2 years ☐ More than 2 years ☐

Distribution of the duration intervals for the first completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 week	16	23.9	35.6	35.6
	1 week–1 month	8	11.9	17.8	53.3
	1–3 months	7	10.4	15.6	68.9
	3–12 months	5	7.5	11.1	80.0
	1 – 2 years	2	3.0	4.4	84.4
	More than 2 years	7	10.4	15.6	100.0
	Total	45	67.2	100.0	
Missing	System	22	32.8		
Total		67	100.0		

Distribution of the duration intervals for the second completed table

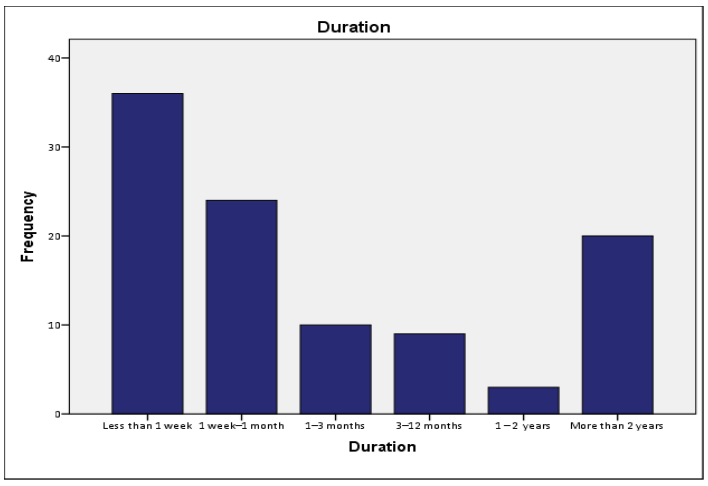
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 week	13	19.4	33.3	33.3
	1 week–1 month	11	16.4	28.2	61.5
	1–3 months	3	4.5	7.7	69.2
	3–12 months	2	3.0	5.1	74.4
	1 – 2 years	1	1.5	2.6	76.9
	More than 2 years	9	13.4	23.1	100.0
	Total	39	58.2	100.0	
Missing	System	28	41.8		
Total		67	100.0		

Distribution of the duration intervals for the third completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 week	7	10.4	38.9	38.9
	1 week–1 month	5	7.5	27.8	66.7
	3–12 months	2	3.0	11.1	77.8
	More than 2 years	4	6.0	22.2	100.0
	Total	18	26.9	100.0	
Missing	System	49	73.1		
Total		67	100.0		

Distribution of the duration intervals of PRMDs for all three completed tables

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Less than 1 week	36	30.0	35.3	35.3
	1 week–1 month	24	20.0	23.5	58.8
	1–3 months	10	8.3	9.8	68.6
	3–12 months	9	7.5	8.8	77.5
	1 – 2 years	3	2.5	2.9	80.4
	More than 2 years	20	16.7	19.6	100.0
	Total	102	85.0	100.0	
Missing	System	18	15.0		
Total		120	100.0		



Bar chart showing the distribution of duration intervals of PRMDs for all three completed tables

Quality of duration

Each time you played your instrument during this time period the playing-related problem:

- ☐ occurred consistently;
- ☐ fluctuated between better and worse but never went away completely;
- ☐ went away completely but returned periodically (recurring).

Distribution of the quality of the duration for the first completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Occurred consistently	8	11.9	13.8	13.8
	Fluctuated between better and worse but never went away completely	28	41.8	48.3	62.1
	Went away completely but returned periodically	22	32.8	37.9	100.0
	Total	58	86.6	100.0	
Missing	System	9	13.4		
Total		67	100.0		

Distribution for the quality of the duration for the second completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Occurred consistently	6	9.0	14.3	14.3
	Fluctuated between better and worse but never went away completely	21	31.3	50.0	64.3
	Went away completely but returned periodically	15	22.4	35.7	100.0
	Total	42	62.7	100.0	
Missing	System	25	37.3		
Total		67	100.0		

The distribution of the quality of the duration for the third completed table

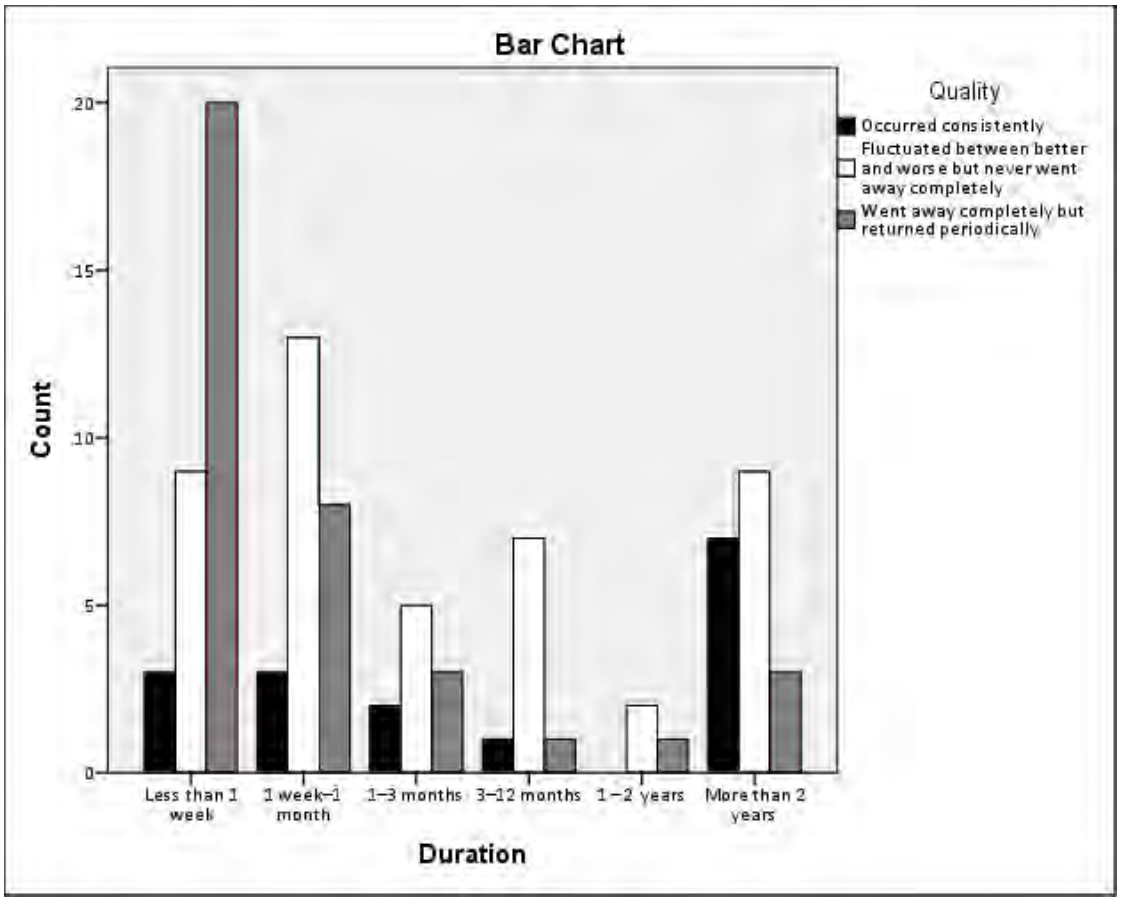
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Occurred consistently	2	3.0	13.3	13.3
	Fluctuated between better and worse but never went away completely	7	10.4	46.7	60.0
	Went away completely but returned periodically	6	9.0	40.0	100.0
	Total	15	22.4	100.0	
Missing	System	52	77.6		
Total		67	100.0		

Distribution of the quality of the duration for all three completed tables

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Occurred consistently	16	13.3	13.9	13.9
	Fluctuated between better and worse but never went away completely	56	46.7	48.7	62.6
	Went away completely but returned periodically	43	35.8	37.4	100.0
	Total	115	95.8	100.0	
Missing	System	5	4.2		
Total		120	100.0		

Relationship between the duration and the quality of duration

			Quality			
			Occurred consistently	Fluctuated between better and worse but never went away completely	Went away completely but returned periodically	Total
Duration	Less than 1 week	Count	3	9	20	32
		% within Duration	9.4%	28.1%	62.5%	100.0 %
	1 week–1 month	Count	3	13	8	24
		% within Duration	12.5%	54.2%	33.3%	100.0 %
	1–3 months	Count	2	5	3	10
		% within Duration	20.0%	50.0%	30.0%	100.0 %
	3–12 months	Count	1	7	1	9
		% within Duration	11.1%	77.8%	11.1%	100.0 %
	1 – 2 years	Count	0	2	1	3
		% within Duration	0.0%	66.7%	33.3%	100.0 %
	More than 2 years	Count	7	9	3	19
		% within Duration	36.8%	47.4%	15.8%	100.0 %
Total		Count	16	45	36	97
		% within Duration	16.5%	46.4%	37.1%	100.0 %



Bar chart showing the relationship of the duration and quality of duration

Severity

Rate the severity of the playing-related problem on a scale from 1–5 using the descriptions given for each degree.

Pain, weakness, lack of control, numbness, tingling or other symptoms that *(Tick only one box):*

- ☐ **1** Only occurs temporarily while OR after playing, without having to shorten the playing session;
- ☐ **2** Starts while playing, lasting for only a short period after playing, without having to shorten the playing session;
- ☐ **3** Requires the playing session to be shortened, but stops shortly after playing;
- ☐ **4** Requires the playing session to be shortened, but does not totally stop between playing sessions;
- ☐ **5** Prevents playing**.**

Distribution of the severity of PRMDs for the first completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Only occurs temporarily while/after playing,without having to shorten the playing session	22	32.8	37.3	37.3
	Starts while playing, lasting for only a short period after playing, without having to shorten the playing session	9	13.4	15.3	52.5
	Requires the playing session to be shortened, but stops shortly after playing	14	20.9	23.7	76.3
	Requires the playing session to be shortened, but does not totally stop between playing	12	17.9	20.3	96.6
	Prevents playing	2	3.0	3.4	100.0
	Total	59	88.1	100.0	
Missing	System	8	11.9		
Total		67	100.0		

Distribution for the severity of PRMDs for the second completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Only occurs temporarily while/after playing,without having to shorten the playing session	15	22.4	34.9	34.9
	Starts while playing, lasting for only a short period after playing, without having to shorten the playing session	8	11.9	18.6	53.5
	Requires the playing session to be shortened, but stops shortly after playing	8	11.9	18.6	72.1
	Requires the playing session to be shortened, but does not totally stop between playing	12	17.9	27.9	100.0
	Total	43	64.2	100.0	
Missing	System	24	35.8		
Total		67	100.0		

Distribution for the severity of PRMDs for the third completed table

			Frequency	Percent	Valid Percent	Cumulative Percent
Valid		Only occurs temporarily while/after playing,without having to shorten the playing session	6	9.0	33.3	33.3
		Starts while playing, lasting for only a short period after playing, without having to shorten the playing session	4	6.0	22.2	55.6
		Requires the playing session to be shortened, but stops shortly after playing	4	6.0	22.2	77.8
		Requires the playing session to be shortened, but does not totally stop between playing	4	6.0	22.2	100.0
		Total	18	26.9	100.0	
Missing	System	49	73.1			
Total		67	100.0			

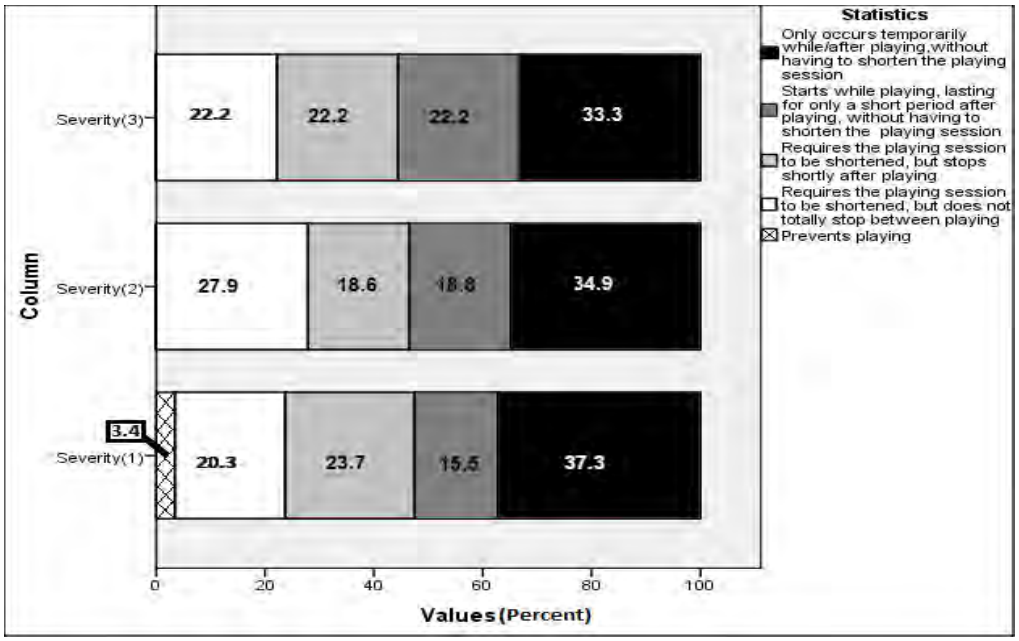


Chart showing the relationship between the severities from all three completed tables

Distribution of the severity of the PRMDs from all

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1.Only occurs temporarily while/after playing, without having to shorten the playing session	43	35.8	35.8	35.8
	2. Starts while playing, lasting for only a short period after playing, without having to shorten the playing session	21	17.5	17.5	53.3
	3. Requires the playing session to be shortened, but stops shortly after playing	26	21.7	21.7	75.0
	4. Requires the playing session to be shortened, but does not totally stop between playing	28	23.3	23.3	98.3
	5. Prevents playing	2	1.7	1.7	100.0
	Total	120	100.0	100.0	

Frequency

Please circle a number below that best describes how frequently you suffer from this playing-related problem.

Once **Seldom** **Often** **Very often** **Constantly**

1 **2** **3** **4** **5**

Distribution of frequency of PRMDs for the first completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once	3	4.5	5.1	5.1
	Seldom	24	35.8	40.7	45.8
	Often	19	28.4	32.2	78.0
	Very often	8	11.9	13.6	91.5
	Constantly	5	7.5	8.5	100.0
	Total	59	88.1	100.0	
Missing	System	8	11.9		
Total		67	100.0		

Distribution of frequency of PRMDs for the second completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once	1	1.5	2.3	2.3
	Seldom	18	26.9	41.9	44.2
	Often	12	17.9	27.9	72.1
	Very often	9	13.4	20.9	93.0
	Constantly	3	4.5	7.0	100.0
	Total	43	64.2	100.0	
Missing	System	24	35.8		
Total		67	100.0		

Distribution of frequency of PRMDs for the third completed table

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once	2	3.0	11.1	11.1
	Seldom	7	10.4	38.9	50.0
	Often	7	10.4	38.9	88.9
	Very often	1	1.5	5.6	94.4
	Constantly	1	1.5	5.6	100.0
	Total	18	26.9	100.0	
Missing	System	49	73.1		
Total		67	100.0		

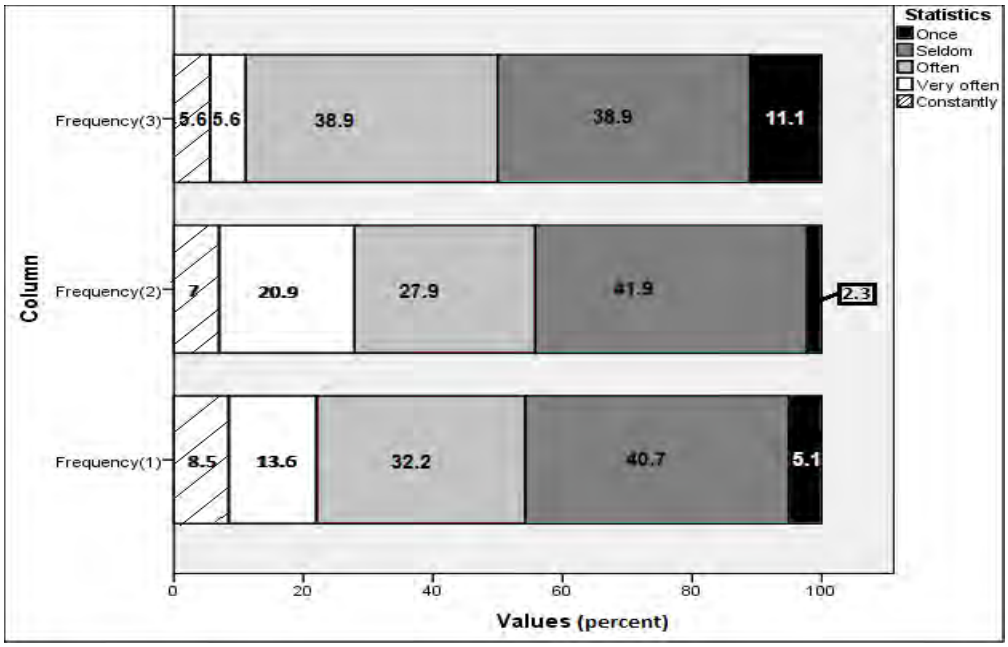


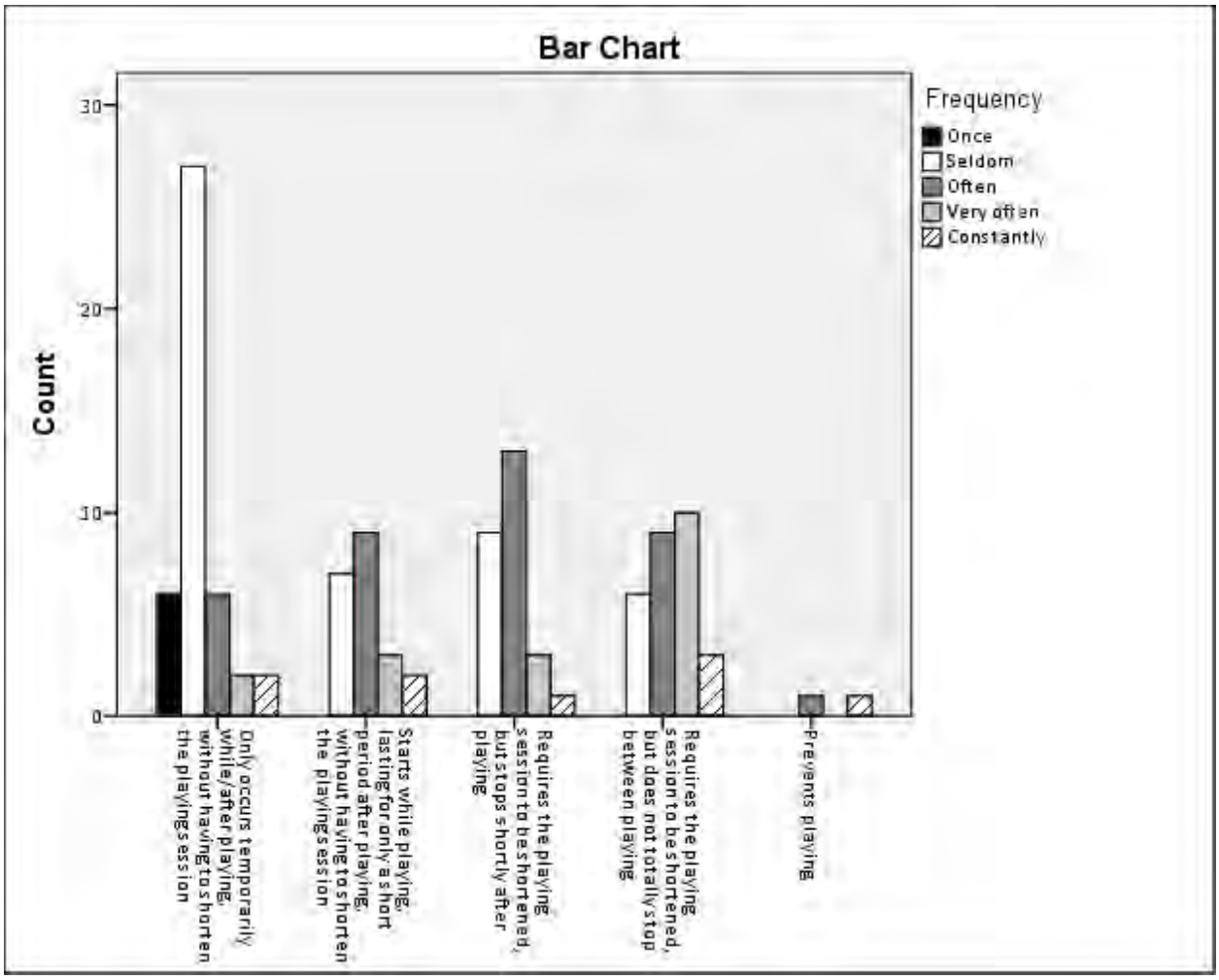
Chart showing the relationship between all three completed tables

Distribution of the frequency of PRMDs for all three completed tables

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once	6	5.0	5.0	5.0
	Seldom	49	40.8	40.8	45.8
	Often	38	31.7	31.7	77.5
	Very often	18	15.0	15.0	92.5
	Constantly	9	7.5	7.5	100.0
	Total	120	100.0	100.0	

Relationship between the severity and the frequency of PRMDs

			Frequency					
			Once	Seldom	Often	Very often	Constantly	Total
Severity	Only occurs temporarily while/after playing,without having to shorten the playing session	Count	6	27	6	2	2	43
		% within Severity	14.0%	62.8%	14.0%	4.7%	4.7%	100.0%
	Starts while playing, lasting for only a short period after playing, without having to shorten the playing session	Count	0	7	9	3	2	21
		% within Severity	0.0%	33.3%	42.9%	14.3%	9.5%	100.0%
	Requires the playing session to be shortened, but stops shortly after playing	Count	0	9	13	3	1	26
		% within Severity	0.0%	34.6%	50.0%	11.5%	3.8%	100.0%
	Requires the playing session to be shortened, but does not totally stop between playing	Count	0	6	9	10	3	28
		% within Severity	0.0%	21.4%	32.1%	35.7%	10.7%	100.0%
	Prevents playing	Count	0	0	1	0	1	2
		% within Severity	0.0%	0.0%	50.0%	0.0%	50.0%	100.0%
Total		Count	6	49	38	18	9	120
		% within Severity	5.0%	40.8%	31.7%	15.0%	7.5%	100.0%



Bar chart showing the relationship between the severity and frequency of PRMDs

Section D: Consultation and treatment

1. Have you ever consulted any health professionals (i.e. Doctor, physiotherapist, Alexander technique teacher) for a playing-related problem?

Yes ☐ No ☐

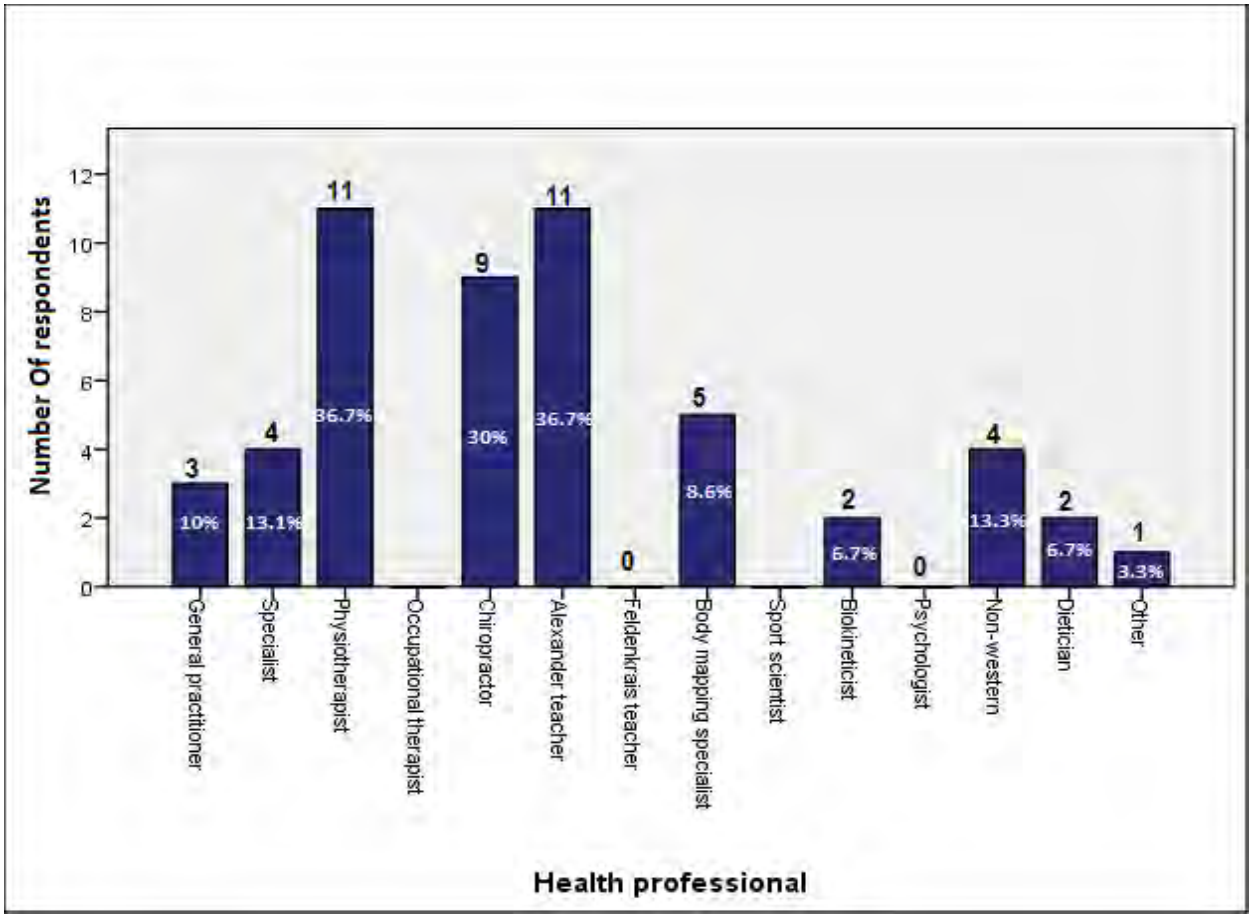
Consultation of a health professional

		Frequency	Percent	Valid Percent
Valid	Yes	30	44.8	51.7
	No	28	41.8	48.3
	Total	58	86.6	100.0
Missing	System	9	13.4	
Total		67	100.0	

If YES, which health professional, if any, did you consult? (If NO, continue to Question 2)

Health professionals consulted

Count		Table Total n %
General practitioner	3	10%
Specialist	4	13.1%
Physiotherapist	11	36.7%
Occupational therapist	0	0.0%
Chiropractor	9	30%
Alexander teacher	11	36.7%
Feldenkrais teacher	0	0.0%
Body mapping specialist	5	8.6%
Sport scientist	0	16.7%
Biokineticist	2	6.7%
Psychologist	0	0.0%
Non-western	4	13.3%
Dietician	2	6.7%
Other	1	3.3%
N=30		

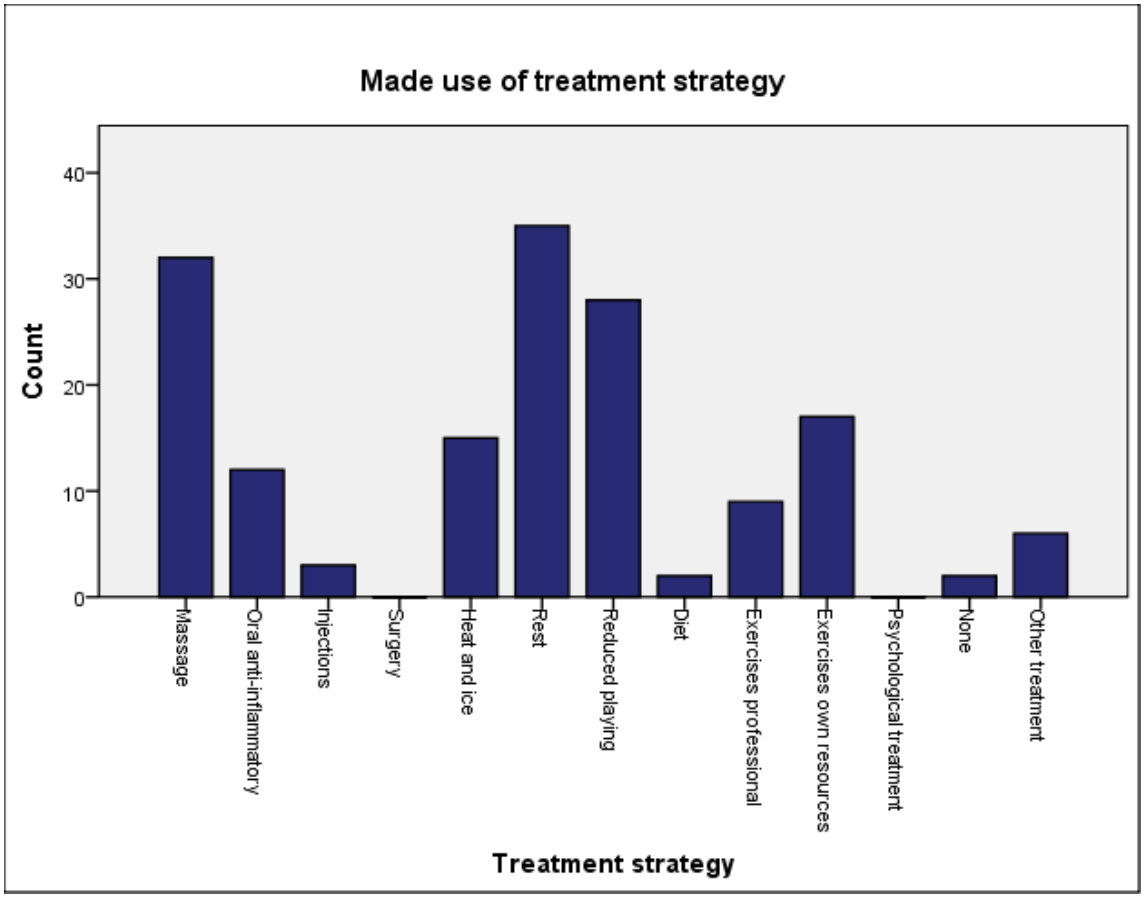


Bar chart showing the distribution of health professionals consulted

2. Which of these treatments strategies did you make use of?

Treatment strategies used

n = 54	Made use of treatment strategy	
	Count	Row N %
Massage	32	59.3%
Oral anti-inflammatory	12	22.2%
Injections	3	5.6%
Surgery	0	0.0%
Heat and ice	15	27.8%
Rest	35	64.8%
Reduced playing	28	51.9%
Diet	2	3.7%
Exercises professional	9	16.7%
Exercises own resources	17	31.5%
Psychological treatment	0	0.0%
None	2	3.7%
Other treatment	6	11.1%

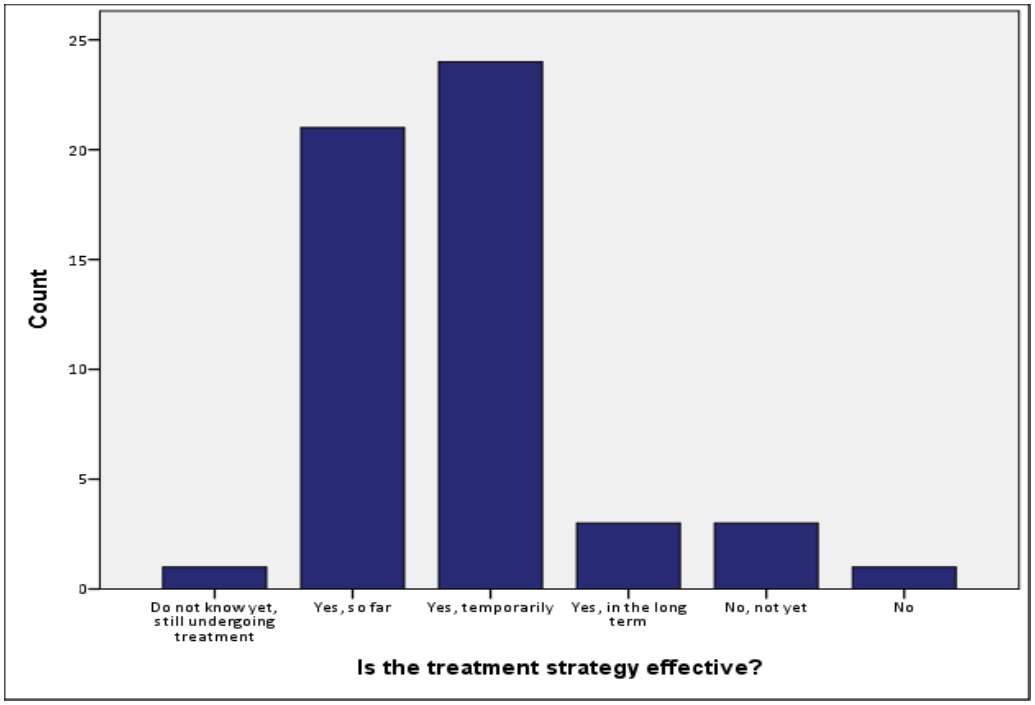


Bar graph showing the distribution of treatment strategies used

2.1 Did any of the treatment strategies resolve the playing-related problem(s)?

Effectiveness of treatment strategies used

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Do not know yet, still undergoing treatment	1	1.5	1.9	1.9
	Yes, so far	21	31.3	39.6	41.5
	Yes, temporarily	24	35.8	45.3	86.8
	Yes, in the long term	3	4.5	5.7	92.5
	No, not yet	3	4.5	5.7	98.1
	No	1	1.5	1.9	100.0
	Total	53	79.1	100.0	
Missing	System	14	20.9		
Total		67	100.0		



Bar chart showing the effectiveness of treatment strategies us