

Musculoskeletal and other performance related disorders in South African undergraduate music students

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Abstract

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Background: Performance related musculoskeletal and associated health issues are prominent amongst musicians. The aim of this study was to explore self-reported musculoskeletal and related health issues in undergraduate music students. A further goal was to ascertain how these problems impact students' learning and playing their instruments.

Materials and Methods: A longitudinal mixed method study was done over a period of three years with 145 undergraduate music students at the Department of Music, University of Pretoria, Pretoria, South Africa who completed a health survey, which included verbal statements to open-ended questions. The frequency and percentages of each quantitative variable were calculated using Excel software.

Results: The results showed an overall 83% prevalence of musculoskeletal and related health problems among music students. The four most prominent problems cited were related to inappropriate tiredness, concentration problems, sleep disturbances and headaches. Prominent musculoskeletal problems included orofacial issues such as sinus problems, and pain experienced in the lower spine, upper spine, left and right forearm. Students were generally reticent to report problems to healthcare professionals, particularly if they were not musculoskeletal in nature.

Conclusions: The current study shows that undergraduate music students at the University of Pretoria experience similar types of playing-related problems to students elsewhere in the world. However, there is a need to further probe and report playing-related musculoskeletal and its associated health problems at this institution as well as other tertiary institutions in South Africa. Furthermore, issues of diagnosis, treatment and impediments dedicated to specific instrument groups should be addressed.

Keywords: Music, Students, Musculoskeletal, South Africa

Introduction

Performance related musculoskeletal disorders (PRMDs) are highly prevalent in professional musicians (1-6) and professional orchestral musicians particularly, endure significant performance-related pain (7). A systematic review of pain prevalence in instrumentalist musicians found a lifetime prevalence rate of up to 85% (7). Factors affecting musicians' health include psychological challenges (such as performance anxiety), and physical challenges (technical demands, incorrect practice habits, over-practicing, repertoire) (9-11). International studies indicate that mental problems are equally frequently reported among musicians and performing artists (12). Mental problems such as performance anxiety,

general anxiety, social anxiety, sleep disturbance and depression were found to be highly prevalent in professional musicians (13-15), although research suggests that there is still a lack of studies investigating this phenomenon in different populations.

University music students are particularly at risk for psychological stressors and the incidence of psychological disturbance and disorders, especially during the first few years of study, was found to be significant (16). Music students are particularly prone to PRMDs because they often continue playing

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their instrument regardless of experiencing pain. Aside from the fact that many music students find it difficult to distance themselves from music-making, it appears that there is a misperception that pain and discomfort is acceptable in musicians (17, 18). Injury rates in this population have been found to be comparable to professional musicians. According to Brandfonbrenner, various factors contribute to injury prior to entering tertiary music studies and the risk factors are associated with instrument played (19). Of the 330 participants (46% men and 54% women), 79% reported a history of playing-related pain, which varied by instrument. Almost 100% of percussionists and 61% of vocalists, reported experiencing pain, but among keyboards, woodwinds and brass players, it was consistently 84%-87%.

The prevalence of PRMD has been mostly been investigated among classical students, recent studies have included genres such as jazz and rock. The prevalence of musculoskeletal disorders among Icelandic classical and rhythmic music students was overall 62%, however, the classical students experienced a 66% prevalence rate versus 22% of rhythmic music group (10). The prevalence of PRMDs among both the tertiary student jazz pianist population and professional jazz pianists in Australia and the USA found similar if not higher prevalence of PRMD (21). There is a lack of research on health-related issues among performing artists, musicians and tertiary music students in the South African context. In 2013 Ajidahun and Phillips reported the prevalence of musculoskeletal disorders among instrumental musicians at a center for performing arts in South Africa (22). The participants included music teachers and students. In spite of a small sample, 82% of the participants reported a musculoskeletal disorder within the last 12 months. Findings from a recent study on self-reported health promoting behaviors and psychosocial well-being of undergraduate music students at the University of Pretoria, Pretoria, South Africa showed overall deficiencies in music students'

healthy habits (23). The results correlate with previous studies and showed that healthy behaviors generalize across different socio-cultural contexts.

The aim of this study is to determine the prevalence of both musculoskeletal and non-musculoskeletal health issues in undergraduate music students enrolled for either of the two degrees, Bachelor of Arts (BA) in Music or Bachelor of Music (BMus) degree at the University of Pretoria. The BA in Music is a three year less intensive music degree whereas the BMus is a comprehensive four-year music degree.

The study addresses three research questions: 1) to what extent are health-related problems prevalent in undergraduate music students, 2) what is the prevalence ratio between musculoskeletal and non-musculoskeletal issues in this population group, and 3) to what extent do the nature of the problems impact on learning and performing musical instruments. A further goal of the study was to ascertain the occurrence of health problems with regard to instrument type (keyboard, strings, vocal, winds) and gender.

Material and Methods

The study used a longitudinal design employing both quantitative and qualitative methods to investigate the musculoskeletal and related non-musculoskeletal problems among the undergraduate music students at the University of Pretoria. The term non-musculoskeletal in this study refers to the problems caused by tiredness such as sleep disturbance, lack of concentration, headache, and other related physiological problems such as allergies, blood pressure, hearing, and bowel problems.

Willing participants completed informed consent forms and were assured that the project would abide by the ethical guidelines and requirements of the University of Pretoria. Data collection took place in the middle of the second semester of the academic year between 2011-2013. The respondents provided basic

demographic information before completing the health survey.

The questionnaire was derived from a comprehensive inventory devised by Ginsborg, Kreutz, Thomas and Williamon (2009), that specifically addressed self-reported musculoskeletal and related non-musculoskeletal health problems. The questionnaire addressed a fairly detailed list of musculoskeletal problems which were to be indicated on a scale of 1 (non-existent) to 5 (severe).

Musculoskeletal problems included the following:

- Orofacial: head, sinuses, nose, lips, teeth, tongue, jaw, throat, and face;
- Neck and upper back, middle and lower spine;
- Left shoulder, upper arm, elbow;
- Right shoulder, upper arm and elbow;
- Left lower arm, wrist, hand, fingers, thumb;
- Right lower arm, wrist, hand, fingers, thumb;
- Clavicle (collar bone) and pelvis;
- Left hip, thigh, femoral bone and knee;
- Right hip, thigh, femoral bone and knee;
- Left shin, calf, ankle, heel, foot arch, and toes;
- Right shin, calf, ankle, heel, foot arch

and toes;

Non-musculoskeletal problems were clustered into questions related to mental or physical problems, rated on a scale of 1 (with no problems) to 5 (with severe difficulty):

- Fatigue: sleep disturbance, headache requiring medication, lack of concentration, problems with vision and inappropriate tiredness.
- Miscellaneous: sensitivity to weather, palpitations, breathing problem, high blood pressure, low blood pressure, stomach ache, urinary problems, bowel problems, excessive sweating acute hearing loss general hearing loss, tinnitus, occupational allergies and cram/focal dystonia.

In addition, a further five open-ended self-reported physical health problem items were included in the health survey which contained the following questions: “Have you experienced any other physical problems over the past week? If yes, what was (or do you think was) the cause of the problem?”, “Have you ever had injuries that have affected you while practicing or performing for more than two weeks? If yes, how long did the problem persist?”, and “Have you ever received a medical diagnosis related to your practice of performance injury? If yes, please provide details of the diagnosis”.

Table 1: Study year, instrument distribution and gender of participants

		n*	%
Study year	1	41	28
	2	46	32
	3	37	25
	4	21	14
Instrument distribution	Keyboard	62	42
	Strings	25	17
	Vocal	32	22
	Winds	26	18
Gender	Women	79	54
	Men	66	45

*Number of items per scale

A total of 145 undergraduate music students (first to fourth year) took part in the survey. A

non-probability purposeful sampling strategy was used. The sample included 79 women and

66 men aged between 18-37, with the majority of the participants aged between 11 and 22 years. Data collection took place in two sessions, three years apart. The reason for the two data collection sessions was the small numbers in the department. The first session included 74 participants and the second 72 participants. The distribution of the year of study, main instrument and gender are displayed in table 1.

The frequency and percentages of each quantitative variable were calculated using Excel software. Due to the small sample size and small between group numbers it was not possible to perform meaningful statistical analysis. Therefore, the data in this article presents a descriptive view of the analysis only.

Results

Overall, 83% of the participants in our study reported prevalence of musculoskeletal and non-musculoskeletal problems. The four most

prominent symptoms across the sample were related to non-musculoskeletal problems such as inappropriate tiredness (83%), concentration problems (79%), sleep disturbances (78%), and headache (65%). The most prominent musculoskeletal problems were sinuses (64%), lower spine (64%), and muscle cramps (62%). The other prominent non-musculoskeletal problems included vision problems (59%) and sensitivity to the weather (57%).

Table 2 summarizes the most prominent non-musculoskeletal problems in undergraduate music students. Only scores above the 50% response rate are reported.

The six most prominent symptoms included inappropriate tiredness, concentration problems, sleep disturbances, headache requiring medication, vision problems, and sensitivity to weather and allergies. Overall both men and women reported high incidence of non-musculoskeletal problems (80% and 86%, respectively).

Table 2: The most prominent non-musculoskeletal problems that received above 50% positive response rate

Non-musculoskeletal problems	Overall n = 145 (%)	Women n = 79 (%)	Men n = 66 (%)	Keyboard n = 62 (%)	Strings n = 25 (%)	Vocal n = 32 (%)	Winds n = 26 (%)
Inappropriate tiredness	120 (83)	63 (80)	57 (86)	54 (87)	19 (76)	26 (81)	21 (81)
Concentration problems	115 (79)	61 (77)	54 (82)	53 (85)	20 (80)	24 (75)	18 (69)
Sleep disturbances	113 (78)	64 (81)	49 (74)	51 (82)	16 (64)	28 (88)	18 (69)
Headache requiring medication	94 (65)	57 (72)	37 (56)	39 (63)	14 (56)	24 (75)	17 (65)
Vision problems	86 (59)	47 (59)	39 (59)	39 (63)	14 (56)	15 (57)	18 (69)
Sensitivity to the weather e.g. allergies	83 (57)	37 (56)	46 (58)	30 (48)	13 (52)	23 (72)	17 (65)

Approximately two thirds of the students in this sample reported musculoskeletal problems. The overall most reported musculoskeletal problems experienced were related to head/sinuses (64%), lower spine (64%), muscle cramps (62%) and upper spine (58%). Table 3 summarizes the most prominent responses related to musculoskeletal problems.

A total of 100 open-ended responses were

received from 75 (52%) students. They provided answers to the open-ended questions about health problems affecting their performance. There were 39 detailed responses from women and 33 from men. Students reported a 43% incidence of problems experienced in the past week, of which 76% declared that it interfered with their practice schedule. However, only 19% reported a medical diagnosis of the problems.

Table 3: The most prominent musculoskeletal problems that received above 50% positive response rate

Musculoskeletal problems	Overall n = 145 (%)	Women n = 79 (%)	Men n = 66 (%)	Keyboard n = 62 (%)	Strings n = 25 (%)	Vocal n = 32 (%)	Winds n = 26 (%)
Orofacial: Sinuses	93 (64)	53 (67)	40 (61)	36 (58)	14 (56)	25 (78)	15 (58)
Lower spine	93 (64)	46 (58)	47 (71)	42 (68)	20 (80)	17 (53)	14 (54)
Muscle cramps	90 (62)	52 (66)	38 (58)	39 (63)	19 (76)	17 (53)	15 (58)
Upper spine	84 (58)	47 (59)	37 (56)	39 (63)	19 (76)	14 (44)	12 (46)
Neck	83 (57)	44 (56)	39 (59)	37 (60)	19 (76)	14 (44)	12 (46)
Middle Spine	82 (57)	41 (52)	41 (62)	38 (61)	19 (76)	13 (41)	12 (46)
Throat	80 (55)	46 (58)	43 (52)	25 (40)	15 (60)	26 (81)	15 (58)
Left-hand	78 (54)	39 (49)	39 (59)	35 (56)	18 (72)	11 (34)	14 (54)
Left-hand wrist	77 (53)	39 (49)	38 (58)	36 (58)	17 (68)	12 (38)	12 (46)
Left shoulder	75 (52)	39 (49)	36 (55)	37 (60)	16 (64)	9 (28)	13 (50)
Right shoulder	75 (52)	42 (53)	33 (50)	33 (53)	21 (84)	11 (34)	10 (38)
Right wrist	73 (50)	33 (42)	40 (61)	33 (53)	15 (60)	10 (31)	15 (58)

Table 4 shows the examples of the responses of injuries caused “entirely”, “partially” or “not at all” by practice or performance activities.

There were 18 responses providing details of diagnosis to injuries. Carpal tunnel syndrome and tendonitis were diagnosed in seven students. Other diagnosis related to music making included loss of hearing “loss of hearing in my left ear, my balance was off and I could not pinpoint where the sound was

coming from”, vocal chord problems in singers “induced laryngitis from practicing too much singing, resulting in vocal chord swelling”, and “I was developing nodules, but it was at the early stages and so could heal naturally”, and injuries related to incorrect posture “sitting for extended periods of time causes my back muscles to go into spasm which has to be regularly treated at the physiotherapist”.

Table 4: Examples of responses to open-ended questions of injuries caused entirely, partially, or not at all by practice or performance activities

Injuries caused by practice or performance activities	Responses
Entirely	“Severe back pain from too much practicing I guess.” “Playing big chords with small hands is painful.” “Muscle cramps and movement difficulty in my neck and right shoulder. Possibly over-practice and pushing myself too hard.” “Muscle ache due to wrong posture from practicing.”
Partially	“Not sleeping well, muscles go into a spasm. Might be from stress.” “Shoulders tense because of stress.” “My hair has been falling out, I think due to stress and I have shoulder pain.” “Chronic headaches for three weeks.”
Not at all	“Left wrist needed surgery after formation of dorsal ganglion. Left ulna broke last year.” “Car accident aged 14 results in back pain.” “I broke my little finger on my right hand playing cricket. I also severely injured (dislocated) my right elbow playing rugby.” “A friend fell on me from above and hurt my right elbow and hip. I could not move my arm without pain for at least two weeks.”

Diagnosis not directly related to playing included mood disorder “I was diagnosed with mood, psychological and attention disorder”,

past injuries “ligament and nerve shortening of the neck and trapezius muscles and arms”, and surgery required to remove a dorsal ganglion.

Discussion

The purpose of the study was to explore self-reported musculoskeletal and related non-musculoskeletal problems among undergraduate music students, and to ascertain how these problems impact learning and performing their instruments. Gender and instrument (keyboard, strings, vocal, winds) were taken into account.

The study revealed 83% of the undergraduate music students reported experiencing musculoskeletal and related non-musculoskeletal problems at the University of Pretoria. Although alarming, the result is congruent with previous studies in music students (24, 25).

The four most prominent health related symptoms across this sample were related to non-musculoskeletal problems, of which mental issues such as inappropriate tiredness (83%) was cited as the highest concern. It is not surprising that students in this study also reported high incidence of concentration problems (79%), sleep disturbances (78%), as well as headache (65%) requiring medication. These results resonate with several other studies which also proposed fatigue to be the most prominent non-musculoskeletal problems among their music student sample. For instance, Spahn et al. found that music students showed more somatic symptoms of exhaustion than medical and sport students (34). Inappropriate fatigue could lead to or be indicative of other psychological symptoms such as negative perfectionism and depression. Zander et al. found that music students were particularly at risk of developing psychological symptoms because of the required long practice hours and the fact that students have to organize their own schedules (35). They also found that music students suffer from both psychological and physical symptoms, especially during the first two years of study. Further non-musculoskeletal problems in this study included vision problems (59%) and sensitivity to the weather (57%).

The relationship between psychological stressors and musculoskeletal pain has been studied amongst various musician populations. In an International Conference of Symphony and Opera Musicians (ICSOM) survey by Fishbein et al. many of the participants reported experiencing psychological problems, such as acute anxiety (13%), depression (17%), sleep disturbances (17%), and performance anxiety (24%). The impact of psychological symptoms is often underestimated at tertiary level amongst music students. Furthermore, music students are loathe to report psychological symptoms and seek help versus 74% of music students who reported physical symptoms (3). Few studies thus far have focused on the relationship between psychological factors and musculoskeletal symptoms.

There were a number of interesting gender differences in non-musculoskeletal problems in this sample. Women reported a much higher incidence of headache than men (72% versus 56%) and they also experienced higher rate of sleep disturbance (81% versus 74%). This is congruent with research on sex differences in female musicians who reported a higher prevalence of psychological distress than male musicians (1). The proportion of men reporting inappropriate tiredness was only marginally higher than women (86% versus 80%). Men (82%) also report higher incidence of concentration issues than women (77%).

The results of non-musculoskeletal issues experienced among instrument groups in this study revealed that all students experienced a high incidence of inappropriate tiredness (75%-81%), regardless of their instrument type; however, keyboard players (87%) experienced this more acutely. Keyboard and string (80%) students struggled the most with concentration problems. This finding could be explained by the fact that it is highly probable that keyboard and string players collectively spend much longer hours practicing than the other instrument groups, however, the data cannot verify this supposition. Of the instrumental groups, vocal (88%) students

reported the highest incidence of sleep disturbance followed by keyboard (82%) players. Vocal students also experienced a higher incidence of headaches (75%) than other instrument groups, but this could be linked to a more acute sensitivity to weather-related allergies. In South Africa, particularly in the Highveld region (Gauteng province), grass pollens are present for a significant period of time resulting in over 80% of allergies in allergic rhinitis patients (27).

Overall the high prevalence of non-musculoskeletal issues among this population is worrying given that anxiety, depression and pain are often comorbid (28).

The most prominent musculoskeletal problems experienced by music students in this study were related to head/sinuses (64%), lower spine (64%), muscle cramps (62%), lower left and right forearm (58%) and upper spine (58%). This finding is congruent with Kreutz et al. who investigated the occurrence of musculoskeletal and non-musculoskeletal problems in performance students. They concluded that fatigue and spinal pain were the most common factors, whereas the forearm was identified as the most affected body part.

Various studies have reported gender differences in musculoskeletal pain prevalence, proposing that women are more likely to experience significantly higher incidents of pain (29-31). However, in this study the number of women (60%) and men (65%) reporting musculoskeletal problems were evenly distributed with men experiencing a slightly higher incidence of issues. Men in our sample were particularly prone to lower back pain (71%) where as women complained about muscle cramps more (66%).

Of the four instrument groups, string players have by far experienced a higher incidence of musculoskeletal issues than the other instruments groups. The issues related to the right shoulder (86%), lower spine (80%), muscle cramps (76%), upper spine (76%), neck (76%), middle spine (76%), and left hand (72%) had the highest prevalence. This corresponds with other studies reporting that

upper string players are a high-risk group for musculoskeletal problems (32, 33). Recently Nawrocka et al. found similar results among students of a Polish music school (34). In their study, string players experienced more pain in the most of the assessed anatomic regions, but particularly in the shoulder and neck area. Keyboard players reported issues with lower spine (68%), muscle cramps (63%), upper spine (63%), middle spine (61%), and left shoulder (61%). Fifty-eight percent of keyboard players reported issues with their left wrist as opposed to 53% for the right wrist. In a meta-analysis assessing risk factors associated with PRMDs in pianists, Bragge et al. reported prevalence rates ranging from 26% - 93% (3). Wind players' most prominent issues relate to head/sinus (58%); muscle cramps (58%); throat (58%); right wrist (58%); lower spine (54%), and left-hand (54%).

Vocal students in this study reported by far the highest incidence of head/sinus (78%) and throat (81%) problems and to a lesser degree lower spine (53%) and muscle cramps (53%). The head/sinus finding is possibly correlated with the high incidence of headache in this group. The result is consistent with other studies that have found that vocalists present with a similar prevalence of medical problems than instrumentalists (2).

The open-ended questions probed details of physical or other health problems and medical diagnosis, and whether these problems affected music performance. The results showed that largely there is a level of acceptance of playing related pain, and that students seem generally ill-informed about issues related to pain affecting their performance. Carpal tunnel syndrome and tendonitis are cited as issues reported and diagnosed by a healthcare professional, whereas psychological issues are seldom addressed. This is consistent with the findings of Spahn et al. who found that musicians tend to view physical problems more seriously than psychological problems (35).

The main limitations of this study was that the number of subjects investigated was too small and subgroup analysis was not feasible. The study was descriptive and exploratory in nature and therefore conclusions about severity and causality cannot be drawn. Prospective studies with a larger sample would enable a more in-depth assessment of risk factors and severity levels between gender and instrument groups in this population.

Conclusion

The prevalence of musculoskeletal and non-musculoskeletal problems was 83% in undergraduate music students at the Department of Music at the University of Pretoria. The most debilitating non-musculoskeletal problems were inappropriate tiredness, concentration problems and sleep disturbances, followed by musculoskeletal issues involving sinus problems, lower spine pain and muscle cramps. This study is the first to report non-musculoskeletal and musculoskeletal issues in undergraduate music students in the context of a South African tertiary institution. The unacceptably high prevalence rates accentuate a need for developing an awareness of risk factors and injury amongst teaching staff and students. The findings demonstrate a need for preventive performance health programs in tertiary institutions in South Africa. Educational curricula could focus on musicians' health and wellbeing, health risks, and ergonomically suitable exercises tailored to specific instrument groups, as well as guidance on seeking professional help when necessary.

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References

1. Ackermann BJ, Adams R. Physical characteristics and pain patterns of skilled violinists. *Med Probl Perform Art* 2003; 18(2):65-71.
2. Ackermann BJ, Kenny DT, Fortune J. Incidence of injury and attitudes to injury management in skilled flute players. *Work* 2011; 40(3): 255-59.
3. Bragge P, Bialocerkowski A, McMeeken J. A systematic review of prevalence and risk factors associated with playing-related musculoskeletal disorders in pianists. *Occup Med (Lond)* 2006; 56(1): 28-38.
4. Fry HJH. Incidence of overuse syndrome in the symphony orchestra. *Med Probl Perform Art* 1986; 1(2):51-5.
5. Kaufman-Cohen Y, Ratzon NZ. Correlation between risk factors and musculoskeletal disorders among classical musicians. *Occup Med (Lond)* 2011; 61(2): 90-5.
6. Leaver R, Harris EC, Palmer KT. Musculoskeletal pain in elite professional musicians from British symphony orchestras. *Occ Med (Lond)* 2011; 61(8):549-55.
7. Kenny D, Ackermann B. Performance-related musculoskeletal pain, depression and music performance anxiety in professional orchestral musicians: a population study. *Psychol Music* 2015; 43(1):43-60.
8. Silva AG, Lã F, Afreixo V. Pain prevalence in instrumental musicians: a systematic review. *Med Probl Perform Art* 2015; 30(1):8-19.
9. Hansen PA, Reed K. Common musculoskeletal problem in performing artist. *Phys Med Rehabil Clin N Am* 2006; 17(4):789-801.
10. Kenny DT. The role of negative emotions in performance anxiety. In: Juslin P, Sloboda J, editors. *Handbook of music and emotion: theory, research, applications*. 1st ed. Oxford, England, United Kingdom: Oxford University Press; 2009. P.425-52.
11. Kenny D. *The psychology of music performance anxiety*. 1st ed. Oxford, England, United Kingdom: Oxford University Press; 2011.
12. Ackermann BJ, Kenny DT, O'Brien I, Discoll TR. Sound practice-improving occupational health and safety for professional orchestral musicians in Australia. *Front Psychol* 2014; 5: 973.
13. Barbar AE, de Souza Crippa JA, de Lima Osório F. Performance anxiety in Brazilian musicians: Prevalence and association with psychopathology indicators. *J Affect Disord* 2014; 152-154:381-6.
14. Vaag J, Bjørngaard JH, Bjerkeset O. Symptoms of anxiety and depression among

- Norwegian musicians compared to the general workforce. *Psychol Music* 2016; 44(2):234-48.
15. Fishbein M, Middlestadt SE, Ottati V, Straus S, Ellis A: Medical problems among ICSOM musicians: overview of a national survey. *Med Probl Perform Art* 1988; 3(1):1-8.
 16. Zaza Ch. Playing-related health problems at a Canadian music school. *Med Probl Perform Art* 1992; 7(2):48-51.
 17. Ackermann B, Driscoll T. Attitudes and practices of parents of teenage musicians to health issues related to playing an instrument: a pilot study. *Med Probl Perform Art* 2013; 28(1): 24-7.
 18. Britsch L. Investigating performance-related problems of young musicians. *Med Probl Perform Art* 2005; 20(1):40-7.
 19. Brandfonbrener AG. History of playing-related pain in 330 university freshman music students. *Med Probl Perform Art* 2009; 24(1):30-6.
 20. Árnason K, Árnason A, Briem K. Playing-related musculoskeletal disorders among Icelandic music students: differences between students paying classical vs rhythmic music. *Med Probl Perform Art* 2014; 29(2):74-9.
 21. Wood GC. Prevalence, risk factors, and effects of performance-related medical disorders (PRMD) among tertiary-trained jazz pianists in Australia and the United States. *Med Probl Perform Art* 2014; 29(1):37-45.
 22. Ajidahun AT, Phillips J. Prevalence of musculoskeletal disorders among instrumental musicians at a center for performing arts in South Africa. *Med Probl Perform Art* 2013; 28(2):96-9.
 23. Panebianco-Warrens CR, Fletcher L, Kreutz G. Health-promoting behaviors in South African music students: A replication study. *Psychol Music* 2015; 43(6):779-92.
 24. Ginsborg J, Kreutz G, Thomas M, Williamon A. Healthy behaviours in music and non-music performance students. *Health Educ (Lond)* 2009; 109(3):242-58.
 25. Kreutz G, Ginsborg J, Williamon A. Music students' health problems and health-promoting behaviours. *Med Probl Perform Art* 2008; 23(1):3-11.
 26. Langendörfer F, Hodapp V, Kreutz G, Bongard S. Personality and performance anxiety among professional orchestra musicians. *J Individ Differ* 2006; 27(3): 162-71.
 27. Butler N. National guidelines at a glance: allergic rhinitis. *S Afr Pharm J* 2009; 76(7):25-7.
 28. Kroenke K, Wu J, Blair MJ, Krebs EE, Damusch TM, Tu W. Reciprocal relationship between pain and depression: a 12-month longitudinal analysis in primary care. *J Pain* 2011; 12(9):964-73.
 29. Bruno S, Lorusso, A, L'Abbate N. Playing-related disabling musculoskeletal disorders in young and adult classical piano students. *Int Arch Occup Environ Health* 2008; 81(7):855-60.
 30. Zetternburg C, Backlund H, Karlsson J, Werner H, Olsson L. Musculoskeletal problems among male and female music students. *Med Probl Perform Art* 1998; 13(4):160-8.
 31. Shields N, Dockrell S. The prevalence of injuries among pianists in music schools in Ireland. *Med Probl Perform Art* 2000; 15(4):155-60.
 32. Middlestadt SE, Fishbein M. Health and occupational correlates of perceived occupational stress in symphony orchestra musicians. *J Occup Med* 1988; 30(9):687-692.
 33. Nawrocka A, Mynarski W, Powerska-Didkowska A, Grabara M, Garbaciak W. Musculoskeletal pain among Polish music school students. *Med Probl Perform Art* 2014; 29(2):64-9.
 34. Spahn C, Strukely S, Lehmann A. Health conditions, attitudes toward study, and attitudes toward health at the beginning of university study: music students in comparison with other student populations. *Med Probl Perform Art* 2004; 19(1):26-44.
 35. Zander ME, Voltmer E, Spahn C. Health promotion and prevention in higher music education: results of a longitudinal study. *Med Probl Perform Art* 2010; 25(2):54-65.