



## The Prevalence of Playing-related Musculoskeletal Disorders (PRMSD) Among Professional Orchestra players

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**Abstract:** The prevalence of playing-related musculoskeletal disorders (PRMSD) among musicians is high and several causes, such as the quality of working conditions can influence their onset. The aim of this study was to study the influence of working conditions on the prevalence of PRMSD. Three professional orchestras were invited to take part in the study. They were then divided into two groups according to the working conditions they offered. Group A was considered to present adequate working conditions and group B was not. PRMSD and its intensity, as measured by Verbal Numeric Scale (VNS), were registered through an individual semi-structured interview. Group B presented a higher percentage of self-reported PRMS complaints (67.4%) than group A (59.4%). VNS values were also higher ( $p$  value = 0.021) in group B (VNS=5.1) than in group A (VNS=4.0). Results suggest that the prevalence and the severity of PRMSD could be reduced by adequate working conditions.

**Keywords:** Working conditions; Playing-related musculoskeletal disorders; Orchestra musicians; Working related problems; Professional musicians.

A prevalência de lesões músculo esqueléticas relacionadas com o trabalho (LMERT) entre músicos de orquestras profissionais

**Resumo:** A prevalência de lesões músculo esqueléticas relacionadas com o trabalho (LMERT) entre os músicos é elevada e várias causas, entre as quais a qualidade das condições de trabalho, são descritas como variáveis importantes que podem influenciar o seu aparecimento. O objectivo deste trabalho foi examinar a influência das condições de trabalho sobre a prevalência de LMERT entre os músicos. Três orquestras profissionais foram convidadas a participar no estudo. Os músicos participantes foram divididos em dois grupos de acordo com as condições de trabalho providenciadas pelas orquestras em que trabalhavam. O grupo A foi considerado como apresentando condições adequadas de trabalho e o grupo B foi considerado como não apresentando condições adequadas de trabalho. As LMERT e a sua intensidade, medida pela escala verbal numérica (EVN), foram registadas através de uma entrevista semiestruturada individual. O Grupo B apresentou uma maior percentagem de pessoas com mobilidade reduzida e de queixas (67,4%) do que o grupo A (59,4%). Os valores da EVN também foram mais elevados ( $p = 0,021$ ) no grupo B (EVN = 5,1) do que no grupo A (EVN = 4,0). Os resultados sugerem que tanto a prevalência como a gravidade das LMERT poderiam ser reduzidas através de condições de trabalho adequadas.

**Palavras-chave:** Condições de trabalho; Lesões músculo esqueléticas relacionadas com o trabalho (LMERT); Músicos de orquestra; Músicos profissionais.

### 1. Background

The prevalence of playing-related musculoskeletal disorders (PRMSD) among musicians is well documented in literature (Ostwall et al., 1994). Lockwood (1989) reported that almost 50% of musicians experience PRMSD to a level that could threaten or end their careers. According to Zaza (1998) the percentage of affected musicians ranged from 39% to 87% in adult musicians and from 34% to 62% in secondary school music students. More recent data states that 50% to 76% of musicians are affected by PRMSD (Heinan, 2008). An Australian study that involved 485 orchestra musicians referred to a 42% prevalence of PRMSD (Fry, 1996) while 86% of elite professional musicians of British symphonic orches-

tra claimed to have suffered some type of musculoskeletal pain during the last year (Leaver, Harris, Palmer, 2011).

However, in spite of the historical importance of such statistics it is clear that the problem of PRMSD among musicians is far from being solved, since the numbers have remained almost the same over several years. Common solutions used to treat musculoskeletal complaints include rehabilitation programs and drugs such as paracetamol, a very well-known pain killer (Schnitzer, 2006). In fact, 49% of orchestra musicians mention the use of paracetamol to control their pain and 64% had been examined or treated by a health care professional, such as a physiotherapist (Paarup, 2011). However, according to Curatolo and Bogduk (2000), many drugs are ineffective while others reduce pain only modestly and briefly and have only a minimal effect on musicians' quality of life. Other strategies include rehabilitation programs, and the recommendation to stop playing, with approximately one third of the affected musicians having to stop playing for a period of time (Heming, 2004).

PRMSD may bring emotional, physical, financial, occupational and social consequences to a musician's life (Zaza, Charles and Muszynski, 1998). The fear of losing their work might be responsible for the dangerous attitude of ignoring pain, the symptoms requiring treatment or the necessary rest (Suskin et al. 2005; Llobet, 2004; Shafer-Crane 2006). The consequence of this behaviour may be the development of acute to chronic conditions. Indeed, musculoskeletal disorders often become chronic and painful causing decreased quality of life (Zaza, 1998; Lockwood, 1989). Data shows that 73% of orchestra musicians mention the need to change their way of playing, 55% reported feeling difficulty in daily activities at home, and 49% reported having difficulty in sleeping (Paarup et al., 2011). PRMSD may also have a negative impact on the quality of a musician's performance and Ackermann et al. (2012) or Zaza et al (1998) suggest that PRMSD adversely affect a musician's ability to play to their optimum level.

According to the Portuguese Health Ministry, an occupational disease is a condition directly caused by working conditions that can lead to incapacity or death during performance of the occupation (Decreto Regulamentar N° 76/2013). Unfortunately, perhaps because of the fact that performing arts are so much a part of everyday life, they are not regarded as a perceived occupation and job (Lederman, 2003). However, like many other occupational diseases, PRMSD have multifactorial causes and several risk factors that could contribute to their onset.

As common occupational diseases, factors such as awkward static or dynamic postures, repetitive movements, unhealthy habits, the lack of ergonomic precautions and preventive wellness behaviour, age, gender or stressful environments could influence their onset (Costa, Vieira, 2010; Paarup et al, 2011). Additionally, individual issues specifically related to musicians' activity such as technique, number of years of experience, type of repertoire, previous trauma, or the individual adaptation to the instrument itself, could influence the appearance of PRMSD (Frank and Mühlen, 2007; Fragelli, et al, 2008; Wu, 2007; Hansen & Reed, 2006; Nyman, 2007). As previously mentioned, it is also known that organizational management and working environment could influence the prevalence of PRMSD. The extremely competitive environment, the self-imposed pressures, the average of playing hours, inadequate material resources or warm-up before playing could highly influence the development of PRMSD (Cohen and Ratzon, 2011).

Zander et al (2002) identified 3 main groups of risk factors that can preclude the development of PRMSD: environmental aspects, physical demands and activities, and personal characteristics. Environmental aspects include temperature, confined spaces, space lay-

out, equipment, equipment layout or configuration, surfaces (floor) and lighting. Physical demands include aspects such as long-duration activities with inadequate rest and personal characteristics include e.g. psychological stress, age and gender.

If some of those causes and risk factors such as the musicians' individual characteristics could not be changed, variables related to environmental aspects and working conditions within the orchestra framework, such as adequate material resources, could be ameliorated. Recent studies alert that providing adequate working conditions could reduce the appearance of PRMSD (Shafer-Crane, 2006; Zander et al, 2002). For instance, depending on the problem, ergonomic instrument modifications may influence the prevalence of musculoskeletal pain. To avoid diseases related to incorrect body posture, which can influence the appearance of muscle or spinal injuries, it is necessary to keep the body in an ergonomically recommended posture during a musical performance. To control this problem, the chair should be adapted to the musician's individual characteristics. It must be supportive in order to maintain a proper posture that allows a view of the conductor (Heinan, 2008; Suskin et al, 2005).

Light and temperature conditions in the rehearsal and concert room can also influence the onset of PRMSD. Poor light conditions could cause eyestrain and cool temperatures slow nerve conduction, making the finger response harder and diminishing finger sensitivity (Hansen and Reed, 2006; Norris, 2011).

The possibility of taking breaks during practice is also very important. Taking short breaks during long practice could contribute to reducing the appearance of musculoskeletal pain (Zaza and Fareweel, 1997, Zander et al). In addition to this, Suskin et al (2005) suggest that warming-up and breathing exercises before performance, and strengthening and stretching exercises are considered to be good health habits to prevent PRMSC among musicians. According to the authors, regular health examination by a doctor must also be included within those preventive strategies and therefore it is very important that the orchestra management provides musicians with a medical examination to diagnose health problems like hearing alterations, psychological stress or physical complaints, among others conditions.

One other aspect to consider is the fact that musicians are subjected to noise exposure that could threaten their hearing acuity and is responsible for hearing impairment. Therefore, the orchestra should provide individual solutions to hearing protection in order to prevent future damage (Royster, Royster, and Killion, 1991; Hansen and Reed, 2006; Behar, Wong, and Kunov, 2006; Russo et al, 2013)

As previously stated, the fear of losing work is one of the main facts responsible for musicians neglecting their musculoskeletal problems. Consequently, a stable work contract could alter this behaviour and have a positive influence on the chronicity of PRMSD. Maybe if musicians know that their job is secure, they treat their injury at an earlier stage.

According to Allemendiger (1996), managers and artistic directors are in the challenging position of providing stability to the orchestra. Creating opportunities, promoting the professional development of musicians, controlling the fairness and efficacy of the recruitment/selection process, dealing with the conception of authority and promoting adequate financial and material resources are some of the variables that could influence the working stability of musicians.

By analysing all these preventive strategies one could define adequate working conditions as:

- The presence of ergonomic chairs exclusively made to respect the individual characteristics of the musician, stable light and temperature conditions and a fixed rehearsal room;
- The possibility of taking adequate breaks during rehearsal;
- The possibility of using hearing protection;
- The possibility of having regular health examinations to prevent hearing impairment and the appearance of PRMSD;
- A stable work contract.

## 2. Method

The aim of this research was to ascertain whether there is an association between the defined adequate working conditions and the prevalence and severity of playing-related musculoskeletal complaints. The inclusion criteria to consider that the orchestra has adequate working conditions were as below:

- The presence of ergonomic chairs exclusively made to respect the individual characteristics of the musician,
- Fixed rehearsal room,
- Stable light and temperature conditions in the rehearsal room
- Adequate breaks during rehearsal
- Possibility of using hearing protectors
- Regular health examinations
- Stable work contract

Three professional orchestras from Portugal were invited to take part in this research, totalling 162 professional orchestra musicians. To form part of the study the musician had to comply with the following inclusion criteria:

- Musculoskeletal pain present at the time of the interview and stable for at least seven days
- Diagnosis of PRMSD by a physiotherapist

In an individual semi-structured interview acute playing-related musculoskeletal self-reported complaints (PRMSC) and their intensity (measured by Verbal Numeric Scale-VNS) were registered. The data was collected between September of 2012 and June of 2013 after ethical approval and the informed consent of all participants, in accordance with the Helsinki declaration.

The numeric verbal scale (NVS) for pain intensity is a valid instrument to assess changes in pain intensity and it is one of the most frequently used pain scales (Holdgate et al, 2003). The person estimates their pain on a scale of 0 to 10 (Sousa and Silva, 2005). 0 represents no pain, from 1 to 3 represents mild pain, from 4 to 6 represents moderate pain and from 7 to 10 represents severe pain.

VNS values were analysed using SPSS (version 21.0, SPSS Inc., Chicago, Illinois, USA). The Mann-Whitney test was performed to analyse the difference of VNS values between groups (Fortin, 1999).

### 3. Results

#### Recruitment

- 1<sup>st</sup> inclusion criteria

One out of the three professional orchestras complied with the inclusion criteria and 69 out of 89 (77.5%) musicians agreed to participate into the study- Group A

Two out of three professional orchestras did not comply with the inclusion criteria and of those 43 out of 73 (68.9%) musicians participated in this research – Group B

- 2<sup>nd</sup> inclusion criteria

41 out of 69 (59.4%) musicians of group A complied with the inclusion criteria and 29 out of 43 (67.4%) musicians of the group B complied with the inclusion criteria.

The recruitment procedure is represented in the following flow chart

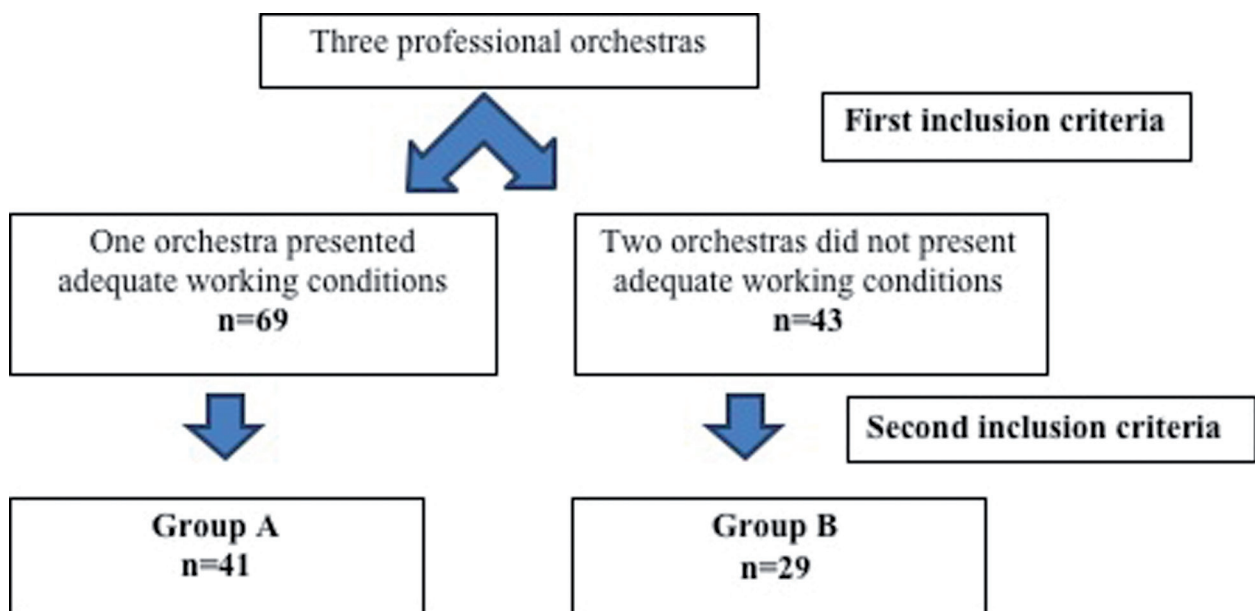


Figure 1: Recruitment flow chart

#### Sample characteristics

The following table contains the sample characteristics.

Table 1: Sample characteristics

	Age	Gender
Group A (n=41)	41.7 (SD=8.9)	14 women (34%)
Group B (n=29)	31.8 (SD=7)	11 women (38%)

#### Prevalence of self-reported PRMSC

As shown in table 2, group B has a higher percentage of self-reported PRMSC (67.4%) than group A (59.4%). However, the number of complaints per affected musician is higher in group A (1.9 against 1.6).



Table 2: prevalence of self-reported PRMSC

	Interviewed	Self-reporting PRMSC	% of affected musicians	Number of reported complaints	Complaints/Musician	Complaints/affected musician
Group A	n= 69	n=41	59.4%	79	1.1	1.9
Group B	n=43	n=29	67.4%	47	1.1	1.6

### Pain intensity

Pain intensity was measured by verbal numerical scale (VNS) from 0 to 10. Table 3 and figure 2 show the VNS values.

Table 3: Pain intensity

	Group A	Group B
VNS	4.0 (SD=1.9)	5.1 (SD=1.9)

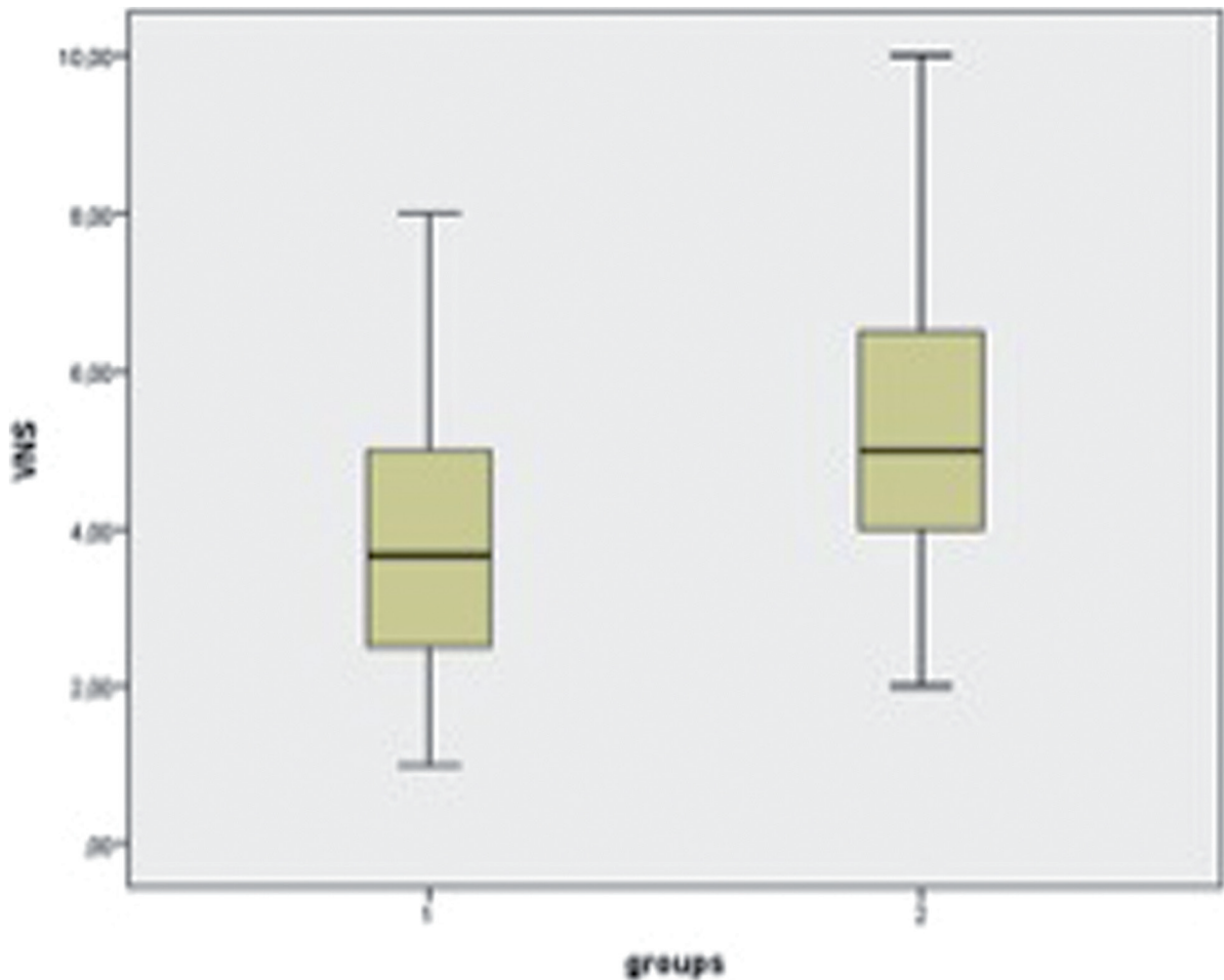


Figure 2: Distribution of VNS values

Results show that comparing VNS values through a Mann-Witney test, VNS values are statically significant (p value= 0.021).

#### 4. Discussion

Results show a higher percentage of PRMSC among group B. The difference between groups is 11%. This value suggests that working conditions may influence the prevalence of playing-related musculoskeletal disorders. Although the percentage of affected musicians is higher in group B, the number of self-reported complaints per affected musician is higher in group A. Despite the fact that the difference between groups is almost nil (0.3), it is important to consider that those data came from interviews and the complaints were self-reported by the musicians. According to Suskin et al. (2005), Shafer-Crane (2006) and Llobet (2004) the recommendation to stop playing and the fear of losing their work could be responsible for a dangerous tendency to ignore pain and symptoms requiring treatment or rest. It is also important to bear in mind that group A has more stable working contracts than group B. In this way, we can speculate that perhaps the musicians of group B tend to ignore some of their complaints because they fear losing their jobs.

As far as pain intensity measured by VNS is concerned, results clearly show a statistical difference between groups ( $p$ value=0.021). Group B (VNS=5.1) states more intense musculoskeletal pain than group A (VNS=4.0). Those results also tally with the hypothesis that working conditions may influence the severity of PRMSD. Nevertheless, those values are concerning because musicians are working with moderate pain.

Literature states that PRMSD could be explained by several causes and several risk factors could preclude their appearance. Individual musicians' characteristics like age and gender have a strong influence on the prevalence of PRMSD. Women are more affected than men and increased age is also a risk factor to their development (Paarup et al, 2011, Lobet, 2004, Russo et al, 2013). As regards gender, our sample is equivalent, and thus we can affirm that the difference between pain intensity could not be explained by this variable.

In our sample the difference between ages in group A and B is 10 years. A study performed with 1613 musicians of different ages and professional levels demonstrated that 90% of the musicians aged between 30 and 40 were affected by physical problems, compared with 55% in adults aged from 20 to 30 (Llobet, 2004). According to this information, it could be expected that older musicians present a higher prevalence and severity of PRMSC than younger musicians. In terms of the age variable it could be expected that group A presented more PRMSD than group B. This was not the case and the highest percentage of PRMSD in group B may well be explained by the influence of adequate working conditions preventing PRMSD, since musicians in Group B are younger but work under poorer working conditions.

Taking another perspective, it is known that the lack of efficacy of individual technique could also contribute to musculoskeletal pain. Although we are aware of the difficulty of defining a good individual technique, we can speculate that perhaps older musicians present a technique which is more adequate to the function they perform than younger musicians and therefore this variable could also have influenced our results.

Yet another perspective is presented by Warrington (2002), according to whom PRMSD must be analysed by three different pathological groups: "trauma" "degenerative" and "non-specific pain". The author states that there are no differences between ages in the prevalence of PRMSD caused by trauma. Degenerative conditions are most common over the age of 40, but "non-specific arm pain" is much higher in musicians under 25. Thus, although age could help to explain our results, there are several variables which are impossible to control.



## Conclusion

According to our data, the prevalence and intensity of playing-related musculoskeletal disorders is associated with less adequate working conditions, suggesting their important role in professional musicians' health and well-being. In fact, it is documented that PRMSD have multifactorial causes and risk factors, and that adequate working conditions proved to be an important variable to promote good quality of life.

Although adequate working conditions are important to promote a good working environment, other variables should also be considered. As Allmendinger (1996) suggested, the orchestra management board is in the challenging position of providing the orchestra with stability, creating opportunities, promoting the professional development of the orchestra musicians, and promoting adequate financial and material resources. Nevertheless, adequate working conditions could be expensive. Providing stable contracts, the aforementioned ergonomic chairs, or adequate rehearsal rooms costs money. But it is our belief that the investment may prove worthwhile when the expected number of sick leaves decreases. However, the monetary factor is not the most important at play. Institutions and the individuals that work in them have a lot to gain if a healthy orchestra is to be promoted and it is everyone's moral and ethical duty to promote the healthiest possible working environment.

Although it is known that PRMSD have multifactorial causes, it is difficult to isolate and to study only one of those causes, risk factor or variables. Our results do not allow the establishment of a direct cause-effect relationship between adequate working conditions and the prevalence and intensity of PRMSD. We are aware that variables like gender, age, repertoire or individual technique could not be changed or controlled by us and that they could have influenced our results. This fact represents the main limitation of our study and further studies are needed to ameliorate our conclusions.

Nevertheless, our results tally with the hypothesis that adequate working conditions may influence the prevalence and the severity of PRMSD in professional orchestra musicians. It is possible to change this variable. Providing adequate material and stable working conditions is an ethical duty of both employers and their co-workers. The orchestra management has also the ethical duty of preserving quality of life, promoting health and avoiding illnesses among musicians and of promoting more responsible behaviour on the musician's part. With this research we hope to have raised awareness about the importance of adequate working conditions, especially when research at a national level in Portuguese orchestras is so scarce.

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