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Musculoskeletal pain in professional orchestra instrumentalists and its determinants: a Polish pilot study

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ABSTRACT

Introduction: This study aimed to assess pain in professional musicians playing various instruments, as well as to analyse the relationships between the intensity and frequency of pain and the duration of playing the instrument and somatic variables.

Materials and methods: A cross-sectional study was conducted between 60 professional musicians, who were divided into 3 groups: cellists, violinists, and musicians playing wind instruments. Pain intensity was assessed using the visual analogue scale (VAS). The respondents also assessed the frequency of musculoskeletal disorders, the location of pain, the number of hours of playing the instrument per week, and the playing experience in years. In addition, body weight and height were measured and the body mass index (BMI) was calculated.

Results: Musculoskeletal disorders occurred among 83.33% of musicians, including: cellists (n = 20; 100%), violinists (n = 18; 90%), and musicians playing wind instruments (n = 12; 60%). The pain was more often localised in the lumbar and cervical spine, and less frequently in the upper and lower limbs. Cellists and violinists experience the most intense pain (appropriately Me = 4.50, IQR = 4.00 and Me = 5.00, IQR = 3.50) and of greater frequency (appropriately Me = 3.00, IQR = 2.00 and Me = 3.00, IQR = 6.00) in contrast to musicians who play wind instruments (Me = 1.00, IQR = 2.00); $p < 0.01$.

Conclusions: Musculoskeletal pain is very common among musicians, especially among string players. There is a need for greater awareness and knowledge among musicians of strategies to prevent pain and overload. Playing stringed instruments, including many hours of practice per week and a longer experience in playing the instrument, is conducive to greater intensity and frequency of pain in the musculoskeletal system.

Keywords: musculoskeletal pain; occupational health; pain measurement; instrumentalists.

INTRODUCTION

The prevalence of work-related health problems is an important issue from the perspective of an individual worker. By deteriorating health, it may also result in a loss of ability to work. However, it is also important from an economic and organizational perspective, e.g. due to more frequent or prolonged absences, sick leave, and even permanent inability to work and unemployment [1]. Musculoskeletal dysfunction syndromes occur in various professional groups. Musculoskeletal problems and pain are also common in instrumental musicians [2, 3, 4].

In order for a musical instrument to sound properly, to practice and perfect their play in a correct way, it is necessary to properly position the body in space and adjust your posture to the given instrument. When playing the instrument, each body segment is in a forced position. Improving the playing of an instrument involves daily practice, often many hours of exercise, so the period of staying in a non-physiological position of the body is a large segment of the day [5, 6]. Performing repetitive movements for a long time and engaging the same muscle groups may lead to pathological changes in the musculoskeletal system. Pain is often the first warning sign but it is often neglected at the beginning [7].

Due to the different types of instruments, musculoskeletal ailments may vary between musicians. Each instrument requires a different position of the musician's body [8, 9].

Each instrument presents a different challenge to the musculoskeletal system. Therefore, it is recommended to study the dysfunctions of the musculoskeletal system in different groups of instruments. Recent studies confirm the occurrence of musculoskeletal disorders in 80–90% of musicians [10, 11, 12]. Although research regarding occupational health risks of musicians is systematically conducted abroad, the number of studies on Polish instrumentalists is still limited.

The purpose of this study was to estimate the prevalence of musculoskeletal pain and its severity in professional Polish musicians playing various instruments as well as to analyse the relationships between the intensity and frequency of pain and the duration and the experience of playing the instrument and somatic variables.

MATERIALS AND METHODS

Study design and setting

This cross-sectional study was carried out in January and February 2020 in the Opolskie Voivodeship, Poland. The research

was carried out under the guidelines of the Declaration of Helsinki and Good Clinical Practice. It was approved by the Bioethical Commission at the Opole Medical School (permission No. KB/240/FI/2020). The work is an excerpt from research registered on the International Standard Randomised Controlled Trial Number platform under number 37451, which has been discontinued since March 2020 due to the COVID-19 pandemic. The Strengthening the Reporting of Observational Studies in Epidemiology guidelines were followed.

Participants

Professional musicians from the Symphony Orchestra of the Opole Philharmonic Józef Elsner and the Princely Symphony Orchestra in Brzeg were examined. The inclusion criteria were: (1) professionally active musician, (2) cellist, violinist, or musician playing wind instruments in an orchestra, (3) a min. 5-year experience in playing the instrument, and (4) a voluntary written consent to participate in the study. Exclusion criteria were: (1) diagnosed chronic disease of the musculoskeletal system, (2) active infection, acute injury, or exacerbation of any chronic disease, (3) a history of trauma that may be associated with pain sensations, (4) cancer, (5) pregnancy, and (6) a lack of written consent to participate in the study. The questionnaires were addressed to 82 musicians. Twenty-two people did not complete the questionnaires and did not proceed with further research. Ultimately, 60 musicians were examined, including 34 women and 26 men. The research was carried out at the Opole Philharmonic and the City Hall in Brzeg in the afternoon.

All participants gave written informed consent after a thorough explanation of the procedures involved. Before the examination, each patient was informed about its aim and method, and the possibility of withdrawal at any stage of the research. The examinees were also assured of full anonymity and the voluntary nature of the study.

Research tools

The study was carried out using the method of a diagnostic survey based on the questionnaire technique. An original questionnaire was used.

Pain intensity was assessed using the visual analogue scale (VAS), which assesses pain ranging 0–10, where 0 means no pain and 10 means intense, unbearable pain [13]. The respondents also assessed the frequency of occurrence of musculoskeletal disorders (number of days a week) and the location of the pain. The participants could indicate several places of pain sensation.

This was supplemented by questions about the number of hours of playing the instrument per week and the playing experience in years. In addition, body weight and height were measured and the body mass index (BMI) was calculated.

Statistical methods

Descriptive statistics were calculated – mean (M), standard deviation (SD), median (Me), and the interquartile range (IQR). The distribution of the examined parameters was assessed in terms of normality using the Shapiro–Wilk test. The distribution of variables did not meet the assumptions of the normal distribution. Non-parametric methods were used. The Kruskal–Wallis ANOVA rank test was used to assess the significance of differences between the 3 groups based on the type of instrument. For Kruskal–Wallis ANOVA, the Dunn test was used as a *post hoc* test. The Spearman's rank correlation was used to assess the relationship between the number of hours of play and the experience of playing an instrument and the intensity and frequency of pain. The strength of the dependence was interpreted as follows: $|r| \geq 0.9$ – very strong dependence, $0.7 \leq |r| < 0.9$ – strong dependence, $0.5 \leq |r| < 0.7$ – average dependence, $0.3 \leq |r| < 0.5$ – weak dependence, and $|r| < 0.3$ – very weak dependence [14].

The differences in the frequency of pain in particular parts of the body between musicians were assessed with chi-square test. All calculations were made using the Statistica 13.3 program (TIBCO Inc., Tulsa, United States). The level of $p \leq 0.05$ was adopted to assess statistical significance.

RESULTS

Descriptive data

A total of 60 musicians were examined. The participants were divided into 3 groups: cellists, violinists, and musicians playing wind instruments. There were 20 people in each group. The wind instruments included musicians playing the trombone (3), clarinet (3), bassoon (3), flute (1), French horn (4), trumpet (5), and horn (1). The musicians were of a similar age. Statistically significant differences between the musicians were noted in body height ($p \leq 0.01$), body weight ($p \leq 0.0001$), and BMI ($p \leq 0.05$). The age and somatic characteristics of the participants are presented in Table 1.

Main results

Musculoskeletal disorders occurred among 83.33% (n = 50) of musicians, including: cellists (n = 20; 100%), violinists (n = 18; 90%), and musicians playing wind instruments (n = 12; 60%).

In the group of cellists, pain was most often located in the lumbar spine (n = 16; 80%) and in the upper limb (n = 10; 50%) and was less common in the cervical spine (n = 5; 25%) and in the lower limb (n = 1; 5%). In the group of violinists, the most common localisation of pain was the cervical spine (n = 16; 80%) and the lumbar spine (n = 11; 55%). In the group of musicians playing wind instruments, pain most often occurs in the lumbar spine (n = 8; 40%) and less often in the upper limb (n = 5; 25%) and cervical spine (n = 3; 15%). No musician playing wind instruments experiences pain in the lower limb. Cervical pain was significantly more often experienced by violinists than by cellists and wind instrumentalists ($p < 0.001$). In turn, pain in the lumbar spine was most often experienced by the cellists ($p = 0.034$) – Table 2.

Musicians playing wind instruments experienced the least pain ailments (Me = 3.00, IQR = 4.00) compared to cellists and violinists (respectively Me = 4.50, IQR = 4.00 and Me = 5.00, IQR = 3.50), $p = 0.007$ (Tab. 3, 4).

Cellists and violinists experience pain significantly more often (Me = 3.00, IQR = 2.00 and Me = 3.00, IQR = 6.00) than

musicians playing wind instruments (Me = 1.00, IQR = 2.00), p = 0.004 (Tab. 3, 4).

The average number of hours of playing an instrument per week in the violinists group (Me = 42.00, IQR = 18.00) was higher compared to wind instrumentalists (Me = 20.0, IQR = 16.0), p = 0.019 (Tab. 3, 4).

The greatest experience in playing the instrument was experienced by violinists (Me = 26.50, IQR = 15.00), then cellists (Me = 20.50, IQR = 19.00) and musicians playing wind instruments (Me = 13.50, IQR = 16.0). The difference between the results was not statistically significant (p = 0.073) – Table 3.

TABLE 1. Descriptive statistics of age and anthropometric variables in the studied groups of musicians

Variables	Descriptive statistics	Cellists (n = 20)	Violinists (n = 20)	Wind instrumentalist (n = 20)	Kruskal–Wallis one-way analysis of variance
Age (years)	mean ±SD	33.20 ±11.95	33.20 ±13.15	31.10 ±13.77	1.096
	median (IQR)	29.50 (20.50)	33.50 (8.00)	25.00 (18.00)	p = 0.578
Body height (cm)	mean ±SD	169.75 ±6.99	167.85 ±8.38	175.50 ±9.23	10.099*
	median (IQR)	170.00 (9.00)	168.00 (8.00)	177.00 (9.50)	p = 0.006
Body mass (kg)	mean ±SD	68.60 ±17.03	61.40 ±14.88	79.25 ±12.80	14.329**
	median (IQR)	61.50 (16.00)	58.00 (19.50)	83.00 (13.50)	p = 0.000
BMI (kg/m²)	mean ±SD	23.62 ±4.82	21.59 ±3.82	25.62 ±3.25	13.335*
	median (IQR)	22.45 (3.59)	20.43 (4.22)	25.72 (4.52)	p = 0.001

p-value of Kruskal–Wallis one-way analysis of variance: * p ≤ 0.01; ** p ≤ 0.0001

BMI – body mass index; SD – standard deviation; IQR – interquartile range

TABLE 2. Typical localization of pain in professional musicians

Group	Cervical spine n (%)	Lumbar spine n (%)	Upper limb n (%)	Lower limb n (%)
Cellists	5 (25%)	16 (80%)	10 (50%)	1 (5%)
Violinists	16 (80%)	11 (55%)	9 (45%)	2 (10%)
Wind instrumentalists	3 (15%)	8 (40%)	5 (25%)	0 (0%)
χ^2 **p**	20.417** 0.000**	6.720* 0.034*	2.917 0.232	2.105 0.349

p-value of χ^2; * p ≤ 0.05; ** p ≤ 0.001

TABLE 3. Statistical characteristics of pain and playing an instrument in groups of musicians

Variables		M ±SD	Me (IQR)	Kruskal–Wallis one-way analysis of variance
Pain assessment on the VAS (n)	cellists	4.70 ±2.02	4.5 (4.00)	10.023** p = 0.007
	violinists	4.60 ±2.50	5.0 (3.50)	
	wind instrumentalists	2.40 ±2.47	3.0 (4.00)	
The frequency of symptoms per week (n)	cellists	3.60 ±1.72	3.0 (2.00)	11.235** p = 0.004
	violinists	3.60 ±2.79	3.0 (6.00)	
	wind instrumentalists	1.70 ±2.25	1.0 (2.00)	
Number of hours of playing per week (hours)	cellists	25.00 ±12.29	28.0 (15.00)	7.911* p = 0.019
	violinists	33.40 ±16.68	42.0 (18.00)	
	wind instrumentalists	20.60 ±10.15	20.0 (16.00)	
Experience in playing the instrument (years)	cellists	24.15 ±10.69	20.5 (19.00)	5.223 p = 0.073
	violinists	25.95 ±12.51	26.5 (15.00)	
	wind instrumentalists	18.35 ±12.54	13.5 (16.5)	

p-value of Kruskal–Wallis one-way analysis of variance: * p ≤ 0.05; ** p ≤ 0.01

VAS – visual analogue scale; M – mean; SD – standard deviation; Me – median; IQR – interquartile range

TABLE 4. Pairwise comparisons using Dunn *post hoc* test, by instrument specialisation

	Group	Cellists	Violinists	Wind instrumentalists
Pain assessment on the VAS	cellists		1.000	0.009**
	violinists	1.000		0.001*
	wind instrumentalists	0.009**	0.001*	
The frequency of symptoms per week	cellists		1.000	0.035*
	violinists	1.000		0.035*
	wind instrumentalists	0.035*	0.035*	
Number of hours of playing per week	cellists		0.153	0.902
	violinists	0.153		0.010*
	wind instrumentalists	0.902	0.010*	

* $p \leq 0.05$; ** $p \leq 0.01$
VAS – visual analogue scale

In the group of cellists, a statistically significant average correlation was found between the weekly number of hours of playing an instrument and the pain intensity level on the VAS. The greater the number of hours spent on playing the instrument, the greater the pain ($p \leq 0.05$) – Table 5.

In the group of violinists, a significantly statistical strong correlation was found between the frequency of symptoms per week and pain expressed on the VAS ($p \leq 0.05$), as well as a weak correlation between the weekly number of hours of playing an instrument and the frequency of symptoms per week ($p \leq 0.05$) – Table 5.

In the group of musicians playing wind instruments, a significantly statistical average correlation was found between the experience of playing the instrument and the pain intensity on the VAS ($p \leq 0.05$) as well as a strong correlation between the intensity of pain and the frequency of symptoms per week ($p \leq 0.01$) – Table 5.

DISCUSSION

The first aim of this study was to assess musculoskeletal pain in musicians playing various instruments. Over 83% of the surveyed musicians reported musculoskeletal disorders. Pain is more common among string players, i.e. violinists (100%) and cellists (90%), compared to 60% of musicians playing wind instruments. The pain intensity measured on the VAS is statistically significantly higher, and the frequency of pain symptoms is more frequent in cellists and violinists compared to musicians playing wind instruments. Among cellists and violinists, pain occurs in the cervical and lumbar spine and in the upper limb. Among musicians who play wind instruments, pain occurs in the lumbar spine.

Violinists can play standing, but most are sitting. The violin is placed on the left collarbone. The head remains laterally bent to the left and rotated in the opposite direction, the chin rests on the instrument. The left upper limb is in the abduction, flexion in the shoulder and elbow joints, and the fingers are on the instrument. The right upper limb, which is also flexed in the shoulder and elbow joints, is constantly in motion while playing. The bow rests only on the thumb and the other fingers lie freely [8, 9]. String players press the string in a precise manner so that the right pitches are achieved. By contrast, wind players play fixed notes. Therefore, string players have to keep their left fingers vertical to minimize the dispersion of the sound. To make high tones, players place their fingertips on the fingerboard near the bridge by controlling their elbow and forearm. This can require the hyperflexion of the player's left elbow and wrist and the forearm can be extremely supinated. Unlike the left hand, the range of motion of the right upper extremity is wide, as the players are sometimes required to use the entire bow. In this process, extreme movements of the upper extremity may lead to joint problems [9]. The seated posture throughout the practice period by the violinist represents a considerable factor of discomfort for the performance of the activity, due to an increase in static muscle effort required to maintain the postures as well as the reduced blood flow which promotes the appearance of pain. Traditional chairs do not have adjustment devices so they offer no other option than the body's adaptation to the postural requirements involved in playing the violin [6].

While playing, the cellist is seated, occupying the front part of the chair without touching the back. The instrument rests on the floor, placed between the knee and ankle joints, the hip joints are in abduction. The body of the cello is placed between the player's knees while the fingerboard is at the left side of the head, and an endpin is used to support the instrument. The feet point outwards, resting on the ground with their entire surface. The spine is slightly bent, the chest and the shoulder girdle remain in the closed position, the shoulders are protracted, and the head is an extension of the spine line. The finger position and bow grab are similar to violin [8, 9].

The group of wind instruments includes clarinet, flute, trumpet, trombone, horn, French horn, and bassoon. The body position assumed by musicians while playing individual wind instruments is very similar. The musician assumes a standing or sitting position. The upper limbs are bent to an angle of 90° at the elbows, raised and bent at the shoulder joints to the

TABLE 5. Correlation of Spearman's ranks in particular groups of musicians

Cellists							
variables	**hours of playing per week (hours)**	**experience of playing an instrument (years)**	**pain assessment on the VAS (n)**	**the frequency of symptoms per week (n)**	**BH (cm)**	**BM (kg)**	**BMI (kg/m²)**
Hours of playing per week (hours)		0.33	0.54*	0.30	−0.47*	−0.32	−0.27
Experience in playing the instrument (years)	0.33		0.34	0.24	0.12	0.11	0.14
Pain assessment on the VAS (n)	0.54*	0.34		−0.04	0.01	0.18	0.23
The frequency of symptoms per week (n)	0.30	0.24	−0.04		−0.32	−0.32	−0.20
BH (cm)	−0.47*	0.12	0.01	−0.32		0.81***	0.61*
BM (kg)	−0.34	0.11	0.18	−0.32	0.81***		0.93***
BMI (kg/m²)	−0.27	0.14	0.23	−0.20	0.61*	0.93***	
Violinists							
variables	**hours of playing per week (hours)**	**experience in playing the instrument (years)**	**pain assessment on the VAS (n)**	**the frequency of symptoms per week (n)**	**BH (cm)**	**BM (kg)**	**BMI (kg/m²)**
Hours of playing per week (hours)		0.44	0.32	0.46*	−0.07	0.15	0.34
Experience in playing the instrument (years)	0.44		0.12	0.42	0.22	0.41	0.54*
Pain assessment on the VAS (n)	0.32	0.12		0.71*	0.01	0.14	0.29
The frequency of symptoms per week (n)	0.46*	0.42	0.71*		−0.10	0.02	0.27
BH (cm)	−0.07	0.22	0.01	−0.10		0.83***	0.46*
BM (kg)	0.15	0.41	0.14	0.02	0.83***		0.86***
BMI (kg/m²)	0.34	0.54*	0.29	0.27	0.46*	0.86***	
Wind instrumentalists							
variables	**hours of playing per week (hours)**	**experience in playing the instrument (years)**	**pain assessment on the VAS (n)**	**the frequency of symptoms per week (n)**	**BH (cm)**	**BM (kg)**	**BMI (kg/m²)**
Hours of playing per week (hours)		−0.29	0.04	−0.17	0.17	0.14	0.18
Experience in playing the instrument (years)	−0.29		0.55*	0.39	−0.06	0.27	0.33
Pain assessment on the VAS (n)	0.04	0.55*		0.76**	−0.17	0.10	0.18
The frequency of symptoms per week (n)	−0.17	0.39	0.76**		−0.40	−0.29	−0.22
BH (cm)	0.17	−0.06	−0.17	−0.40		0.50*	0.01
BM (kg)	0.14	0.27	0.10	−0.29	0.50*		0.79***
BMI (kg/m²)	0.18	0.33	0.18	−0.22	0.01	0.79**	

* $p \leq 0.05$; ** $p \leq 0.01$; *** $p \leq 0.001$
VAS – visual analogue scale; BH – body height; BM – body mass; BMI – body mass index

appropriate height depending on the length of the instrument, the elbows do not touch the body, so as not to compress the chest and ensure free-breathing and airflow, the fingers remain slightly bent and loose placed on the appropriate elements of the instrument [8].

One of the interesting concepts in the approach to traffic is Anatomy Trains. Anatomy Trains is not a theory of movement, but a kind of map showing how stabilization is maintained and how loads are transferred within the body during movement. These Fascia Lines create stability, resistance, power, flexibility, elasticity, and, above all, a compensatory posture. There is a very strong tendency among musicians to adopt a shape and adjust the body position to the instrument on which the person is playing. The sitting position often taken by a musician while playing an instrument can be dangerous as it at least partially excludes the lower limbs from their support function, leaving the pelvis as the main support plane. Such a fit of the musician's body to the instrument can cause musculoskeletal disorders, including overstrain and pain. Although cellists use their bodies quite correctly, it can be seen that the Superficial Front Line is shortened and pulls the head down. The consequence of this positioning is difficulty breathing and may lead to overloading of the lumbar spine. Due to the holding in the hands of the bow, the upper limb is positioned in the Abduction, thus within the Fascia Arm Lines on the other side, the said tape on the opposite side will be shortened to compensate for this positioning. Additionally, there will be more pressure on the left foot. Similar trends in body positioning will occur among violinists, but with greater intensity. While playing, the musician squeezes the instrument between the left shoulder girdle and the left side of the lower jaw. The lateral line will shorten, which is most noticeable in the cervical spine. Additionally, increased pelvic retroversion is noted in the body positioning. Due to the position of the foot on the opposite side of the body, it may become overloaded. A similar body position as when playing the violin only in the opposite direction occurs when playing the transverse flute. All the instruments mentioned above are held asymmetrically. The situation is different when playing the trumpet, oboe or clarinet, which are held more or less symmetrically. Wind players hold the instrument in front of their body and are more dependent than other musicians on breathing, concentrating their breath in the front of their lungs. Among these musicians, an increased pelvic anterior tilt is observed in order to balance the weight of the instrument in this way [15].

Some authors have observations that are similar to our research. Current studies, conducted in various countries, show that about 70–90% of musicians experience problems with the musculoskeletal system [7, 9, 12, 16, 17, 18]. Finnish professional orchestra musicians reported more pain in the back and upper extremity than other people of our profession [19]. Danish violinists experience greater ailments of the musculoskeletal system and cellists are characterised by a higher frequency of symptoms than musicians playing wind instruments. The most common locations of pain were the cervical and lumbar spine and the upper limb [7]. In the group of Scottish musicians, 43% reported having pain in 3 or more locations, most commonly the right upper limb, neck, and left forearm and elbow [17]. German violinists and cellists are characterised by a higher frequency of pain compared to other instrumentalists [20]. Heming's research shows that musicians who play stringed instruments most often (77%) have health problems related to the musculoskeletal system [21]. Among South African musicians upper strings players reported the most playing-related musculoskeletal problems. The most commonly reported pain locations were the right and left upper limb, neck, forearm, and elbow [18]. A study conducted in Poland on 255 musicians shows that string instrumentalists report greater severity of musculoskeletal disorders compared to wind instrumentalists [22]. Other results were obtained by Piątkowska et al. cellists had more complaints of cervical pain than violinists [23]. However, this study included a small number of musicians. Leaver et al. indicate that it is the wind instrumentalists who experience stronger complaints in the area of the wrists, hands, and neck, and weaker complaints in the area of the lower spine, compared to musicians playing stringed instruments [24].

Experts emphasize that knowledge in the field of health education regarding the mechanisms of the formation and prevention of musculoskeletal disorders related to playing an instrument is insufficient among musicians and should be implemented from an early age of learning to play an instrument [25, 26].

Icelandic researchers have shown that the level of knowledge on the prevention of musculoskeletal disorders related to playing an instrument among music school students is insufficient. Only over half of the respondents had knowledge of the prevention of musculoskeletal disorders [25].

Factors favoring the development of musculoskeletal disorders, in addition to the real ergonomic factors related to body posture while playing an instrument, may be long hours of work, especially if it is performed without breaks or adequate warm-up [25, 27].

Pain related to playing an instrument among musicians is commonly regarded as a normal and acceptable phenomenon [28, 29, 30, 31].

The aim of the study was also to analyse the relationship between the intensity and frequency of pain and the time spent on playing and the experience in playing the instrument. The found correlations in the studied groups of musicians were not strong and there were few of them. A significantly statistical correlation was found between the number of hours of playing an instrument per week and the perception of pain in the VAS in the group of cellists and the frequency of pain in the group of violinists, as well as between experience of playing an instrument the assessment of pain intensity on the VAS in the group of wind instruments.

Other researchers emphasise the relationship between the experience in playing an instrument as well as playing time per week and perception of pain. The long experience in playing the instrument and many hours of playing increases pain [12, 32, 33, 34]. Gómez-Rodríguez et al. studied 213 Spanish musicians and found that playing an instrument more than

14 h a week is a risk factor associated with symptoms of musculoskeletal disorders [12].

Musculoskeletal disorders and pain among musicians constitute a serious health problem that requires attention in this professional group. Australian researchers find it particularly worrying that despite medical advances, the prevalence of musculoskeletal disorders has remained at the same level for many years [35]. The musicians' knowledge of risk factors and methods of preventing these diseases would be of great importance in reducing symptoms.

Limitations of the study

This study has some limitations. The research covers a sample of 60 subjects from 2 orchestras of the Opolskie Voivodeship. Therefore, when interpreting the obtained results, it is worth remembering that they only approximate the situation regarding musicians in Poland. In addition, the study looks at only a few risk factors for symptoms among musicians. In future research, it would also be worth considering measuring playing-related musculoskeletal disorders using the Musculoskeletal Pain Intensity and Interference Questionnaire for Musicians accurate instrument [36].

Practical implication

Based on our study results, there are some implications for clinical practice that might be considered by musicians. Systematic observation and analysis of musculoskeletal dysfunction syndromes is recommended as one of the elements of health monitoring. Future research on musculoskeletal ailments among musicians should focus on risk factors and physioprophylaxis of problems associated with playing the instrument. Further studies are foreseen in a larger and more representative group of musicians on risk factors such as overweight and obesity, low levels of physical activity, and stress.

CONCLUSIONS

1. Musculoskeletal pain is very common among professional musicians, especially among string players.
2. Playing stringed instruments as well as more hours of playing a week and a longer professional experience of playing an instrument contribute to greater intensity and frequency of pain in the musculoskeletal system.

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