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TITLE	Violists and Violinists Report More Intense Hand Pain on NRS Than Other Orchestra Musicians
YEAR	2020, 1st September
DOI	https://doi.org/10.21091/mppa.2020.3024
VERSION	Final Draft
ARTICLE INFORMATION	Authors: Vastamäki, Martti; Vastamäki, Heidi; Ristolainen, Leena; Laimi, Katrinas; Saltychev, Mikhail: Source: Medical Problems of Performing Artists, Volume 35, Number 3, 1 September 2020, pp. 162-166(5) Publisher: Science & Medicine, Inc. DOI: https://doi.org/10.21091/mppa.2020.3024

Violists and violinists report more intense hand pain on NRS than other orchestra musicians.

<1918 words, 2 tables, 0 figs – BRIEF REPORT>

NRS, numeric rating scale, orchestra musician, violin, viola, instrumentalist, musician's medicine, pain, musculoskeletal pain

Abstract

Objective String players have the highest prevalence for musculoskeletal overuse. Playing a violin or viola requires rapid, repetitive and complicated movements of the hands and fingers. This cross-sectional study aimed to examine whether violin/viola, violin/cello, and violin/French horn players experience more intense musculoskeletal pain than other instrumentalists.

Methods The study sample consisted of 590 orchestra musicians (354 male/236 female, mean age 36 years). Self-administered questionnaires were used to assess pain of the back, neck, shoulder, face, jaw, and upper extremity. Pain intensity during the last 7 days was measured by an 11-point NRS with a score from 0 to 10 as well as was disadvantage at work and leisure.

Results Of the interviewed musicians, 20% presented playing-related musculoskeletal disorders during the time of the interview. Compared to other professional orchestra musicians, violin and viola players reported significantly more intense pain in hand during the last week. Also, they had experienced more often neck pain ever and in 5 years than the others. During the past 30 days, violin and viola players had also perceived more harm in their upper limb joints. Violin/cello and violin/French horn players did not differ from the others.

Conclusions Our study showed that musicians playing violin or viola have more intense hand pain and more often neck pain than other colleagues but these seem to disturb their daily tasks only a little.

Musicians have a high prevalence of playing-related musculoskeletal disorders (PRMD) with a risk of overuse especially in string players such as violinists (1-3). Many of musculoskeletal problems of instrument players are due to inappropriate playing technique, misuse or mismatch to the instrument or fatigue (4). String players have the highest prevalence for musculoskeletal overuse (5). Violinists and violists as well as woodwind musicians except flutists have more strains than other players (6). The instrument type also seems to contribute to the onset of PRMD (7). Instruments imposing asymmetric postures e.g. violin, viola, flute, and others also contribute to the assuming of unhealthy postures by the musician (8). String instrumentalists are more prone to suffer from PRMD (9, 10). Playing violin requires rapid, repetitive and complicated movements of the hands and fingers. String instrumentalists are more prone to suffer from PRMD (10). Almost half of the orchestra musicians experience playing-related medical problems that could threaten or end their careers (11). More recent data states that the percentage of affected musicians varies between 64% and 94%. (10, 12-14).

Biomechanical risk factors, perceived physical environment risk factors, instrument weight and average playing hours per week are the main predictors of PRMD (9). To achieve the necessary skills, hours of training and perfection are required. The neck, shoulder and temporomandibular joints are often affected, perhaps due to prolonged flexion of the head and shoulder required to hold the violin or viola (15). Steinmetz et al. (7) investigated the flexor muscle behavior in violin/viola players with and without neck pain using the cranio-cervical flexion test. Playing-related neck pain in violinists/violists is associated with altered behavior of the superficial neck flexor muscles consistent with neck pain, despite the specific use of the deep and superficial neck flexors during violin playing. Regarding the posture, in a Swedish study of orchestra musicians, musicians working in an elevated arm position (e.g., violinists) had a higher prevalence of neck-shoulder pain than those working in a more neutral position (16). When violists with performance-related injuries evaluated reasons for their injuries, factors rated as high risk were primarily intrinsic and related to the manner respondents practiced, to playing posture, and to flaws in skill technique (17). Musicians with a violin or a viola as the main instrument had four times the incidence for right elbow/forearm disorder and twice the incidence of neck pain, pain in the right shoulder and the left elbow/forearm compared to those who had piano as the main instrument (18).

The assessment of prevalence of musculoskeletal pain and problems, pain location, pain frequency and duration, pain intensity, pain affective interference, and pain activity interference are crucial when investigating the health and quality of life of musicians. Berque et al. developed the Musculoskeletal Pain Intensity and Interference Questionnaire for professional Musicians (MPIIQM) (19). Many of those tools adopted for it were also used in the present study.

Sousa et al. found that wind players present more intense pain measured by verbal numerical scale for pain than string instrumentalists. Musicians playing first violin were the most affected, but pain intensity was highest in viola players (20). We did not find any study comparing the intensity of pain between violin and viola players and other orchestra musicians. This study aimed to examine whether violin and viola players experience more intense musculoskeletal pain than other instrumentalists among a population of professional orchestra musicians in our country. We hypothesized that musicians whose main instrument was either violin or viola would report more intense musculoskeletal pain than other instrumentalists.

Methods

A cross-sectional nationwide epidemiological study was performed to examine orchestra musicians` health, working conditions, and wellbeing. We wanted to contact the maximum number of violinists and violists and the widest reach representing all symphony orchestras and the biggest music school to enable us to make conclusions about the pain in violinists and violists at a national level. A questionnaire survey was mailed to all 1000 orchestra musicians in our country + 500 students giving a study population of 1500. We had altogether 590 respondents, 390 orchestra musicians and 200 students. A package with appropriate numbers of questionnaires, altogether 1000, was sent to the intendents of each professional orchestra in our country, and to the head of our music academy, questionnaires for those 500, studying orchestra music. The response time was one month. The data was collected in 2003. Of them, 231 (39%) were violin or viola players (Table 1). The questionnaire comprised of 185 questions, 40 of them concerning musculoskeletal disorders of the back, neck, shoulder, face, jaw, and upper extremity. Those questions came from the Nordic Musculoskeletal Questionnaire (21, 22). Pain intensity during the last 7 days was assessed by an 11-point numerical rating scale (NRS) with a score from 0 (no pain at all) to 10 (worst pain imaginable). Discomfort at work and leisure time due to back, neck, shoulder or joint

disorders was also calculated using NRS. Participants were also asked to evaluate their symptoms in previous five years, as well as the lifetime prevalence of pain. The study had an IRB approval from the local ethical committee.

We compared violin and viola players to other professional orchestra musicians concerning intensity of pain in neck, shoulder, hand, and face as well total pain intensity, and pain during the past five years or ever experienced and dis-comfort at work and leisure time. We also compared violin and cello players as well as violin and French horn players to other professional orchestra musicians.

Pain level and demographics were reported as mean and standard deviation when appropriate. The Chi^2 test and independent samples t-test were employed to assess the significance of difference between groups. Results were reported along with two-tailed p-values (considering values ≤ 0.05 to be statistically significant). All analyses were performed using IBM SPSS Statistics (version 25.0).

Results

Out of 1000 orchestra musicians and 500 orchestra music students, 390 musicians and 200 students returned the questionnaire (Table 2). There were 176 violin players (30%) and 55 viola players (9%). Violin and viola players were as old, mean 36 years and they had worked in orchestra as many years, 15 years as other orchestra musicians, and their median general health was the same as the others had, but they had started to play their instrument 2 years earlier ($p<0.001$) and played 1.7 hours a week more than the others ($p=0.014$).

Compared to other professional orchestra musicians, violin and viola players reported significantly more intense pain in hand (OR 95% CI 1.2 (1.1-1.3), $p = 0.001$). Also, they had experienced more often neck pain ever (OR 95% CI 2.8 (1.2-6.6) and neck pain in 5 years as well as pain in upper limb joints during the last 30 days than the others (Table 2). Violin / cello or violin / French horn players did not differ significantly from the other musicians concerning perceived symptoms ever, in 5 years, in 30 days or in 7 days (Tables 3 and 4).

Discussion

Our aim was study whether violin and viola players experience more intense musculoskeletal pain than other instrumentalists. Violin and viola players really reported more intense handpain and a tendency of more total pain in 7 days as well as more often neck pain ever and in 5 years but not substantially more disadvantage at work than other instrumentalists. Violin / cello and violin / French horn players did not do the same.

We acknowledge weaknesses in our study. First, the drop out percentage was high, and some musicians with the worst health may not have participated. Ackermann et al. (23) reported the overall response rate about 70%. We had only 40%. Although our response rate was lower, the number of respondents may still be worth reporting. However, we have to state that broad generalisations are restricted due to the low response rate. Second, groups vary slightly when it comes to job status, age when starting to play and hours of playing in one week (Table 2). However, these absolute differences were clinically small, for instance the difference in playing-hours per week being only 1.7 hours, but however significant. In our study population, there were significantly more women among the violists and violinists. Generally, women have been reported to have a higher risk for musculoskeletal pain than male musicians (24, 25). If this gender difference was, however, the only reason for the different pain report between groups, we assume that also back pain would have been more prevalent in female violinists. We might also consider, whether the women had more pain because a greater amount of them were violinists. When compared to another survey among musicians in symphony orchestras, pain symptoms were frequent both in women and men in both studies. In this previous study (26) of 342 musicians, differences between violinists/violists and other musicians were not as clear as in our study of 590 musicians. In addition, the discrimination ability of the pain NRS may be dependent on the body area to which it is applied. In our earlier study, the discrimination was low 0.5 (95% CI 0.4. to 0.7) for the hand region and perfect only for the shoulder and neck (27).

Ergonomically, violin and viola players have a particularly challenging posture for upper extremities. This means hyperflexion of the left elbow and wrist with forearm extremely supinated. The weight of the instrument and the asymmetric posture imposed by the instrument type also contribute to the appearance of PRMD (28). Weekly playing time has also a role here.

Sousa et al. (20) compared pain intensity and prevalence among professional orchestra musicians between string and wind instruments. They found that playing-related

musculoskeletal disorders are more common in string players, but more intense in wind players, however, insignificantly, p = 0.328. Regarding pain intensity within the group of string players, violas presented the highest VNS values (20). We compared between violin and viola plyers and other orchestra musicians, finding significant differences in pain intensity using an NRS scale.

Salaffi et al. (29) stated that on average, a reduction of one point or a reduction of 15.0% in the NRS represented a minimal clinically important difference (MCID) of changes in chronic musculoskeletal pain intensity for the patient. According to their findings, MCID among our musicians between the groups was not reached. Only pain NRS in hands in 7 days between violin/viola players and the others almost reached that (2.3 vs. 1.4) as well as disadvantage at work NRS (3.9 vs. 3.1)

According to previous studies, pain in violinists and violists seems to be more frequent in upper part of the body than in other musicians. Pain of violin and viola plyers is also more intensive but it seems to disturb daily tasks only a little. Future research may find out potential role of pain intensity in performing daily tasks among upper string players.

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Table 1. Distribution of sample by musical instruments

Musical instrument	Freq.	%
Violin	176	30
Viola	55	9
Cello	52	9
French horn	45	7
Double bass	39	7
Flute	35	6
Clarinet	24	4
Trumpet	24	4
Piano	28	5
Oboe	23	4
Bassoon	23	4
Percussion	22	4
Trombone	18	3
Others[1]	26	4
Total	590	100

[1]tuba, harp, kantele, sax, guitar, accordion

1
2
3
4

5

Table 2. Demographics and reported pain intensity on a numeric rating scale (NRS) among violin/viola players and other professional orchestra musicians.

	Violin/Viola	Others[1]	P-value[2]	OR 95% CI[3]	P-value[4]
N	231	359			
Gender, men (%)	83 (36)	248 (69)	<0.001		
Job status, N (%)			0.001		
Studying	58 (25)	139 (39)			
Working	173 (75)	220 (61)			
Age, years (SD)	36.2 (11.0)	35.6 (11.9)	0.518		
Work years (SD)	14.6 (10.9)	14.5 (11.0)	0.887		
Week hours (SD)	29.9 (7.7)	28.2 (9.3)	0.014		
Start age (SD)	6.9 (2.4)	9.2 (3.7)	<0.001		
General health, mean (SD)	7.6 (1.6)	7.7 (1.6)	0.586	0.9 (0.8-1.1)	0.256
median	8	8			
Pain NRS 7 days					
Back, mean (SD)	2.4 (2.4)	1.6 (2.3)	0.162	1.1 (0.97-1.1)	0.222
median	2	0			
Neck, mean (SD)	2.3 (2.4)	2.0 (2.4)	0.022	1.0 (0.98-1.1)	0.476
median	2	1			
Shoulder, mean (SD)	1.8 (2.5)	1.3 (2.3)	0.004	1.1 (0.98-1.2)	0.118
median	1	0			
Hand, mean (SD)	2.3 (2.5)	1.4 (2.1)	<0.001	**1.2** (1.1-1.3)	**0.001**
median	2	0			
Face, mean (SD)	0.3 (1.1)	0.4 (1.1)	0.048	0.9 (0.7-1.1)	0.271

median	0	0			
Jaw, mean (SD)	0.5 (1.3)	0.4 (1.2)	0.762	0.97 (0.8-1.1)	0.791
median	0	0			
Pain, total, mean (SD) all aforementioned					
	1.8 (1.6)	1.4 (1.5)	0.001	1.1 (0.98-1.3)	0.086
Neck pain ever, N (%)	189 (82)	256 (71)	0.004	**2.8** (1.2-6.6)	**0.017**
Perceived symptoms in 5 years, N (%)					
Neck	78 (34)	65 (18)	<0.001	**2.0** (1.3-3.2)	**0.002**
Shoulder	31 (13)	29 (8)	0.036	1.6 (0.8-3.1)	0.155
Upper limb joints, 30 days	62 (27)	63 (18)	0.007	**1.9** (1.2-2.8)	**0.002**
Disadvantage, mean (SD) (NRS)					
At work, all aforementioned	3.9 (2.5)	3.1 (2.3)	<0.001	1.1 (1.1-1.2)	0.001
At leisure	2.8 (2.4)	2.4 (2.2)	0.041	1.2 (0.97-1.2)	0.151

[1] All other instruments

[2] P-values are distributed between violin/viola and other instruments

[3] Logistic regression are distributed between violin/viola and others, OR (Odds Ratio) and its 95% CI (95 % Confidence Interval), adjusted for gender, job status, work years and playing hours per week (week hours)

[4] P-values at logistic regression

P-values are distributed between different instrument and dichotomy variables in Person Chi^2 test. P-values are distributed between instruments and constant variables in independent samples t-test

NRS= Numeric Rating Scale

Table 3. Demographics and reported pain intensity on a numeric rating scale (NRS) among violin/cello and other professional orchestra musicians.

	Violin/Cello	Others[1]	P-value[2]	OR 95% CI[3]	P-value[4]
N	228	362			
Gender, men (%)	96 (42)	235 (65)	<0.001		
Job status, N (%)			0.001		
Studying	58 (25)	142 (39)			
Working	170 (75)	220 (61)			
Age, years (SD)	35.9 (10.9)	35.8 (12.0)	0.962		
Work years (SD)	14.4 (10.6)	14.6 (11.1)	0.814		
Week hours (SD)	30.0 (7.6)	28.2 (9.4)	0.014		
Start age (SD)	6.9 (2.4)	9.2 (3.7)	<0.001		
General health NRS, mean (SD)	7.7 (1.6)	7.6 (1.7)	0.606	0.99 (0.9-1.1)	0.922
median	8	8			
Pain NRS 7 days					
Back, mean (SD)	2.3 (2.4)	1.7 (2.3)	0.393	0.9 (0.9-1.1)	0.757
median	2	0			
Neck, mean (SD)	2.3 (2.4)	2.0 (2.4)	0.203	1.01 (0.9-1.1)	0.876
median	2	1			
Shoulder, mean (SD)	1.7 (2.5)	1.4 (2.3)	0.251	0.99 (0.9-1.1)	0.986
median	0	0			
Hand, mean (SD)	2.1 (2.4)	1.5 (2.2)	0.003	0.9 (0.8-1.04)	0.062
median	1	0			
Face, mean (SD)	0.2 (1.0)	0.4 (1.1)	0.153	1.2 (0.96-1.4)	0.128
median	0	0			

Jaw, mean (SD)	0.4 (1.2)	0.5 (1.3)	0.717	1.1 (0.9-1.2)	0.366
median	0	0			
Pain, total, mean (SD) all aforementioned	1.7 (1.5)	1.4 (1.5)	0.089	0.98 (0.9-1.1)	0.786
Neck pain ever, N (%)	179 (79)	266 (74)	0.167	1.04 (0.5-2.2)	0.909
Perceived symptoms in 5 years, N (%)					
Neck	70 (31)	73 (20)	0.004	0.8 (0.5-1.2)	0.220
Shoulder	26 (23)	34 (9)	0.431	1.03 (0.5-2.0)	0.921
Upper limb joints, 30 days	62 (27)	63 (17)	0.005	0.7 (0.5-1.03)	0.071
Disadvantage, mean (SD) (NRS)					
At work, all aforementioned	3.7 (2.5)	3.2 (2.4)	0.022	0.9 (0.9-1.02)	0.134
At leisure	2.6 (2.4)	2.5 (2.3)	0.722	1.02 (0.9-1.1)	0.710

[1] All other instruments

[2] P-values are distributed between violin/viola and other instruments

[3] Logistic regression are distributed between violin/cello and others, OR (Odds Ratio) and its 95% CI (95 % Confidence Interval), adjusted for gender, job status, work years and playing hours per week (week hours)

[4] P-values at logistic regression

P-values are distributed between different instrument and dichotomy variables in Person Chi^2 test. P-values are distributed between instruments and constant variables in independent samples t-test

NRS= Numeric Rating Scale

Table 4. Demographics and reported pain intensity on a numeric rating scale (NRS) among violin/French horn and other
professional orchestra musicians.

	Violin/French horn	Others[1]	P-value[2]	OR 95% CI[3]	P-value[4]
N	221	369			
Gender, men (%)	92 (42)	239 (65)	<0.001		
Job status, N (%)			0.001		
Studying	57 (26)	143 (39)			
Working	164 (74)	226 (61)			
Age, years (SD)	36.3 (10.9)	35.5 (11.9)	0.391		
Work years (SD)	14.7 (11.0)	14.4 (10.9)	0.817		
Week hours (SD)	29.3 (8.0)	28.6 (9.2)	0.308		
Start age (SD)	7.5 (2.9)	8.8 (3.7)	<0.001		
General health NRS, mean (SD)	7.6 (1.6)	7.6 (1.7)	0.929	1.01 (0.9-1.1)	0.919
median	8	8			
Pain NRS 7 days					
Back, mean (SD)	1.9 (2.4)	1.7 (2.3)	0.226	0.96 (0.9-1.04)	0.335
median	1	0			
Neck, mean (SD)	2.3 (2.4)	2.1 (2.4)	0.308	1.02 (0.9-1.1)	0.670
median	2	1			
Shoulder, mean (SD)	1.8 (2.5)	1.4 (2.3)	0.070	0.96 (0.9-1.04)	0.307
median	0	0			
Hand, mean (SD)	1.9 (2.4)	1.6 (2.2)	0.112	0.97 (0.9-1.1)	0.501
median	1	0			
Face, mean (SD)	0.4 (1.2)	0.3 (1.0)	0.442	0.9 (0.8-1.1)	0.358
median	0	0			
Jaw, mean (SD)	0.5 (1.4)	0.4 (1.2)	0.468	0.99 (0.9-1.1)	0.897
median	0	0			

Pain, total, mean (SD) all aforementioned	1.7 (1.6)	1.4 (1.5)	0.045	0.95 (0.8-1.1)	0.441
Neck pain ever, N (%)	168 (76)	277 (75)	0.795	0.6 (0.3-1.2)	0.155
Perceived symptoms in 5 years, N (%)					
Neck	65 (29)	78 (21)	0.023	0.9 (0.6-1.3)	0.456
Shoulder	23 (10)	37 (10)	0.882	1.2 (0.6-2.2)	0.623
Upper limb joints, 30 days	57 (26)	68 (18)	0.034	0.96 (0.7-1.4)	0.808
Disadvantage, mean (SD) (NRS)					
At work, all aforementioned	3.7 (2.6)	3.1 (2.4)	0.026	0.9 (0.9-1.02)	0.164
At leisure	2.7 (2.5)	2.5 (2.2)	0.149	0.97 (0.9-1.1)	0.478

[1] All other instruments

[2] P-values are distributed between violin/French horn and other instruments

[3] Logistic regression are distributed between violin/French horn and others, OR (Odds Ratio) and its 95% CI (95 % Confidence Interval), adjusted for gender, job status, work years and playing hours per week (week hours)

[4] P-values at logistic regression

P-values are distributed between different instrument and dichotomy variables in Person Chi^2 test.
P-values are distributed between instruments and constant variables in independent samples t-test

NRS= Numeric Rating Scale