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MUSCULOSKELETAL PAIN IN ELITE PROFESSIONAL MUSICIANS FROM BRITISH SYMPHONY ORCHESTRAS

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Abstract

Background—Professional musicians may have high rates of musculoskeletal pain, but few studies have analysed risks by work activities or the psychosocial work environment.

Aims—To assess the prevalence and impact of musculoskeletal pain, and its relation to playing conditions, mental health and performance anxiety, in musicians from leading British symphony orchestras.

Methods—Musicians from six professional orchestras completed a questionnaire concerning their orchestral duties and physical activities at work; mental health (somatising tendency, mood, demand, support and control at work, performance anxiety); and regional pain in the past four weeks and past 12 months. Prevalence rates were estimated by anatomical site, and associations with risk factors assessed by logistic regression.

Results—Responses were received from 243 musicians (51% of those approached), among whom 210 (86%) reported regional pain in the past 12 months, mainly affecting the neck, low-back, and shoulders. Risks tended to be higher in women, in those with low mood, and especially in those with high somatising scores. Only weak associations were found with psychosocial work stressors and performance anxiety. However, risks differed markedly by instrument category. Relative to string players, the odds of wrist/hand pain were raised 2.9-fold in wind players, but 60% lower in brass players, while the odds of elbow pain were 50% lower among wind and brass players.

Conclusions—Musculoskeletal pain is common in elite professional musicians. A major personal risk factor is somatising tendency, but performance anxiety has less impact. Risks differ substantially by instrument played, offering pointers towards prevention.

Introduction

The work of professional musicians exposes them to a range of physical and psychological risk factors, which, in other occupations, have been linked with occurrence of musculoskeletal disorders. These include static loading of muscles, repetition, precision grip, and psychosocial work pressures. Understanding, however, about the burden, pattern and determinants of musculoskeletal pain in members of professional orchestras is incomplete.

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A systematic review by Zaza [1] covering seven databases over a 16-year period, and including hand-searching of textbooks on the topic and performing medicine journals, identified 24 relevant studies, mostly cross-sectional and with information on prevalence. Of these, however, only two focused solely on professional musicians [2,3] and three others on an admixture of professionals and students [4,5,6]. In addition to the paucity of data relevant to professional orchestral musicians, Zaza drew attention to several other limitations in this field, such as small sample size, poor response rates, errors of sampling and analysis, and widely differing case definitions. Moreover, none of the reports explored risk factors for symptom reporting, although the relation of regional pain to instrument type, workload, mental health and performance anxiety are relevant to preventive planning. In the decade or so following Zaza's review, there have been several further epidemiological surveys in professional [7-13] or mixed professional and amateur orchestras [14-16], and in players of particular instruments [15,17-19], together with a further systematic review [20]; but many of the limitations of earlier reports remain. In particular, despite this invested effort, relatively little is known about risks by work activities or the psychosocial work environment.

To supplement this literature, we assessed the frequency and impact of musculoskeletal pain and the relation of symptoms to playing conditions, including instrument category, mental health and performance anxiety, in a sample of musicians from leading British symphony orchestras.

Methods

The target population comprised orchestral musicians employed full-time by professional symphony orchestras in Britain. Recent figures suggested that a total of 1,200 musicians were employed in 14 major symphony orchestras. All of the orchestras were approached and six (listed in acknowledgements) participated in our study.

Enumeration lists were prepared for each participating orchestra after excluding part-time workers and the study was publicised via discussions with orchestral managers, playing committee representatives and a series of presentations at orchestral rehearsals.

Subjects were approached during rehearsal sessions which were chosen to involve the full complement of musical parts. Subjects attending such rehearsals were invited to self-complete a questionnaire – either during the rehearsal or later with return by post. Members of the enumeration list who were absent from the relevant rehearsals were mailed the questionnaire, and reminders by telephone and email were sent to orchestral managers one week and one month after the rehearsals to encourage a full response. Data collection occurred in November 2008 – January 2009 in major UK concert halls and BBC rehearsal studies in London, Manchester and Birmingham.

Data were collected by orchestra, on age, sex, instrument category, working hours, somatising tendency (using the validated Brief Symptom Inventory) [21], mood (using the mental health section of the Short-form-36 (SF-36)), demand, support and control at work (according to the Karasek model), performance anxiety, physical activities in a typical working day (elbow bending, working with the hands elevated, lifting weights, repetitive wrist/finger movements), job security, regional pain and knowing someone else affected by regional pain. The questions of musculoskeletal symptoms were based on the standardised Nordic questionnaire [22], and concerned pain in the low back, neck, shoulders, elbows, and wrists and hands over the past four weeks and past 12 months, including disabling pain in the past 12 months.

Following inspection of frequency distributions, age was categorised into three bands, somatising tendency into rough thirds of the total distribution of scores for all respondents, SF-36 assessed mood into two bands (worst third of scores vs. the rest), and instrument type into a single variable with four levels – strings, wind, brass, other. 'Disabling pain' was defined as pain in the past 12 months present for at least a month and which prevented attendance at work for at least one day (modified from the Nordic questionnaire [22], with a more specific definition of work limitation framed in terms of sickness absence). Univariate associations between the regional pain outcomes and risk factors were assessed using logistic regression and expressed as odds ratios with associated 95% confidence intervals. Multivariable models were then constructed to assess risk of each pain outcome by instrument type, with adjustment for age, sex and risk factors showing reasonably strong associations (OR ≥1.5 or ≤ 0.67) with the outcome in univariate analysis.

Results

In all, 478 orchestral musicians were approached and this resulted in 243 usable responses (51% response rate overall, and 35% to 67% by orchestra). The relative frequency of instrument categories among the study sample was close to the standard complement of UK symphony orchestras as a whole (Table 1). The mean age of participants was 44 years (range 23-64 years) with an inter-quartile range of 37-53 years. In comparison with the sex distribution of those in the six orchestras approached, women were over-represented among respondents (37% in orchestral enumeration lists vs. 44% among respondents). On average, respondents played for 30 hours/week and 58% had worked as professional musicians for over 20 years.

Altogether 210 (86%) subjects reported musculoskeletal pain in the past 12 months, including 100 (41%) with 'disabling' pain. Table 2 shows the prevalence of symptoms by anatomical region. The commonest sites for pain in the past 12 months were the neck, low back, and shoulder (51 to 56% in the past year), with 1 in 10 to 1 in 5 of respondents reporting 'disabling' pain at one of these sites.

Table 3 sets out the univariate associations between regional pain in the past 12 months and the non-occupational risk factors investigated. Patterns of associations were similar for pain in the past month (data not presented). The strongest and most consistent associations were found with somatising score (with ORs increased about 2.5 to 5.5-fold in highest vs. lowest band comparisons, and findings all significant at the 5% level). Risks tended also to be higher in women and in those with low mood; but elbow pain proved an exception, being associated with male sex and older age, and not with low mood. Smoking history showed little relation to pain.

As might be expected, physical activities involving use of the upper limb were frequently reported, with 209 (86%) musicians undertaking repeated movements of the wrist or fingers for >4 hours in total per day in an average working day, 182 (75%) repeatedly bending and straightening their elbow for >1 hour per day, 101 (47%) (violin, viola, double bass, harp) musicians working for >1 hour per day with their hands above shoulder height and, 37 musicians (16%, mainly from the brass family) holding weights of ≥5 Kg for ≥3 hours in total.

Regarding the psychosocial work environment, 44% of respondents felt that they could sometimes or often exercise choice over how much they worked, 77% reported feeling supported sometimes or often by other colleagues at work, and 22% felt that their jobs would be unsafe or very unsafe if a significant illness kept them from attending work for ≥3 months. Very common factors that showed little overall variation (and were not considered

in subsequent analyses) included: being under pressure to complete tasks by a fixed time (90% of musicians); seldom or never having a choice in the ingredients of work (86%); and job satisfaction (93% were satisfied or very satisfied). Frequent performance anxiety was far less prevalent (14%).

Table 4 summarises the univariate associations of regional pain with occupational physical activities, psychosocial aspects of the work environment, performance anxiety, and the instrument played. Repeated bending and straightening of the elbow was significantly associated with low-back and shoulder pain, and repeated wrist/finger movements non-significantly with wrist/hand pain (all ORs being increased 2.4 to 2.7-fold). Occupational psychosocial factors were associated somewhat inconsistently with regional pain, but ORs of ≥1.5 were found in relation to low choice (for low-back and wrist/hand pain) and low support (for low-back, neck and shoulder pain), and an OR of 0.6 in relation to job insecurity and wrist/hand pain.

There were marked differences in prevalence of regional pain by the category of instrument played. For example, relative to a baseline of string players, players of wind instruments reported more wrist/hand pain (OR 1.9) and more neck pain (OR 1.6); but brass players had less low-back pain, elbow pain and wrist/hand pain (odds >50% lower).

To assess the relation of pain to instrument type after allowing for the other occupational and non-occupational risk factors in Tables 3 and 4, separate multivariable models were constructed for each regional site of pain (Table 5). Age, sex, and somatising score, as strong predictors of pain (Tables 3), were included in every model. Adjustment was also made for factors from Tables 3 and 4 that were at least moderately associated with pain at the same site (OR≥1.5 or OR≤0.67). (However, no adjustment was made for physical activity on the assumption that differences in activity could lie on the causal pathway between instrument type and regional pain.) The footnotes to Table 5 record the final models used; the corresponding multivariate associations with somatising tendency (the leading non-occupational risk factor) are given for comparison.

Differences by instrument persisted after adjusting for other risk factors. Thus, the odds of wrist/hand pain were raised 2.9-fold in wind players, but almost 60% lower in brass players (a 7.1-fold difference for the brass-wind comparison); and against the same baseline the odds of elbow pain were about 50% lower among wind and brass players; odds of low-back pain were also over 50% lower in brass than in string players. Independently, somatising tendency remained a strong, significant, and consistent risk factor for regional pain, with ORs in the highest vs. lowest band raised some 2.5 to 4.4 fold.

Discussion

As judged by these findings, regional musculoskeletal pain is common in professional musicians, the main sites of complaint being the low back, neck, and shoulders. In some cases pain was disabling. Expected associations were found with sex, mental health and especially somatising tendency, but no independent effect of performance anxiety was seen. After allowing for other factors, the prevalence of regional pain varied markedly by instrument category.

This study had several limitations, notably cross-sectional design, incomplete response and moderate sample size. The first of these meant that those who dropped out of work because of musculoskeletal pain would not have been sampled. We tried to contact musicians who were not at rehearsal, but those giving up a career because of musculoskeletal pain would have been omitted from the enumeration list. Healthy worker selection bias may explain why neck and shoulder pain become less common with age in this group of orchestral

musicians, but tend to become more common in the general population. If present, the bias would tend to lead to an underestimation of the extent of severe MSDs in professional musicians. However, the effect of non-response might operate in the opposite direction, if responders who were in pain were more motivated to participate. These limitations perhaps affect estimates of prevalence. However, prevalence rates were not dissimilar to those previously reported [1-20], and associations of pain with risk factors (e.g. with instrument type after controlling for important confounders) are unlikely to be biased unless these associations differed between responders and non-responders, while the choice for risk factor assessment of an internal comparison group may have served to limit the impact of the healthy worker effect on estimates of relative risk. The study lacked sufficient power to permit elaborate sub-analyses by instrument type and some estimates of relative risk were bounded by fairly wide confidence intervals.

Accuracy of the information given may have been affected by errors of recall. Reassuringly, however, patterns of association between risk factors and regional pain were very similar over the past 12 months as over the past one month. Aspects of the occupational history, such as instrument played, are likely to be reported without important error.

Set against these limitations were some strengths. The study was large comparatively in its field – the largest so far in Britain – and the job experiences of study participants are likely to have been representative of professional orchestras as a whole (e.g. similar mix of instruments). Moreover, the analysis extends the boundaries of inquiry: while several earlier studies have focussed on MSDs in professional elite musicians or populations including professionals as well as amateurs [2-16], few allowed in analysis for important non-occupational risk factors [8] and seldom have risks been explored by physical activity [11]. Only occasionally have risks been compared systematically by instrument type [8-11]; even here, we found only one other study with data both by instrument and by anatomical site [10], as opposed to aggregated data on MSDs at all sites combined [8,9,11].

This study confirms previous findings [1-20] that musicians appear to suffer high rates of musculoskeletal pain. Additionally, it indicates marked differences in regional pain by instrument category. Such differences are largely explicable in terms of physical workload. For example, in string players, among whom higher overall rates of musculoskeletal pain have been reported previously [6,8,9,13], affected joints were those subjected to repeated movement or technical positioning as required by the instrument; and higher rates of shoulder, elbow, wrist, and hand pain were found in string players as compared with brass players, in agreement with a survey of the Puerto Rico Symphony Orchestra [10].

The greater risk of neck and wrist/hand pain in woodwind players when compared with string players probably arises from static loading, with suspension of instruments that weigh up to four kilograms. To reduce static loading, some woodwind players have adopted slings that attach around the neck, and there may be a case for further development of ergonomic supports for these players. More generally, knowledge that regional pain is more frequent in particular instrument groups should raise awareness in physicians and in those who hope to design ergonomic solutions that satisfy the performance needs of elite professional musicians.

In keeping with another key report [6], and in contrast to some others [9,13], performance anxiety and psychosocial factors in the work environment did not show much independent association with musculoskeletal symptoms. Levels of overall job satisfaction were very high. To an extent this limits scope for psychological interventions. However, somatising tendency, which seems not to have been studied previously in musicians, proved to be a strong consistent non-occupational risk factor for MSDs, as it is in the general population

[23]. This is a fluctuating and potentially modifiable trait which might be targeted therapeutically [24]. Hitherto, there have been few evaluations of interventions to prevent MSDs in musicians [25,26] and even fewer approximating to the design requirements of a randomised controlled trial [27]. One initiative, involving education, strengthening, and flexibility exercises, suffered high attrition rates and drew no conclusions [25]; another, based on education and behavioural self-help goals, found gains in psychological but not in physical health [26]; and a third reported improvement in perceived exertion of playing after strength or endurance training, but no improvement in musculoskeletal pain [27]. In a small before-after comparison of students from the Zurich Conservatory, education, relaxation, postural exercises and playing analysis resulted in better coping, with fewer playing-related symptoms, but findings were not specific to the musculoskeletal system [28].

Considering the need for further research, a longitudinal study of musicians with a suitably large sample would provide information about the incidence of symptoms and premature medical retirements arising from musculoskeletal problems. A survey of retired musicians could provide further insight into the circumstances of such medical retirements. Ergonomic and observational studies could assess the impact of prevailing generic advice [29,30] (e.g. about posture, seating, warm up sessions, adjustable music stands, chin rests, harnesses and other devices to reduce static loading) according to instrument played, informing the design of suitable intervention trials. Finally, investigation is merited to assess the impact on pain of psychological interventions to combat somatic distress and poor mental health.

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Key points

- Although musculoskeletal pain appears common in professional musicians, few studies have explored underlying risk factors
- In this survey, somatising tendency was a major personal risk factor, more so than performance anxiety
- Risks also differed substantially by instrument played, providing a focus for prevention

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Table 1

Response rates by orchestra and instrument type

Orchestra	N (studied / approached)	% response	Instrument	N (participants)	% of all respondents*
A	58/86	67	Strings	151	62
B	42/94	45	Wind	36	15
C	38/82	46	Brass	39	16
D	29/83	35	Other	17	7
E	36/52	65			
F	40/81	49			
ALL	243/478	51		243	100

*A full symphony orchestra comprises a complement of 91 musicians, among whom 66% are string players, 13% are wind players, 14% are brass players and 7% play other instrument types

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Table 2

Prevalence (%*) of regional pain among participants

Anatomical Site	Pain during the past 12 months		Pain during the past 4 weeks		Disabling pain in the past 12 months	
	No.	(%)	No.	(%)	No.	(%)
Low Back	125	(51)	80	(33)	42	(17)
Neck	135	(56)	88	(36)	54	(22)
Shoulder	124	(51)	91	(37)	23	(10)
Elbow	50	(21)	30	(12)	7	(3)
Wrist/hand	79	(33)	59	(24)	14	(6)
Any of these	210	(86)	172	(71)	100	(41)

*% of all respondents (n=243)

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Table 3

Non-occupational risk factors for regional pain in the past 12 months

	N	Low Back Pain (n =125)‡				Neck Pain (n =135)‡				Shoulder Pain (n =124)‡				Elbow Pain (n = 50)‡				Wrist/hand pain (n = 79)‡			
		No	(%)	OR	95% CI	No	(%)	OR	95% CI	No	(%)	OR	95% CI	No	(%)	OR	95% CI	No	(%)	OR	95% CI
Sex																					
M	135	64	(47)	1	-	65	(48)	1	-	57	(42)	1	-	32	(24)	1	-	39	(29)	1	-
F	108	61	(56)	1.4	0.9-2.4	70	(65)	2.0	1.2-3.3	67	(62)	2.2	1.3-3.8	18	(17)	0.6	0.3-1.2	40	(37)	1.4	0.8-2.5
Age (years)																					
<40	86	43	(50)	1	-	51	(59)	1	-	50	(58)	1	-	8	(9)	1	-	30	(35)	1	-
40-50	80	46	(58)	1.4	0.7-2.5	47	(59)	1.0	0.5-1.8	45	(56)	0.9	0.5-1.7	20	(25)	3.3	1.3-7.9	27	(34)	1.0	0.5-1.8
>50	75	35	(47)	0.9	0.5-1.6	35	(47)	0.6	0.3-1.1	28	(37)	0.4	0.2-0.8	22	(29)	4.1	1.6-9.8	21	(28)	0.7	0.4-1.4
Smoking																					
Never	169	87	(52)	1	-	92	(54)	1	-	86	(51)	1	-	34	(20)	1	-	55	(33)	1	-
Ever	74	38	(51)	1.0	0.6-1.7	43	(58)	1.2	0.7-2.0	38	(51)	1.0	0.6-1.8	16	(22)	1.1	0.6-2.1	24	(32)	1.0	0.6-1.8
Somatising score†																					
Low	83	31	(37)	1	-	37	(45)	1	-	29	(35)	1	-	9	(11)	1	-	19	(23)	1	-
Medium	89	45	(51)	1.7	0.9-3.2	47	(53)	1.4	0.8-2.5	42	(47)	1.7	0.9-3.1	22	(25)	2.7	1.2-6.3	30	(34)	1.7	0.9-3.4
High	71	49	(69)	3.7	1.9-7.3	51	(72)	3.2	1.6-6.2	53	(75)	5.5	2.7-11.0	19	(27)	3.0	1.3-7.2	30	(42)	2.5	1.2-4.9
Mood*																					
Normal	154	77	(50)	1	-	72	(47)	1	-	69	(45)	1	-	32	(21)	1	-	45	(29)	1	-
Low	86	47	(55)	1.2	0.7-2.0	61	(71)	2.8	1.6-4.9	54	(63)	2.1	1.2-3.6	18	(21)	1.0	0.5-1.9	34	(40)	1.6	0.9-2.8

‡Some respondents did not answer all of the questions

†Cut-points represent approximate thirds of the total distribution of somatisation scores

*Low = Worst approximate third of the total distribution of SF36 mental health scale

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Table 4

Occupational risk factors for regional pain in the past 12 months

	N	Low Back Pain (n =125)‡				Neck Pain (n =135)‡				Shoulder Pain (n =124)‡				Elbow Pain (n = 50)‡				Wrist/hand pain (n = 79)‡			
		No	(%)	OR	95% CI	No	(%)	OR	95% CI	No	(%)	OR	95% CI	No	(%)	OR	95% CI	No ‡	(%) +ve	OR	95% CI
Physical Activities																					
Wrist/finger movements >4 h/d																					
No	33	14	(42)	1	-	20	(61)	1	-	13	(39)	1	-	10	(30)	1	-	6	(18)	1	-
Yes	209	110	(53)	1.5	0.7-3.2	114	(55)	0.8	0.4-1.7	110	(53)	1.7	0.8-3.6	40	(19)	0.5	0.2-1.2	73	(35)	2.4	1.0-6.1
Elbow bending >1h/d																					
No	60	20	(33)	1	-	29	(48)	1	-	21	(35)	1	-	9	(15)	1	-	20	(33)	1	-
Yes	182	104	(57)	2.7	1.5-4.9	105	(58)	1.5	0.8-2.6	103	(57)	2.4	1.3-4.4	41	(23)	1.7	0.8-3.6	59	(32)	1.0	0.5-1.8
Hands above shoulder >1h/d																					
No	141	72	(51)	1	-	79	(56)	1	-	72	(51)	1	-	30	(21)	1	-	41	(29)	1	-
Yes	101	52	(52)	1.0	0.6-1.7	56	(55)	1.0	0.6-1.6	52	(52)	1.0	0.6-1.7	20	(20)	0.9	0.5-1.7	38	(38)	1.5	0.9-2.5
Lifting heavy weights																					
No	202	107	(53)	1	-	110	(54)	1	-	104	(52)	1	-	38	(19)	1	-	64	(32)	1	-
Yes	37	16	(43)	0.7	0.3-1.4	22	(59)	1.2	0.6-2.5	17	(46)	0.8	0.4-1.6	11	(30)	1.8	0.8-4.0	14	(38)	1.3	0.6-2.7
Psychosocial																					
Choice over work																					
Yes	107	49	(46)	1	-	57	(53)	1	-	52	(53)	1	-	24	(22)	1	-	29	(27)	1	-
No	136	76	(56)	1.5	0.9-2.5	78	(57)	1.2	0.7-2.0	72	(49)	1.2	0.7-2.0	26	(19)	0.8	0.4-1.5	50	(37)	1.6	0.9-2.7
Support at work																					
Yes	186	91	(49)	1	-	99	(53)	1	-	90	(48)	1	-	38	(20)	1	-	62	(33)	1	-
No	57	34	(60)	1.5	0.9-2.8	36	(63)	1.5	0.8-2.8	34	(60)	1.6	0.9-2.9	12	(21)	1.0	0.5-2.2	17	(30)	0.9	0.5-1.6
Job security																					
Yes	187	96	(51)	1	-	101	(54)	1	-	95	(51)	1	-	37	(19)	1	-	65	(35)	1	-
No	53	27	(51)	1.0	0.5-1.8	32	(60)	1.3	0.7-2.4	27	(51)	1.0	0.6-1.9	12	(23)	1.2	0.6-2.5	12	(23)	0.6	0.3-1.1
Performance anxiety																					
Seldom	206	104	(50)	1	-	112	(54)	1.0	-	103	(50)	1	-	43	(21)	1	-	68	(33)	1	-

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	N	Low Back Pain (n =125)‡				Neck Pain (n =135)‡				Shoulder Pain (n =124)‡				Elbow Pain (n = 50)‡				Wrist/hand pain (n = 79)‡			
		No	(%)	OR	95% CI	No	(%)	OR	95% CI	No	(%)	OR	95% CI	No	(%)	OR	95% CI	No ‡	(%) +ve	OR	95% CI
Often	34	20	(59)	1.2	0.8-1.7	21	(62)	1.2	0.8-1.7	20	(59)	1.2	0.8-1.7	7	(21)	1.0	0.6-1.6	11	(32)	1.0	0.7-1.5
Instrument type																					
Strings	151	85	(56)	1	-	83	(55)	1	-	83	(55)	1	-	35	(23)	1	-	48	(32)	1	-
Wind	36	16	(44)	0.6	0.3-1.3	24	(67)	1.6	0.8-3.5	18	(50)	0.8	0.4-1.7	5	(14)	0.5	0.2-1.5	17	(47)	1.9	0.9-4.0
Brass	39	15	(38)	0.5	0.2-1.0	19	(49)	0.8	0.4-1.6	18	(46)	0.7	0.4-1.4	5	(13)	0.5	0.2-1.3	6	(15)	0.4	0.2-1.0
Other	17	9	(53)	0.9	0.3-2.4	9	(53)	0.9	0.3-2.5	5	(29)	0.3	0.1-1.0	5	(29)	1.4	0.5-4.2	6	(47)	1.9	0.7-5.3

‡Some respondents did not answer all of the questions

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Table 5

Association between instrument played and regional pain in the past 12 months – multivariate analyses

	OR (95% CI)				
	Low back pain†	**Neck pain‡**	**Shoulder pain‡**	**Elbow pain**	**Wrist/hand pain¶**
Instrument played					
Strings	1.0	1.0	1.0	1.0	1.0
Wind	0.78 (0.35-1.72)	2.53 (1.06-6.03)	1.10 (0.48-2.52)	0.58 (0.19-1.74)	2.90 (1.26-6.68)
Brass	0.45 (0.20-1.03)	0.95 (0.43-2.14)	0.73 (0.32-1.67)	0.39 (0.13-1.20)	0.41 (0.15-1.15)
Other	1.09 (0.38-3.17)	1.38 (0.46-4.15)	0.49 (0.15-1.61)	0.96 (0.29-3.17)	2.55 (0.84-7.70)
Somatising score					
Low	1.0	1.0	1.0	1.0	1.0
Medium	1.60 (0.85-3.03)	1.52 (0.79-2.90)	1.61 (0.84-3.09)	2.91 (1.21-7.03)	2.04 (0.97-4.27)
High	3.61 (1.79-7.31)	2.46 (1.18-5.12)	4.01 (1.91-8.41)	4.35 (1.70-11.14)	3.07 (1.37-6.84)

Separate models were constructed in relation to each site of pain. All models were adjusted for age, sex and somatising tendency

† Also adjusted for low support, lack of choice

‡ Also adjusted for low mood, low support

¶ Also adjusted for low mood, low security, lack of choice