Musculoskeletal health in musicians : epidemiology & biomechanics

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PART 2

IMPACT &

ILLNESS PERCEPTIONS

Chapter 8

Prevalence and consequences of arm, neck, and/or shoulder complaints among music academy students:

A Comparative Study

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ABSTRACT

Objective CANS (Complaints of Arm, Neck, and/or Shoulder not caused by a systemic disease or acute trauma) are a recognized problem in specific occupational groups such as musicians. This study aimed to compare the prevalence, characteristics, and consequences of CANS between music academy students and a control group of peer-age medical students.

Methods A cross-sectional study among music academy students and medical students. Data were collected using a web-based questionnaire on musculoskeletal conditions of the upper extremity in the two cohorts.

Results Students of three music academies (n=345) and one medical university (n=2,870) received the questionnaire, of which 25% (n=87) and 18% (n=503) responded, respectively. The 12-month prevalence of CANS was nearly twice as high among music academy students as the control group (80.7% vs 41.5%, $p<0.001$). Music academy students reported 2.6 times the point prevalence as medical students (47.0% vs 18.2%, $p<0.001$). Chronic CANS was present in 36.1% of the music students, compared to 10.3% of the medical students ($p<0.001$). Music academy students presented more complaints per anatomic localization and a higher number of involved anatomic localizations. Music students rated the influence of CANS on daily functioning as more severe (5.0 vs 3.1, $p<0.001$). Of all subjects with CANS during the last year, more music academy students (46.3%) visited a healthcare professional compared to medical students (29.8%, $p=0.013$).

Conclusion The prevalence of CANS is higher in music academy students compared to medical students. This emphasizes the necessity of effective (preventive) interventions in these high-demanding professionals.

INTRODUCTION

Musculoskeletal problems among musicians are frequent, with reported 12-month prevalences among music academy students and professional musicians ranging from 39% to 90%(1–8), while these numbers vary between 2% and 60% in the general working population.(9,10) These prevalence estimates are often focused on the occurrence of musculoskeletal complaints in the whole body.(2–5,11) However, playing an instrument mainly involves overuse at the upper extremity and neck area. The latter is in accordance with studies showing a high prevalence of musculoskeletal complaints among musicians at the upper extremities, neck, and mouth.(11,12) Since some studies showed that nearly half of professional musicians discontinued practicing their instrument at home during 1 year due to musculoskeletal complaints, evaluation is necessary.(2)

The extent of upper extremity musculoskeletal complaints can be described within the CANS (Complaints of Arm, Neck, and/or Shoulder) model.(13) In the CANS model, complaints due to systemic disease or acute trauma are excluded. This model was developed to support and compare scientific research and to increase multidisciplinary cooperation, using a Delphi consensus strategy. One of the advantages of using this model is the possibility of comparing different populations. Systematically describing the scope of CANS experienced by musicians is not only an important step in recognizing the extent of the problem in that specific group in comparison to other professions, but it will also give clues for addressing preventive interventions. Thus, the primary aim of this study was to evaluate the prevalence of CANS among music academy students compared to a control group of medical students; secondly, the impact of CANS symptoms experienced by music academy students compared to medical students was evaluated.

METHODS

STUDY DESIGN

A cross-sectional study on musculoskeletal conditions of the upper extremity in music academy students was performed. A group of medical school students was considered as a control group. Data were collected from a web-based questionnaire among 3,215 students of three music academies and one medical university in the Netherlands, extensively described in a previous article.(11) Data were collected between February and May 2011. All Dutch-speaking students of three music academies (n=345)—the Royal

Conservatoire, The Hague; CODARTS University for the Arts, Rotterdam; the Amsterdam School of the Arts, Amsterdam, with a classical instrument as main subject (singers and conductors were excluded)—received an invitation, as did medical students (studying to be physicians) from Leiden University (n=2,870). The student registries of the four centers were used to select the subjects. Exclusion criteria were age below 18 years and above 30 years. All eligible students received an e-mail with an invitation to complete the web-based questionnaire. A reminder e-mail was send 3 weeks after the first e-mail. The Leiden University Medical Ethical Committee approved the protocol (11/003b).

QUESTIONNAIRE

The electronic questionnaire included items on sociodemographic characteristics, general health and musculoskeletal complaints (age, gender, height, weight, right/left-hand dominance), study-year (bachelor year 1– 4, master year 1–2), instrument playing (average time playing per week and years of experience) and study (music academy student/medical student), and main instrument. For students playing an instrument, information on the number of years already spent playing the instrument and the average number of hours per week devoted to practice were collected. In addition, the questionnaire included questions concerning smoking, alcohol, sports, and comorbidities.

The existence of musculoskeletal complaints during the last year, current musculoskeletal complaints, and chronic musculoskeletal complaints (complaints during at least 3 months) were scored for six anatomic regions: 1) elbow, wrist, and hand; 2) neck, shoulder, and upper back; 3) lower back; 4) hips and knees; 5) ankles and feet; 6) jaw and mouth. Since this study focused on CANS, only the upper extremity data were used. The body region "elbows, wrists, and hands" was subdivided in six localizations (elbow left and right, wrist left and right, and hand left and right). The region "neck, shoulders, and upper back" was subdivided in four localizations (shoulders left and right, neck and upper back). For all complaints, information was collected concerning the type of the complaint (pain, loss of gross motor skills, loss of fine motor skills, power loss, loss of control, cramp, loss of speed, loss of endurance, swelling, redness, other), the duration of the complaint, cause of the complaint according to the subject, the effect on daily life functioning (scored on a scale from 0–10), and medical consultation (general practitioner, specialist, physiotherapist, alternative medicine). Also the cause(s) of the complaint according to the musicians were questioned (e.g., trauma, repetitive use, etc.).

STATISTICAL ANALYSIS

Statistical analyses were performed with SPSS 20.0 (IBM SPSS, Armonk, NY, USA). Mean and standard deviation (SD) were calculated for each continuous normally distributed variable. Median and range were computed in case of a non-normal distribution. Comparisons of gender, study, smoking, hand preference, and healthcare usage between music academy and medical students were done using chi-square and t-tests.

Prevalence estimates for CANS were calculated by adding all subjects with at least one complaint in one of the six relevant anatomic regions. In case of complaints at multiple sites (e.g., elbow and shoulder), the complaint with the longest duration and the most severe score on daily functioning was used to calculate duration and severity of CANS. Following the definition of CANS complaints due to acute trauma (using the question on causality) and systemic disease (using the questions on causality and comorbidity) were excluded. The following non-exclusive prevalence estimates were calculated: point prevalence of CANS (defined as current CANS); 12-month prevalence of CANS (defined as CANS during the last 12 months); and chronic CANS (defined as CANS present at the time of completing the questionnaire and present for at least 3 months).(13) Prevalence rates, symptoms, occurrence of complaints at multiple sites, and healthcare usage were compared using chi-square tests. The occurrence of complaints at multiple sites was compared using t-tests.

RESULTS

A total of 590 students completed the questionnaire: 87 music academy students (25%) and 503 (18%) medical students. After exclusion of subjects exceeding the age limits, 577 students were included: 83 from the music academies and 494 from the medical school. *Table 1* illustrates the characteristics of the responders.

PREVALENCE

The 12-month prevalence of CANS among music academy students was nearly twice as high as in medical students (80.7% vs 41.5%, $p<0.001$, *Table 2).* The point-prevalence of CANS was 2.6 times higher in music academy students than in medical students (47.0% vs 18.2%, $p<0.001$, *Table 2).* Differences between both groups were highest for those with chronic CANS. Chronic CANS was more than 3 times as frequent in music academy students (36.1%) as in medical students (10.3%, $p<0.001$).

SYMPTOMS

For those with CANS at present, during the last 12 months, or with chronic CANS, *Table 2* reports the symptoms (e.g., pain, loss of gross motor skills, and presence of muscle cramp). Within both the music academy and medical students groups, at least 90% of the subjects reported pain. However, music academy students presented more severe symptoms compared to medical students; music students with CANS reported more joint swelling ($p=0.042$) and more motor skill problems (fine motor skills $p=0.024$, loss of speed $p<0.001$, loss of control $p=0.012$, cramp $p=0.046$, power loss $p=0.043$, and loss of endurance $p<0.001$) than medical students.

LOCALIZATION OF CANS

The localizations of CANS among music academy and medical students are presented in *Table 3*. The neck was the most frequently affected area, with 46% and 27% of the music academy students and medical students reporting complaints of the neck ($p=0.001$). Among all subjects with CANS during the last 12 months, a higher percentage of music academy students compared to medical students report complaints of the shoulders. The right shoulder was affected in 30% and 9% ($p<0.001$) and the left shoulder in 28% and 7% ($p<0.001$) of the music and medical students, respectively.

Table 1: Sociodemographic characteristics of the study populations

		Music Academy Students (n=83)	**Medical Students (n=494)**	**p-value**
Age		21.5 (SD 2.2)	22.1 (SD 2.6)	0.062
Gender	Male	22 (26.2%)	120 (24.3%)	0.843
	Female	62 (73.8%)	374 (75.7%)	
Grade	Bachelor	72 (86.7%)	248 (50.2%)	<0.001
	Master	11 (13.3%)	246 (49.8%)	
Smoking		10 (11.9%)	26 (5.3%)	0.019
Sport (hrs/wk)		2.2 (SD 2.4)	3.0 (SD 2.8)	0.005
Alcohol consumption (glasses/wk)		3.9 (SD 4.5)	5.5 (SD 6.9)	0.090
Body mass index (kg/m^2)		21.2 (SD 3.0)	22.0 (SD 2.5)	0.001
Practice time (hrs/wk)		20.7 (SD 8.7)		
Experience (no. of playing years)		13.0 (SD 3.3)		
Hand preference	Right	71 (85.5%)	43 (87.7%)	0.593
	Left	12 (14.5%)	61 (12.3%)	

Table 2: Characteristics and duration in music academy and medical students with CANS

			12-months-prevalence of CANS			Point prevalence of CANS			Chronic CANS		
			Music Academy Students (n=83)	**Medical Students (n=494)**	**p**	**Music Academy Students (n=83)**	**Medical Students (n=494)**	**p**	**Music Academy Students (n=83)**	**Medical Students (n=494)**	**p**
Prevalence of CANS			80.7%	41.5%	0.001	47.0%	18.2%	<0.001	36.1%	10.3%	<0.001
Influence of CANS on functioning (VAS 0-10) (SD)			5.0 (2.8)	3.1 (2.4)	<0.001	5.0 (2.7)	3.7 (2.4)	0.013	5.4 (2.6)	4.4 (2.3)	0.122
Symptoms	Pain		91.0%	91.2%	0.965	92.3%	91.1%	0.329	90.4%	90.2%	0.623
	Motor problems	Gross motor skills	23.9%	25.4%	0.807	25.6%	23.3%	0.823	30.0%	35.3%	0.897
		Fine motor skills	10.4%	3.4%	0.024	2.6%	1.1%	0.013	13.3%	2.0%	0.701
		Loss of speed	13.4%	1.0%	<0.001	5.1%	0	0.001	20.0%	0	0.062
		Loss of control	7.5%	1.5%	0.012	5.1%	1.1%	0.164	13.3%	0	0.062
		Cramp	35.8%	23.4%	0.046	25.6%	23.3%	0.016	40.0%	35.3%	0.422
		Power loss	14.9%	6.8%	0.043	7.7%	1.1%	0.365	23.3%	5.9%	0.107
		Loss of endurance	29.9%	5.4%	<0.001	23.1%	6.7%	0.001	36.7%	9.8%	0.021
	Other	Swelling	10.4%	3.9%	0.042	10.3%	0	0.455	20.0%	0	0.007
		Redness	3.0%	2.9%	0.980	2.6%	0	0.181	3.3%	2.0%	0.190
		Other	0	5.4%	0.053	0	5.6%	0.644	0	13.7%	0.371

Table 3: Affected anatomic localizations in music academy and medical students with CANS during the last twelve months

		Number of music academy students with CANS during the last twelve months (n=67)	Number of medical students with CANS during the last twelve months (n=205)	p
Hand	Right	13 (16%)	21 (4%)	0.005
	Left	7 (8%)	16 (3%)	0.123
Wrist	Right	13 (16%)	30 (6%)	<0.001
	Left	6 (7%)	17 (3%)	0.001
Elbow	Right	1 (1%)	4 (1%)	0.541
	Left	5 (6%)	6 (1%)	0.012
Shoulder	Right	25 (30%)	42 (9%)	<0.001
	Left	23 (28%)	32 (7%)	<0.001
Neck		38 (46%)	135 (27%)	0.001

NUMBER OF INVOLVED ANATOMIC LOCALIZATIONS

More music academy students reported CANS in a higher number of anatomic localizations: 32.8% of the music academy students reported complaints in one, 38.8% in two, and 28.4% in three or more anatomic localizations. In medical students, 58.8% reported complaints in one, 31.7% in two, and 9.8% in three or more localizations. *Table 4* shows the number of anatomic localizations in which complaints were reported in those reporting CANS during the last 12 months.

IMPACT ON FUNCTIONING

Music academy students rated the impact of CANS on activities of daily living as more severe than did medical students (VAS 5.0 vs 3.1; p<0.001, *Table 2).*

Table 4: Overlap of complaints in anatomic localizations in subjects with CANS during the last year

	1 anatomic site	2 anatomic sites	3 anatomic sites	4 anatomic sites	5 anatomic sites	6 anatomic sites	7 anatomic sites
Music academy students (n=67)	22 (32.8%)	26 (38.8%)	13 (19.4%)	5 (7.5%)	0	1 (1.5%)	0
Medical Students (n= 205)	120 (58.5%)	65 (31.7%)	17 (8.3%)	2 (1.0%)	0	0	1 (0.5%)

Table 5: Health care usage of music academy and medical students with CANS

	CANS during the last year			Current CANS			Chronic CANS		
	Music academy students (n=67)	Medical students (n=205)	p	Music academy students (n=39)	Medical students (n=90)	p	Music academy students (n=30)	Medical students (n=51)	p
Any medical care	46.3%	29.8%	0.013	53.8%	52.2%	0.865	63.3%	66.7%	0.761
General practitioner	14.9%	12.7%	0.638	15.4%	23.3%	0.308	16.7%	31.4%	0.145
Specialist	16.4%	4.4%	0.001	20.5%	8.9%	0.066	26.7%	7.8%	0.021
Physiotherapist	34.3%	18.5%	0.007	41.0%	34.4%	0.476	53.3%	49.0%	0.708
Alternative medicine	16.4%	3.4%	<0.001	23.1%	6.7%	0.008	26.7%	9.8%	0.046

HEALTH CARE USAGE

Of all students reporting CANS during the last 12 months, significantly more music academy students than the medical students visited a healthcare professional (46.3% vs 29.8%, p=0.013, *Table 5).*

GENDER AND SCHOOL GRADE

Among the music academy students, a higher prevalence of CANS was present among female students compared to male students (84% vs 71%, p=0.212, *Table 6).* A higher prevalence of CANS was reported among bachelor students than master students (85% vs 55%, p=0.018, *Table 6).*

Table 6: Gender specific occurrence of CANS (12 month prevalence) among music academy students

	CANS (n=67)	No CANS (n=16)	p
Male (n=21)	15 (71.4%)	6 (28.6%)	p=0.212
Female (n=62)	52 (83.9%)	10 (16.1%)	

Table 7: Grade specific occurrence of CANS (12 month prevalence) among music academy students

	CANS (n=67)	No CANS (n=16)	p
Bachelor (n=72)	61 (84.7%)	11 (15.3%)	p=0.018
Master (n=11)	6 (54.5%)	5 (45.4%)	

DISCUSSION

This study showed high prevalence rates of CANS among music academy students, which were two to three times higher than in medical students. Prevalence rates of CANS in music academy students were 80.7% for 12-month prevalence of CANS, 47.0% for point prevalence, and 36.1% for prevalence of chronic CANS. Furthermore, music academy students with CANS presented with a higher number of symptoms for each of the anatomic localizations. Complaints were present at a higher number of anatomic localizations among music academy students than in medical students, and they rated the influence of CANS on daily functioning as more severe compared to the control group of medical students. Music academy students also reported more healthcare use compared to medical students due to these musculoskeletal complaints.

In this study we choose not to account work-relatedness, although we focused on a specific occupational group. The reason for this was that the advantage of using the definition of CANS, a universal term allowing adequate comparison of results, would thereby be lost. Also the term playing-related musculoskeletal complaints (PRMDs)(14) was not used in the present study, due to the limitation to work/music-related complaints in that definition. Furthermore, PRMDs would not have been scored properly in the non-musicians control group, which would make comparison of these groups impossible.

Computer office workers are one of the occupational groups known to have a high risk of upper extremity musculoskeletal complaints. Research on CANS among computer office workers showed 1-year prevalences between 54% and 64%.(9,15,16) This prevalence is higher than the prevalence in the general Dutch population (36.8%).(17) However, this prevalence of CANS among computer office workers is still low compared to the 12-month prevalence in our music academy students (80.7%), underscoring even more the high prevalence of CANS in this specific group of students. Thus, focusing on preventive measures to counteract the occurrence of these musculoskeletal complaints is of importance.

An unexpected outcome of this study was the use of healthcare of music academy students compared with medical students with CANS. Previous research showed a culture among musicians acknowledging musculoskeletal pain as "a normal consequence of playing" and in which talking about these complaints is considered a taboo, the latter

potentially causing a healthcare-avoiding behaviour.(14,18) This was in contrast to our findings, since we found more healthcare use among Dutch music academy students than in medical students. These results are comparable to a Danish study(2) which also showed a high healthcare use among musicians (64%); on the contrary, in the USA, healthcare use among musicians is reported at only 21%.(19) Musicians in general have low economic resources and often no permanent contract, with consequently no healthcare insurance for these complaints in a US-based system.(7) The differences found between the above-mentioned studies and countries may be caused by financial reasons due to national differences in both accessibility of healthcare systems as well as funding of healthcare use, which are both easily accessible and rather cheap in the Netherlands.

LIMITATIONS

The present study has some limitations. First, the response rate was low, which can be due to the fact that the invitation for the questionnaire was sent by e-mail (instead of telephone/mail), and only one reminder was send to the participants. Second, selection bias may be present as a consequence of this low response rate and may have resulted in an over- or underestimation of the results. In general it has been found, that those who sought medical care are more likely to respond to a postal survey(20), and thus an overestimation of musculoskeletal complaints might be present in this study.

Third, selection bias may be present by the use of medical students as a control group. It is unknown whether medical students with CANS will under- or over-report their complaints compared to those with CANS in the general population. The "medical students disease," hypochondria, might result in a higher amount of health-care use; on the other hand, medical students can easily access medical literature and informally consult a physician, which might result in a less "official" healthcare usage.(21) The largest study measuring the prevalence of CANS in the general population reported a 1-year prevalence of 36.8%.(17) This prevalence, in a population aged over 25 yrs of age, is comparable to our outcome data among medical students (41.5%). Also, the overall healthcare usage due to CANS between these studies is comparable: 59% in our control population compared to 58% in the study of Huisstede et al.(17) This comparability of the control group with a study performed in the general population underlines the representativeness of our control group.

There is a lack of literature comparing musicians with non-musicians.(4,11,12,22) Comparative research has a higher level of evidence compared to a non-controlled cross-sectional study. This study has, despite the presence of bias by using medical students, an important additional value to the existing literature on musculoskeletal problems among musicians.

Future research on musculoskeletal complaints among musicians should aim at two important domains: 1) prevention, and 2) treatment of specific and non-specific CANS. One of the options for prevention could be a prevention training program; In all types of professional sports, there are specific strength training programs, in addition to the technical sport-specific training, which have proved to reduce the risk of injuries, also in non-contact sports.(23) A comparable preventive training program should be developed for musicians; a study on a physical training program for musicians or music academy students with a focus on the upper extremity would be very interesting. Khalsa and Cope(24), for example, studied the effect of yoga training on a small group of music students, which seemed to relieve performance anxiety but not musculoskeletal problems. Recently, in Australia, a trial was started to study the effects of a training program on orchestral musicians.(25) In addition to physical efforts preventing musculoskeletal complaints, the mental aspects also should be addressed.(26) These studies are examples of the next steps in preventing musculoskeletal complaints among musicians. However, much work has to be done, especially among music academy students, in which musculoskeletal problems are highly prevalent and changes in health habits and attitude can be made.

A second important future study domain should focus on describing the occurrence, clinical presentation, and treatment options and outcomes of specific syndromes and diseases among musicians. For example, studies describing the presentation of "normal diseases" such as neuropathy of the median or ulnar nerve among musicians(27,28) should focus on specific complaints among musicians that are probably different compared to the general population. Also, the outcome of regular and musicians specific conservative treatment options (e.g., adaptive instruments, playing technique) and operative treatment options should be evaluated in order to optimize healthcare for musicians.(29) This could lead to a field of knowledge, comparable to sports medicine, in which the choice of treatment for musicians possibly differs compared to non-musicians.

The results of this study may help to give directions to both of the above-mentioned study domains.

CONCLUSION

In conclusion, this study emphasized the striking prevalence rates and serious consequences on daily functioning and healthcare usage of CANS among music academy students. Awareness of this health condition among this specific profession is a first step, which may be helpful to develop preventive intervention programs aimed at reducing the extent and consequences of CANS among music academy students and musicians.

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