Playing-related musculoskeletal disorders in musicians: a systematic review of incidence and prevalence

Evidence

Études

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Abstract

Background: Work-related musculoskeletal disorders cause pain, disability and loss of employment for many workers, including musicians. Although performing arts medicine is a growing field, the health problems of musicians remain under-recognized and under-researched. Therefore, the author undertook a systematic review of published information on the incidence and prevalence of playing-related musculoskeletal disorders (PRMDs) in classical musicians.

Methods: Seven databases were searched for the period 1980 to 1996. The main textbook and performing arts medicine journals were searched manually, as were reference lists of all relevant papers. The author also contacted individuals familiar with the literature of performing arts medicine. Studies were included for review if they reported PRMD incidence or prevalence in classical musicians. Of the 24 studies identified, 18 cross-sectional surveys and cohort studies were reviewed. The author subjectively assessed the studies using criteria modified from an existing evaluation scale and used 4 criteria for data combination. On the basis of prevalence values from the eligible studies, χ^2 tests for heterogeneity were performed.

Results: Only one study estimated PRMD incidence. Ten of the 17 prevalence studies were ineligible for data combination, because of low response rates and other methodological problems. In the 7 eligible studies, PRMD point prevalence ranged from 39% to 87% in adult musicians and from 34% to 62% in secondary school music students. The best estimates of PRMD prevalence were derived from the 3 studies that excluded mild complaints; these studies indicated that PRMD prevalence was 39% and 47% in adults and 17% in secondary school music students respectively. Statistical combination of data across studies within each demographic category was not possible.

Interpretation: Available data indicate that the prevalence of PRMD in adult classical musicians is comparable to the prevalence of work-related musculoskeletal disorders reported for other occupational groups. Several recommendations for future research are outlined.

Résumé

Contexte : Les troubles musculosquelettiques liés au travail sont une cause de douleur, d'incapacité et de perte d'emploi pour beaucoup de travailleurs, y compris les musiciens. Même si la médecine des arts du spectacle est un domaine en pleine croissance, les problèmes de santé des musiciens ne sont pas suffisamment reconnus et les recherches en la matière sont insuffisantes. L'auteur a donc entrepris une recension systématique des documents publiés sur l'incidence et la prévalence de troubles musculosquelettiques liés à l'exécution de la musique (TMEM) chez les musiciens classiques.

Méthodes : On a effectué, dans sept bases de données, une recherche portant sur la période de 1980 à 1996. L'auteur a effectué une recherche manuelle dans le principal manuel, dans des journaux sur la médecine des arts du spectacle, ainsi que dans les listes de références de tous les documents pertinents. Elle a aussi communiqué avec des personnes qui connaissent bien les publications sur la médecine des arts du spectacle. L'auteur a inclus les études qui faisaient état

d'une incidence ou d'une prévalence de TMEM chez des musiciens classiques. Sur les 24 études repérées, on a examiné 18 sondages représentatifs et études de cohorte. L'auteur a évalué subjectivement les études en se fondant sur des critères tirés d'une échelle d'évaluation existante qu'elle a modifiée et elle a utilisé quatre critères pour combiner les données. En se fondant sur les valeurs de prévalence tirées des études utilisables, elle a procédé à des tests de χ^2 pour déterminer l'hétérogénéité.

Résultats : On a estimé l'incidence des TMEM dans une étude seulement. Des 17 études de prévalence, 10 n'ont pu servir à la combinaison des données à cause de la faiblesse des taux de réponse et d'autres problèmes de méthodologie. Dans les sept études utilisables, le moment de prévalence de TMEM a varié de 39 % à 87 % chez les musiciens adultes et de 34 % à 62 % chez les étudiants en musique du niveau secondaire. La meilleure estimation de la prévalence des TMEM a été tirée des trois études qui ont exclu les plaintes portant sur des troubles légers. Ces études ont indiqué que la prévalence des TMEM s'établissait à 39 % et 47 % chez les adultes et à 17 % chez les étudiants en musique du niveau secondaire, respectivement. Il n'a pas été possible de combiner statistiquement les données tirées d'études dans chaque catégorie démographique.

Interprétation : Les données disponibles indiquent que la prévalence des TMEM chez les musiciens classiques adultes est comparable à celle des troubles musculosquelettiques liés au travail signalés dans le cas d'autres catégories professionnelles. L'auteur présente plusieurs recommandations sur des recherches futures.

Work-related musculoskeletal disorders cause pain, disability and loss of employment for workers in many occupations.[1,2] The focus has been on the back injuries and musculoskeletal disorders of workers in offices and industries, but evidence is increasing to indicate that musicians are also vulnerable. Although performing arts medicine has grown substantially since 1980, the health problems of musicians remain under-recognized and under-researched. Little is known about the magnitude of the problem, the factors that place musicians at risk, the therapies that are effective and appropriate for musicians and the ways in which musicians can prevent these problems.

Common playing-related musculoskeletal disorders (PRMDs) of musicians include overuse problems, such as tendonitis, and peripheral nerve entrapment syndromes. These conditions typically affect the upper extremities, the neck, the back and the facial musculature. PRMDs experienced by musicians often become chronic, painful, disabling health problems that last, on average, from 2 to 5 years.[3–5] The economic effects of PRMDs among musicians are significant, especially given that most Canadian musicians are self-employed and do not qualify for workers' compensation benefits. Because musicians earn, on average, less than $20 000 per year from their musical work, many of them hold several jobs,[6] and a PRMD can affect a musician's ability to earn a living from any job, musical or otherwise. The arts and culture industry is making an increasingly significant contribution to the Canadian economy.[7] The total revenue from music in Canada was over $111 million in 1993,[8] and in 1993–94 arts and culture directly contributed $29.2 billion (4.7%) to the gross domestic product, with almost 900 000 (6.9%) direct jobs depending on this industry.[7]

Nonetheless, many people do not view the arts as a legitimate profession, and the occupational health problems of musicians are seen as intriguing oddities rather than serious concerns. Anecdotal information about physicians' responses to musicians suggests a similar view in the medical profession.[9,10] Family physicians are now more likely to encounter musicians in their practices,[11] either for treatment or for referral for specialized care. Consultation with physicians and therapists at "musicians' clinics" may be an option for some musicians, but there are few such clinics,[12] and referring physicians may not be aware of them.

Information on the work-related musculoskeletal disorders of industry and office workers, for example, is easily accessible to health care professionals. However, information on musicians' occupational health problems is difficult to locate, even though, since 1980, over 6000 musicians in several countries have participated in surveys and other research studies. Of the 2 published narrative reviews of this literature, the first[13] was published before most of the prevalence studies were conducted, and the second[14] is not comprehensive. Both lack a critical evaluation of primary studies.

This systematic review addresses the incidence and prevalence of playing-related musculoskeletal disorders in classically trained musicians.

Methods

For this review, the term PRMD is used to refer to a host of musculoskeletal problems (e.g., carpal tunnel syndrome, epicondylitis, tendonitis and other conditions related to overuse). The use of an aggregate term is based on the hypothesis that the individual conditions share several common etiologic factors;[15] however, use of the aggregate term does not necessarily imply that causality has been demonstrated.

Inclusion and exclusion criteria

This review included cross-sectional surveys and cohort studies whose primary outcome was the incidence or prevalence of PRMDs in classically trained musicians. To minimize bias, I excluded case series, follow-up studies, studies of a specific technical aspect of playing and studies in which most of the subjects had not been classically trained.

Searching techniques

The following databases were searched for the period 1980 to 1996: MEDLINE, the Cumulative Index to Nursing and Allied Health Literature (CINAHL), Sports Discus, the Social Sciences Index and PsychInfo Lit. All searches except those of MEDLINE and CINAHL were restricted to English-language articles. The search terms included "music," "musician," "instrumentalist," "pain," "disability," "overuse," "musculoskeletal diseases" and "musculoskeletal system." The terms "pain," "musculoskeletal diseases" and "musculoskeletal system" were exploded according to accepted search techniques. The Occupational Diseases of Performing Artists Bibliography from the Library of the Medical and Chirurgical Faculty of Maryland was searched online, item by item. I searched the Computer-Assisted Information Retrieval Service System for Music online using the key words "performing arts medicine," "survey" and "prevalence." In addition to the computerized searches, I searched the 2 main performing arts medicine journals manually, covering all issues of *Medical Problems of Performing Artists* (1986 to March 1996) and the *International Journal of Arts Medicine* (1991 to 1995). The main performing arts medicine text[16] and the reference lists of all relevant papers were also searched manually. Finally, I identified a study that was in press at the time of searching, and I contacted individuals familiar with the performing arts medicine literature.

Assessment of study quality

Studies were eligible for inclusion if they met the following criteria: the study was subjectively classified as at least moderate according to criteria modified from an existing evaluation scale,[17] the response rate was greater than 60%, the original data were provided (or it was possible to calculate prevalence), point prevalence was provided and the data had been collected by an unblinded investigator using systematic methods. Studies that met these evaluation criteria and that differentiated between mild, moderate and severe symptoms provided the best estimates of PRMD prevalence.

Data extraction

I obtained hard copies of all eligible studies and extracted the following information: authors' names, publication year, source, country, study design, sample size, response rate, description of subjects and main outcome (incidence or prevalence).

Results

The searching strategies uncovered 24 reports, including 2 German-language studies, 1 study in press (but now published) and 4 studies that included comparison groups of non-musicians.

Of 3 publications reporting on a single study,[18–20] 2 were excluded.[19,20] Similarly, 2 papers describing different aspects of a single study were counted as 1 study.[21,22] Two retrospective cohort papers[23,24] were counted as 1 study because the second was an extension of the first. The German-language papers[25,26] were excluded because their English abstracts reported neither incidence nor prevalence. Therefore, 18 studies were included in the review.

Data synthesis

Ten of the 18 studies that were critically evaluated were ineligible for data synthesis.[21,27–35] These included 4 studies of university music students,[30–33] 2 studies of professional musicians,[21,27] 2 studies of primary or secondary school music students[34,35] and 2 with mixed samples.[28,29] The most important methodological problem was a lack of definition of observed outcome. With few exceptions, it was unclear whether non-playing-related injuries had been excluded. Another significant methodological weakness was low response rate: below 60%[21,28] or even below 50%.[29,32,33] In some cases, the investigator had not been blinded and the data had been collected in an unsystematic interview and examination,[27,31] a method that suggests a high probability of measurement bias. Significant reporting errors and omissions included erroneous reporting of prevalence as incidence,[27,33,34] results reported as percentages without original data,[27,35] component results that did not add up to

reported totals,[35] incorrect calculation of response rates and prevalence,[32,35] lack of statistical significance testing[27,31,32,35] and omission of the number of musicians surveyed.[35] Of the 8 eligible studies, 1 reported incidence[23,24] and 7 reported point prevalence.[18,36–41]

Incidence of PRMD

Only 2 papers[23,24] reported the incidence of PRMD. In 2 consecutive retrospective cohort studies the authors estimated the annual incidence of upper extremity musculoskeletal disorders at 8.5 PRMD episodes per 100 university music performance majors. The annual incidence ranged from 5.5 to 11.5 episodes over a 3-year period,[23] and from 8 to 9.5 episodes over a 4-year period.[24] Although the incidence values were identical for the 2 periods, interpreting them is difficult because recurrent injuries were included in the calculations for the 4-year period.

Prevalence of PRMD in adults

The point prevalence of PRMDs in adult professional and pre-professional musicians (including university music students) has been reported in 1 Canadian[37] and 3 US studies[18,38,39] (Table 1).

Zaza and Farewell[37] found that 39% (110/281) professional and university student instrumentalists reported current "pain, weakness, numbness, tingling, or other symptoms that interfere with [their] ability to play [their] instrument at the level [they] are accustomed to," an outcome definition developed by other musicians in a qualitative study.[5,42] Musicians with non-playing-related musculoskeletal problems (e.g., arthritis, injuries from motor vehicle crashes) were excluded. Roach and colleagues[38] compared 90 university student instrumentalists (defined as individuals who had played for at least 7 hours per week during the preceding month) with a group of 159 non-instrumentalists. Respondents were asked to report on "any areas in which [they] have had joint pain at least 2 days"[38] during the previous 4-week period. The authors discussed the implication of this outcome definition on their finding that 67% of instrumentalists reported such pain. Larsson and associates[18] found that 67% (441/660) of university students and staff, including 85 vocalists, reported "problems during practice or performance of music." Although severity was measured, it was not reported. Pratt and collaborators[39] compared a group of 246 university music students with 416 non-music majors. "Performance-related pain or discomfort" was recorded as 0 ("unnoticeable") to 4 ("extreme"). Among the 219 music students

Table 1: Summary of studies of playing-related musculoskeletal disorders

Study	Sample	Response rate, %	Outcome measured	Prevalence of outcome, %
Zaza and Farewell[37]	281 professionals and university music students	67	Playing-related musculoskeletal disorder	39
Roach et al[38]	90 university students (instrumentalists), 159 control subjects	99.6	Musculoskeletal complaints	67*
Larsson et al[18]	660 university music students and staff	80	Musculoskeletal symptoms	67
Pratt et al[39]	246 university music students, 416 control subjects	NR	Performance-related pain, any severity†	87
			Performance-related pain, excluding mild pain†	47
Lockwood[41]	120 high school music students	100	Instrument-related problems, any severity	49
			Instrument-related problems, excluding mild problems	17
Fry et al[36]	98 high school music students, 98 control subjects	100	"Music-related" pain	34‡
Grieco et al[40]	117 conservatory piano students	75	Musculoskeletal complaints§	62

Note: NR = not reported.
*65% in control group.
†Data on daily activity-related pain for control group not reported.
‡13% in control group experienced pain from hand use.
§At least one disorder.

who responded to the question, 191 (87%) reported some pain. Excluding the 13% (28/219) who reported pain as unnoticeable and the 40% (88/219) who rated their pain as mild, the prevalence of at least moderate pain was 47% (103/219). Singers comprised 30% of the sample and reported primarily throat pain.

Prevalence of PRMD in adolescent music students

Three studies estimated PRMD point prevalence among adolescent students.[36,40,41] Lockwood[41] reported that the prevalence of "instrument-related problems" was 49% among 113 secondary school instrumentalists who responded to the question. Using a modified version of Fry's 5-point severity grading system,[43] Lockwood found that 32% (36/113) of the students described their problem as grade 1 (mild), and 17% (19/113) rated their problem as grade 2, 3 or 4. Fry and colleagues[36] measured "music-related pain" in secondary school instrumentalists, of whom 34% (33/98) reported "persisting pain (present)." Information on severity was not provided in this very brief report. Grieco and associates[40] measured the occurrence, site and characteristics of "musculoskeletal disorders" among piano students at an Italian conservatory and found that 62% (72/117) reported at least one disorder.

Musicians compared with non-musician controls

The 3 studies comparing the prevalence of musculoskeletal complaints in musicians and non-musicians[36,38,39] had inconsistent results. Roach and colleagues[38] found no difference in the prevalence of joint pain among musicians (67%) and non-musicians (65%). However, the distribution of complaints differed: the instrumentalists reported mainly upper extremity joint pain, and the non-instrumentalists reported primarily low back and lower extremity joint pain. As the authors noted, the lax outcome definition may account for the lack of difference between the groups. Pratt and collaborators[39] reported only the distribution of pain among the non-musicians, and from the data provided it was not possible to calculate prevalence for the control group. Fry and colleagues[36] estimated the prevalence of "persisting pain (present)" at 34% (33/98) in secondary school music students and that of pain from hand use at 13% (7/98) in non-music student control subjects.

Summary of results

According to the 7 eligible prevalence studies, the prevalence of PRMD (any severity) ranged from 39% to 87% in adult musicians and from 34% to 62% in secondary school music students (Table 1). The exclusion of mild, transient complaints narrows the range of prevalence and provides a more accurate estimate. However, only 3 of the eligible studies[37,39,41] excluded mild symptoms. According to these studies, prevalence was 39% and 47% among adults,[37,39] and 17% among secondary school music students.[41] There was too little information from the comparative studies to draw strong conclusions.

The combination of data to derive separate summary estimates of prevalence for adults and for secondary school music students was considered. Variability among the 4 studies of adult musicians and among the 3 studies of school-aged music students was substantial ($\chi^2 = 129.4$, df = 3 for adults, $\chi^2 = 16.57$, df = 2 for school-aged children; $p < 0.001$ for both); therefore, the data were not combined in either group. In addition to the variability in age range among the eligible studies, the samples varied substantially in the types of musicians studied.

Interpretation

It is difficult to summarize the burden of illness from a problem that is not clearly defined or rigorously examined in the primary studies. PRMD prevalence estimates were significantly higher in studies where the methodology or outcome definition was weak.

Including mild, short-lived aches and pains results in inflated estimates of prevalence and misleading conclusions. The most accurate and meaningful prevalence estimates are those derived from rigorous studies that exclude mild aches and pains. Musicians clearly distinguish between PRMDs and mild, everyday complaints, which indicates that even if researchers consider mild symptoms as PRMDs, musicians do not.[5,42] Distinguishing mild, transient complaints from musculoskeletal disorders is consistent with epidemiological research in occupational medicine.[15]

Although definitions varied in the reviewed studies, all endeavoured to measure musculoskeletal health problems attributed to playing an instrument. Given the absence of gold standard criteria for diagnosing musculoskeletal disorders and the extensive overlap in their symptoms, the use of specified medical diagnoses would not necessarily have been more reliable or precise than the use of an aggregate term.

This systematic review would have been stronger if the primary studies had been reviewed by multiple blinded assessors. Although prevalence figures by instrument would have been useful, these data are not generally available in a form suitable for comparison or synthesis. Conclusions regarding incidence and prevalence are limited by the small number of rigorous studies available.

The prevalence of PRMDs in musicians is consistent

with the prevalence of work-related musculoskeletal disorders for other workers. For example, 41% of newspaper workers,[44] 50% of female supermarket checkers,[2] and 56% of female assembly-line food packers[45] report work-related musculoskeletal disorders. There is evidence that the prevalence of musculoskeletal disorders is high among workers with repetitive tasks.[46] However, unlike workers in other occupations, musicians have no industry standards for occupational health and safety.

There is a wide range in sick leave, disability and other benefits among professional Canadian orchestras, most offering few or no benefits.[47] Until musicians' playing-related health problems receive greater recognition, it is unlikely that their occupational health and safety issues will be adequately addressed.

Compared with sports medicine and occupational medicine, the recent advances in performing arts medicine may be less familiar to primary care physicians and other health care professionals. Musicians' clinics typically provide an analysis of posture and technique. Performing arts medicine organizations, such as the Canadian Network for Health in the Arts, foster research and the dissemination of information, and several symposia on the health problems of performing artists are held each year. Health care professionals' awareness of the nature and extent of musicians' health problems, as well as their awareness of treatment and information resources, has important clinical implications.

Future research

Future studies of PRMD incidence and prevalence must be conceived with greater attention to design and methodology. Specifically, investigators should provide a clear operational definition of the outcome — one that allows comparison with other studies — and should exclude non-playing-related injuries and mild aches and pains. Because low response rates and unsystematic measurement procedures lead to biased results, researchers must pay more attention to data collection. Rather than merely reporting means and frequencies, researchers should substantiate their conclusions by performing appropriate statistical analysis.

Although more rigorous studies would improve the estimates of prevalence, the available information indicates that PRMDs have a considerable impact on classical musicians. Perhaps research on risk factors would have a greater impact on the treatment and prevention of these problems than would further studies of prevalence. Prospective cohort studies would provide the best information on incidence as well as risk factors; however, such a study would be costly and time consuming. Research is also needed to evaluate the effectiveness of musicians' clinics and to design and evaluate prevention interventions. A systematic review of evidence on risk factors would improve our understanding of the causes of PRMDs and help to guide prevention programs.

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