

Research Article

Prevalence and Risk Factors of Musculoskeletal Disorders (MSDs) among Primary and Secondary School Teachers: A Narrative Review

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Purpose: Musculoskeletal disorders (MSDs) are among the most common and important occupational health problems in the teaching profession. However, there are few studies of teachers with MSDs in developing countries such as Malaysia. The objective of the study was to review the literature on the prevalence and the risk factors of musculoskeletal disorders among primary and secondary school teachers in Malaysia.

Method: A search was made using various electronic databases and bibliographies (such as PubMed), which identified 18 reports from 2006 to 2016, although only 5 studies were included for the review.

Results: Previous reviews demonstrated that secondary school teachers have a higher risk of MSDs compared to their counterparts in the primary schools. Dominant risk factors cited in the reviews were prolonged sitting and standing, long working hours with computers, and correcting test papers. These all contributed to the development and exacerbation of MSDs among high school teachers.

However, one of the important findings from this review is the lack of high quality studies in both developed and particularly in developing countries.

Conclusion: The studies concerning MSDs among teachers revealed a lot needing to be done, not only in examining the risk factors but also in developing interventions to minimize MSDs in the teaching profession.

Keywords: Musculoskeletal disorder; Prevalence; Risk factors; School teachers

Introduction

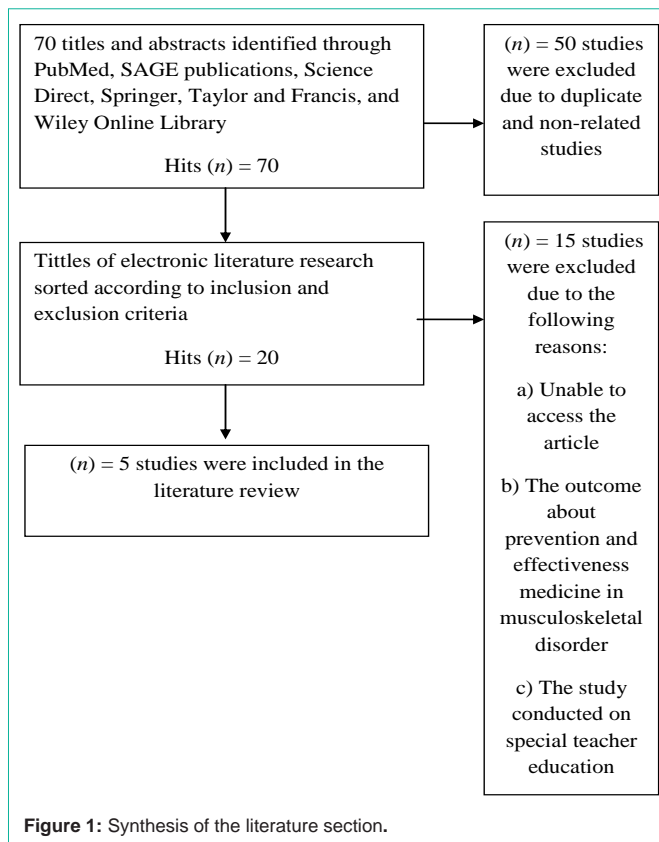
Musculoskeletal disorder (MSD) is a frequent and serious occupational hazard that affects not only the general population but also the working population. MSD particularly affects those in the teaching profession and is assumed to be related to adverse work conditions [1,2]. MSDs include pain or dysfunction in the musculoskeletal system, including the bones and connective tissues that protect and support the human body [3]. People whose work entails a high degree of repetition, physical effort, or unusual positions [4] have an increased risk of developing MSDs. Numerous studies indicated lower back pain (LBP) is a common type of MSD in both developed and newly industrialized countries. Estimates have suggested that 50 percent or more of the population is likely to suffer from LBP at some point in their lives [5-8].

The nature and burden of MSDs are experienced not only by the individual suffering from it but also by family and society. MSDs are a significant factor in the cost of health benefits, workers' compensation and lost wages [9]. MSDs increase operating costs, premium payments and absenteeism from work and compensation of damages to employees. MSDs have caused more absence from work and disability of workers compared with other diseases [3]. The report

from the U.S. Labor Department reported the cost for treating MSDs as more than \$50 billion a year whereas in the United Kingdom, the medical costs for workers with MSDs were estimated at £57 billion [10]. Demographics (male, female, age); type of work involved (heavy lifting, awkward positions, vibrating work environment; as well as emotional attitude towards work, social support and perceived stress level, all have been identified as risk factors [11].

One occupation that has been shown to suffer from MSD is the teaching profession [12]. A wide variety in the incidence of musculoskeletal disorders in school teachers has been reported: for example, from a low of 17.7% in Japan, to 53.3% in Brazil, 59.2% in China and as high as 61% in the United States [12]. Other studies have found school teachers to be an occupational group with a particularly high incidence of MSD [13], reporting rates of between 40% and 95%. Teachers not only engage in pedagogical work, but also must prepare lessons, evaluate students, and assist with sports and other extracurricular activities. Because of this wide range of duties and activities, teachers may be especially vulnerable to both physical and emotional issues [14].

A study in Ireland reported that musculoskeletal disorders were a major reason for disability retirement by school teachers, accounting



for 10% of those retiring with a disability [15]. Epidemiological studies have found an association between such factors as age, gender, length of employment and uncomfortable ergonomic positions and a higher incidence of MSD in teachers [16]. In addition, repetitive strain injuries (RSIs), which often cause problems in the upper musculature of teachers, are the result of protracted standing and repetitive work [17]. Many studies have generated public attention to a variety of teachers' issues, including occupational stress, unemployment, the need for smaller classes and more schools, teacher evaluations, etc. However, very little attention has been given to somatic health problems of teachers. The high incidence of MSDs among teachers clearly demonstrates the need for and the importance of current and relevant studies that focus on the prevalence and risk factors of musculoskeletal disorders among school teachers. The purposes of this study were to measure the prevalence and investigate the risk factors for musculoskeletal disorder in teachers.

1. 3. MethoBefore embarking on a literature search, the inclusion and exclusion criteria were set up, stipulating that articles to be included in the current analysis must met the following criteria:
2. The paper must be written in English or with details in English;
3. Papers must be peer reviewed and published between 2006 and 2016;
4. The study should include the prevalence and risk factors of musculoskeletal disorders among primary and secondary school teachers; and
5. The paper must include cross-sectional surveys.

Searching techniques

A broad search strategy with year limitation was employed to collect from year 2006 until 2016. The papers were selected from six major databases, including PubMed, SAGE publications, Science Direct, Springer, Taylor and Francis, and Wiley Online Library. The search terms included "musculoskeletal disorder*", musculoskeletal disease*, and "school teachers", primary school teachers, secondary school teachers, and high school teachers*. All searches were restricted to English-language articles. For Boolean terms, the phrase "(("musculoskeletal disorder" OR musculoskeletal disease*) AND (school teachers* OR primary and secondary school teachers*))" was used.

Data synthesis

The literature was selected according to the inclusion and exclusion criteria stated in Table 1. For initially, a total of 50 articles were found out of 70. This was narrowed to 20 articles which contained relevant hits. After carefully sorting through the relevant hits, the duplicates were removed. Applying the in- and exclusion criteria, 5 articles were found appropriate and eventually included in the final analysis (Figure 1).

Results

A total of 5 studies were identified, selected and reviewed in terms of prevalence and risk factors provided, the outcome, the sample and the design (Table 1).

Prevalence

In these papers, 6849 primary and secondary school teachers were involved. Most of them employed validated measure to examine the prevalence and risk factors of musculoskeletal disorder among the primary school teachers which are Nordic Musculoskeletal Disorder, General Health Questionnaire, Dutch Musculoskeletal disorder, Oswestry Disability Index, and Job Content Questionnaire.

The main results are presented in Table 1. Based on the previous studies, only the study by Mohseni Bandpei et al. (2014) showed the prevalence rate of musculoskeletal disorders among teachers. The prevalence rates of musculoskeletal disorder at various points, at that time, last month, last six months, annual, and lifetime, were reported as 21.8%, 26.3%, 29.6%, 31.1%, and 36.5%, respectively. The prevalence of low back pain in teachers appeared to be especially high in high school teachers compared to primary school teachers. The prevalence of musculoskeletal disorder among teachers was significantly associated with age, body mass index, job satisfaction, and length of employment.

The studies included in this paper, reported inconsistent findings in sex differences and musculoskeletal disorders. Studies by Samad et al., and Erick and Smith found significant sex differences in musculoskeletal disorders. with female teachers scoring higher (48.1%) than male teachers (39.6%); whilst Mohseni Bandpei et al. found the same result in which female teachers seemed to be more affected than male, but this difference was not statistically significant ($P = .26$). The results also indicated that older teachers were more likely to experience musculoskeletal disorders compared with younger teachers ($P = .00$).

A study conducted by Yue, Liu, and Li also found frequent

Table 1: Summary of the studies prevalence of musculoskeletal disorder.

Reference	Sample	Design	Measurement	Prevalence and risk factors	Outcome	Comments/Remarks
Mohseni, Bandpei, Ehsani, Behtash, & Ghanipour (2014)	Among the 620 teachers, a response rate of 95% (n =586) was obtained for data analyses. Three hundred eighty-seven (66.4%) of the participants were female, and 197(33.6%) were male.	Cross-sectional study	(a) demographic and occupational characteristics, (b) the prevalence of LBP, possible risk factors and managements received for LBP in teacher population, Oswestry Disability Index (ODI)	The prevalence of LBP was significantly associated with age, body mass index, job satisfaction, and length of employment (P b .05 in all instances). Prolonged sitting and standing, working hours with computer, and correcting examination papers (27.4%, 25.2%, 24.3%, and 15.5%, respectively) were the most aggravating factors, respectively.	Lower back pain (LBP)	This study recruited most of the teachers from secondary school compared to primary therefore it could be a source of bias for the results of this study.
Samad, Abdullah, Moin, Tamrin and Hashim, (2010)	A total of 66.5% of the respondents were female, while 33.5% were male.	Cross-sectional study	a) Nordic Musculoskeletal Disorder (NMQ) b) General Health Questionnaire (GHQ)	The prevalence of low back pain was 40.4% among respondents. Lifting load (28.0%) was ranked as the main factor which contributed to low back pain, followed by prolonged sitting (25.2%).	Lower back pain (LBP)	A cross-sectional study does not provide a good basis for establishing causality. Thus, no causation can be implied in this study.
Yue, Liu, & Li. (2012)	There were 1050 respondents from Guang Dong, China completed questionnaire. The participants had a higher proportion of females (67.0% vs 33.0%) than male	Cross-sectional study	a) Nordic Musculoskeletal Disorder (NMQ) b) Dutch Musculoskeletal Disorder	The prevalence of Neck Shoulder Pain among female teachers was much higher than that for males. Lower Back Pain was more consistently associated with twisting posture, uncomfortable back support and prolonged sitting and static posture	Lower back pain and neck pain	Information about musculoskeletal symptoms and related factors were obtained by the self-reporting method and the nature of this retrospective questionnaire survey, it is difficult to rule out the possibility of recall bias, which may lead to over- or underestimation.
Erick & Smith (2014).	A total of 3100 questionnaires were distributed to teachers from whom 1747 were returned. The participants comprised of a higher proportion of female (72.7%) than male teachers (27.3%).	Cross-sectional study	a) Standardized Nordic Questionnaire (SNQ) b) Oswestry Disability Index (ODI)	The prevalence of LBP was higher among teachers with high psychosocial job demands (57.4%) and high job dissatisfaction (58.6%) when compared to those with low psychosocial job demands (48.9%) and low job dissatisfaction (51.7%), respectively; with a statistical difference of $p < 0.05$.	Low back pain	The presence of LBP depends solely upon the subjective self-report of the participants and not based upon an objective clinically verified diagnosis of a specialist.
Cardoso, Ribeiro, Araújo, Carvalho, & Reis (2009)	4,496 school teachers of the municipal elementary education network of Salvador, Bahia, Brazil. Women represented most of the population studied (92.0%);	Cross-sectional study	The data collecting tool used comprised blocks of questions related to socio-demographic information aimed at characterizing teachers; their work in the municipal network of Salvador; conditions in the school work environment; mental health; vocal health and main health problems reported by teachers.	The prevalence of musculoskeletal pain (MSP) was 41.1% for lower limbs, 41.1% for back, and 23.7% for upper limbs.	Musculoskeletal pain	Self-report questionnaire might be bias in the result of study.

complaints of musculoskeletal disorders by teachers, particularly in the lower back, neck and shoulders. Hong Kong teachers reported a greater incidence of pain in the areas of neck shoulder and low back (68.9%, 73%, and 59.2%, respectively) during the prior 30 days. Notably, teachers in Hong Kong teachers complained of a high incidence of pain in all musculoskeletal locations [14]. In the study conducted by Yue, Liu, and Li, the prevalence of neck-shoulder pain and low back pain for 893 teachers in China was reported to

be 48.7% and 45.6%, respectively. Female teachers had a significantly higher prevalence of neck-shoulder pain compared to male teachers (51.7% vs 42.7%, $P = 0.01$). In addition, the results showed that the age group with the highest prevalence of neck-shoulder pain and low back pain was 40–49; there was significant variation among different age groups in the prevalence of low back pain ($P = 0.03$). Moreover, there were significant differences by school levels in the prevalence of neck-shoulder pain and low back pain ($P < 0.001$); female gender

was significantly associated with neck-shoulder pain, but not with low back pain, and physical exercise was significantly associated with neck-shoulder pain and low back pain. The neck-shoulder pain and low back pain were positively associated with high school teachers. The secondary school level remained associated with decreased odds of reporting neck-shoulder pain and low back pain as compared to primary school teachers. Statistically significant associations were found between the prevalence of lower back pain and uncomfortable back support, prolonged sitting, static posture, hours worked on the computer, and correcting examination papers [9,18].

Risk factors

a. Individual factors

The prevalence of MSD is positively associated with age. Supporting this hypothesis are the results of a study in Brazil, in which teachers above 40 years of age were more likely to report lower limb pain (Odds Ratio (OR):1.28, 95% CI:1.01-1.38), back pain (OR:1.20, 95% CI:1.07-1.35) and upper limb pain (OR:1.31, 95% CI:1.10-1.56) [13]. Parallels can be drawn with the results of a study in China conducted by Yue, Liu, and Li, which showed that the age group with the highest prevalence of neck-shoulder pain and low back pain was 40–49, and that there were significant differences in different age groups for the prevalence of musculoskeletal disorders ($P = 0.03$). Senior middle school teachers had the highest prevalence of musculoskeletal disorders. Similarly, there were significant differences among school levels in the prevalence of musculoskeletal disorders ($P < 0.001$). In the study of Erick and Smith (2014), they stated that, among individual factors, gender, age, body mass index, education level and previous low back injury were significantly associated with low back pain disability, all with p -values of less than 0.001. Work related factors included the level of school at which teachers taught ($p < 0.001$) and length of employment ($p = 0.001$). Similarly, a study in Brazil reported that the length of employment of Brazilian teachers, was significantly associated with lower limb (OR: 1.12, 95% CI: 1.01-1.19), back (OR: 1.15, 95% CI: 1.07-1.24) and upper limb pain (OR: 1.34, 95% CI: 1.19-1.50).

b. Physical factors

For the physical factors, the study of Cardoso et al. (2009) showed that intense physical exertion (prevalence ratio (PR):1.29, 95% CI: 1.20-1.38) and inappropriate furniture (PR: 1.11, 95% CI: 1.03-1.19) were positively associated with back pain among Brazilian teachers. Parallels can be drawn to the results of a study in Botswana suggesting that teachers who reported that their job required high physical effort, rapid physical activity, awkward body and awkward arm position had a higher prevalence of MSD. These findings were statistically significant. In this study, which was conducted by Samad et al., teachers who reported low back pain most frequently were those who had to lift heavy loads, including not only textbooks and student papers, but also heavy equipment, particularly for teachers of physical education. Other factors that caused low back pain included long periods of sitting (25.2%) or standing (23.4%). Some teachers also attributed the low back pain to activity during sports and physical education classes or frequent use of stairs (13.5%) or long periods of sitting at the computer (6.3%).

c. Psychosocial factors

In the study conducted by Samad et al., they showed that

psychosocial factors such as mental health among Malay school teachers (OR: 1.11, 95% CI: 1.06-1.15) and anxiety among Chinese teachers (OR: 1.49, 95% CI: 1.07-2.07) have been associated with higher MSD prevalence rates. In another study, Erick and Smith (2014) found a higher rate of MSD among teachers whose jobs involved a high level of psychosocial demands (57.4%) or those reporting a high level of job dissatisfaction (58.6%) than it was among reporting low levels of those factors (48.9% and 51.7%, respectively; the statistical difference was $p < 0.05$). Musculoskeletal disorders were associated with psychosocial job demands, job insecurity and lack of support from supervisors. On the other hand, the results of a logistic regression model showed that the only variables that were still statistically significant in contributing to MSD were female gender (OR: 2.47, 95% CI: 1.52-3.99, $p < 0.001$) or the presence of a prior low back injury (OR: 3.01, 95% CI: 1.92-4.74, $p < 0.001$) (Table 1).

Discussion

Assessment of MSD

This review suggests that while there is a paucity of studies that research the incidence of MSD among teachers, the teaching profession appears to be an occupation with a high risk for MSD. The findings of this literature review were obtained from five papers, each of which examined different musculoskeletal regions using a variety of methods. As most studies used the Standardized Nordic Questionnaire [2,9,18], this is apparently the most common method used to measure the prevalence of MSD. Other questionnaires were also used, such as the Dutch Musculoskeletal Disorder [18], General Health Questionnaires [9], and the Oswestry Disability Index (ODI) [2,12]. Questionnaires are an easy and cost effective way to collect data, but they have some drawbacks. For example, follow up may present obstacle, particularly for anonymous questionnaires, and the possibility exists for recall bias. A physical exam and evaluation would be more accurate; however, because this approach is far more costly and more difficult to use for a large sample, it is rarely used in studies. Accuracy, reliability and reproducibility of measurements are essential features of good research data and uniform, standardized definitions of exposure and disease outcome are necessary if results are to be compared across studies. Research that provides good data needs to be accurate, reliable and repeatable. However, because the presence of a musculoskeletal disorder is subjective, often no with no definitive test to document it, there is currently no clear benchmark definition. As a result, most extant studies use self-reported data [19]. This researcher assumed the results of studies were accurate, as this review did not attempt to evaluate intermediate effects. Lastly, a variety of methods was used to collect data on musculoskeletal disorders. For an example, in four of the studies, the authors' own questionnaire was used without no evidence of validation; only one study reported the psychometric properties. This lack of standardization may have resulted in chance associations, contributing to the observed variation among the studies.

Prevalence

The results demonstrate that musculoskeletal disorder is a frequent complaint by school teachers who often work in conditions that are likely to lead to musculoskeletal disorders. There were only three studies out of five that showed both the point and lifetime prevalence of neck-shoulder pain and low back pain in school teachers

[12,13,18]. For an instance, Mohseni Bandpei et al.'s study provided data on prevalence rates of musculoskeletal disorder (low back pain) for a series of times: at the time of the study, the prior month, the prior 6 months, the prior year, (rates were 21.8%, 26.3%, 29.6%, 31.1%, and 36.5%, respectively). Another study conducted by Cardoso and colleagues showed that the point and lifetime prevalence findings were similar: 41.1% for lower limbs, 41.1% for back, and 23.7% for upper limbs. The study by Yue and colleagues showed prevalence rates of 48.7% for neck and shoulder pain and 45.6% for low back pain. Similarly, a Turkish study revealed prevalence rates of 42.5% for neck pain, 28.7% for shoulder pain and 43.8% for low back pain [20], and a study among secondary school teachers in Hong Kong showed a prevalence of 69.3% for neck pain [21].

Overall, the reviews [12,13,18] showed that high school teachers may have a higher risk of experiencing MSD than primary school teachers have, mainly due to heavier workloads and more stress, factors that make people susceptible to MSD. The prevalence of musculoskeletal disorder had a significant association with length of employment, age, and job satisfaction [12]. Prolonged sitting and standing, working long hours with a computer, and correcting examination papers were the most aggravating factors [9,12]. In the study by Yue and colleagues the authors stated that their intent was to determine the frequency of neck-shoulder pain and low back pain among school teachers in Puning, China. The findings were prevalence of 48.7% for neck-shoulder pain and 45.6% for low back pain. The results parallel others studies where 42.5-47.9% of Turkish school teachers reported having had neck pain, 43.8-74.9% low back pain and of and 28.7-55.9% shoulder pain [22]. In Brazil, 41.1% of elementary school teachers described low back pain, as did 40.4% of elementary school teachers in Malaysia [9,13].

Risk factors

a. Individual factors

Several studies reported a positive association between MSD and female sex in teachers [2,9,12,13] however no consensus has been reached on this association [18] According to Cardoso and colleagues, women reported more back pain than men reported. The authors attributed this to the fact that teaching is a profession populated primarily by women, resulting in a small sample size for comparison. This finding was supported by and the study of Yue et al., who found that being female was not a risk factor for MSD in teachers, whereas Chong and Chan reported a significant difference between male and female in their survey of musculoskeletal disorders. In the present study, no significant relationship was revealed between the teacher's sex and the incidence of musculoskeletal disorders, although females reported a higher rate of MSD than males did.

Moreover, Chong and Chan suggested that women might report pain more frequently than men do because women have less physical strength, and may be pressured by family or career. The noted that it is also possible that women have a different threshold for feeling pain, or those men feel obligated to act "macho." The study of Yue and colleagues reported a significantly higher incidence of NSP in women (51.7%) than in men (42.7%), a finding that was similar to prior studies [23,24]. Furthermore, women appear consistently to report neck, shoulder and upper extremity symptoms more frequently than men do [14,22]. The review study of Mohseni Bandpei et al. showed

that musculoskeletal disorder had a higher incidence rate in teachers who had worked more than 20 years. This positive association with length of employment may be due to the longer time the teacher was exposed to conditions causing MSD [12].

b. Physical factors

Work that involves lifting heavy loads, having to assume awkward positions, including twisting or crouching down, spending long periods of time sitting, standing or using repetitive actions may contribute to the development of MSD [3]. School teachers generally spend much of their time in sustained sitting while reading, grading papers or using the computer. They also must stand while teaching, and repetitively reach over their heads to write on the board, activities that may lead to NSP, LBP or upper limb pain [13]. Positions at the computer while typing may not be ergonomically correct, causing neck and back pain [9].

c. Psychosocial factors

Psychosocial factors have been found to have a positive relationship with MSD. The current review noted that factors such as a heavy workload, high level of stress, inadequate social support, lack of job control, low job satisfaction and monotonous work may be factors in MSD [9]. Teachers frequently work under stressful conditions due to large classes, insufficient resources, and low pay [13]. According to Karasek, people with jobs characterized by lack of control over their work and heavy and stressful work demands might vulnerable to disease as well as less satisfied with their work [25]. It's possible that good social support may lessen this effect, while lack of social support may augment them [26].

Limitations

Self-report questionnaires might cause bias the results due to their being completed by the participants, rather than by a physician who could provide a more objective and clinically-based diagnosis. Another problem with the self-reporting method in these studies was the questionnaire being a retrospective survey, as it creates the possibility of recall bias, in which to the subject may under or overestimate the pain. Another limitation was the cross-sectional design, which is not effective in attempting to determine causality. There may be other variables that affect the relationship between the variables of interest. One issue might have been combining high school and primary school teachers together, as their working conditions are not the same, causing heterogeneity in the sample. Future studies should consider striving for homogeneity in the sample. Although this study examined the relationship between the incidence of musculoskeletal disorders and a few risk factors such as age, length of employment and others, additional studies using a larger and more homogenous sample would help to verify the association.

Conclusion

The current evidence supports the risk that teachers face for developing MSD. The studies reviewed provide some initial although limited evidence. It appears that primary and secondary school teachers frequently experience neck, shoulder and lower back pain. However, additional studies, especially longitudinal ones, should examine MSD among teachers more thoroughly, with greater attention to ergonomic factors. Awareness of the causes could

contribute substantially to prevention of MSD among teachers, particularly if simple preemptive measures could be suggested.

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