

PREVALENCE OF SHOULDER MUSCULOSKELETAL DISORDERS AMONG SCHOOL TEACHERS: A SYSTEMATIC REVIEW

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ABSTRACT

Musculoskeletal disorders (MSDs) represent the second-most common cause of disability worldwide. Teachers have a higher prevalence of MSDs. The resultant medical care has financial implications. The purpose of this study was to quantify the prevalence of and risk factors associated with, shoulder MSD among teachers across various countries. Peer-reviewed literature was extensively researched using different search engines which included PubMed, Science Direct, MEDLINE, EMBASE and Scopus. A total of 44 studies were identified, of which 18 were found to be relevant after a review of inclusion and exclusion criteria. The prevalence of shoulder MSD among teachers ranges between 15% and 83.1%, varying among countries. The highest prevalence of shoulder MSD was reported in South Africa at 83.1%, followed by China with a prevalence of 73.4%. The average prevalence of shoulder MSD was determined to be 58% (95% CI=0.54-0.62). Associated risk factors as reported by previous studies included age, gender, previous injury, psychosocial factors, length of employment and time spent writing on the blackboard. Relative risk calculation reported that females are 1.40 likely to develop shoulder MSD than males (95% CI=1.31-1.50). Future research should focus on interventions to prevent and manage shoulder MSD among teachers.

Keywords: Musculoskeletal disorders; Shoulder injuries; School teachers.

INTRODUCTION

Musculoskeletal disorders (MSDs) are injuries that cause inflammatory and degenerative changes to the musculoskeletal system, including bones, ligaments, muscles, tendons and bursae tissues (Erick & Smith, 2015). Musculoskeletal disorders were identified as the second-most common cause of disability worldwide, following mental and behavioural disorders (Vos *et al.*, 2012) accounting for one of the most expensive occupational health problems in developing and developed countries (Yue *et al.*, 2012).

School teachers present with a high prevalence of MSDs compared to other occupational groups (Cardoso *et al.*, 2009). This has been associated with increased demands in the teaching profession, such as prolonged standing; a head-down posture assumed when marking and planning lessons and writing on the chalkboard; as well as interacting with the learners (Darwish & Al-Zuhair, 2013).

Complications from MSDs among teachers include chronic pain and functional impairment (Abdulmonem *et al.*, 2014), absenteeism (Cardoso *et al.*, 2009), frequent sick leave days taken (El-Sayed Ebied, 2015), poor productivity and early retirement (Maguire & O'Connell, 2007), all of which could have a negative effect on the performance of the learners

(Erick & Smith, 2015). In teachers with MSDs, lower back, shoulder and neck pain are reported to be the most prevalent conditions (Chong & Chan, 2010, Darwish & Al-Zuhair, 2013).

The shoulder joint is a highly mobile joint enabling four articulations, namely glenohumeral, acromio-clavicular, sterno-clavicular and scapula-thoracic articulations (Terry & Chopp, 2000). The stability of the shoulder joint is primarily provided by the surrounding structures (Terry & Chopp, 2000). Due to the complexity of the shoulder joint and the demands placed on it, makes it susceptible to injury (Linaker & Walker-Bone, 2015). Excessive and repetitive activities place the shoulder joint under stress, resulting in injury and dysfunction (Linaker & Walker-Bone, 2015).

While some schools use electronic schools boards as a teaching aid, some schools still make use of chalkboards (Bogaert *et al.*, 2016). Chalk/whiteboard writing, in particular, involves overhead activity that utilises shoulder muscles. Injury to the shoulder joint can affect any of the structures of the shoulder, including bones, muscles, tendons, ligaments, nerves and bursae, all of which can alter the functioning of the shoulder joint (Terry & Chopp, 2000). The over-use involved in writing on the chalk/whiteboard can result in injury to one or more of these structures (Rahman & Warikoo, 2013). The symptoms of such injuries may vary from stiffness, weakness and discomfort, to mild and severe pain (Mitchell *et al.*, 2005). Management of these shoulder MSDs also varies depending on the severity and extent of injury, and includes relative rest, the use of analgesics, exercise rehabilitation and, in some cases, surgery (Mitchell *et al.*, 2005; Brown *et al.*, 2015).

While the prevalence of, and risk factors associated with, MSDs as a whole have been extensively studied among teachers in developed and developing countries, limited research has been conducted pertaining to shoulder MSDs in particular.

PURPOSE OF RESEARCH

The aim of this research is to review and quantify the prevalence of shoulder musculoskeletal disorders among school teachers. It is important to document prevalence to demonstrate the extent of a problem so that solutions can be developed that are of sufficient scale.

METHODOLOGY

Search methods

Several databases were used to review literature on the prevalence of shoulder injuries among school teachers. The databases included PubMed, Science Direct, MEDLINE, EMBASE and Scopus. Further research was reviewed through ResearchGate, Google scholar and bmj.com. The reference lists for the studies found on the databases were further reviewed for additional, relevant literature.

The MeSH terms used were: musculoskeletal diseases, school teachers, prevalence, however, limited articles were presented with these terms with most articles shown being irrelevant to the study since the MeSH terms were too broad. The search strategy further included the keywords musculoskeletal disorders, shoulder injuries, teachers, primary school teachers, prevalence, MSD. The literature search was from the commencement of the electronic databases until September 2019.

Inclusion and exclusion criteria

The study used only peer-reviewed literature. Journal articles included in the study were case studies and empirical research. Only literature published in English was included in the study. Studies combining neck/shoulder injuries were included but analysed separately in this study. Only studies on school teachers were reviewed. Studies that considered the prevalence of upper limb MSDs, but did not specify the prevalence of shoulder MSDs, were excluded. Published dissertations were included in the literature review. A summary on the literature search methodology is provided in the flow diagram in Figure 1.

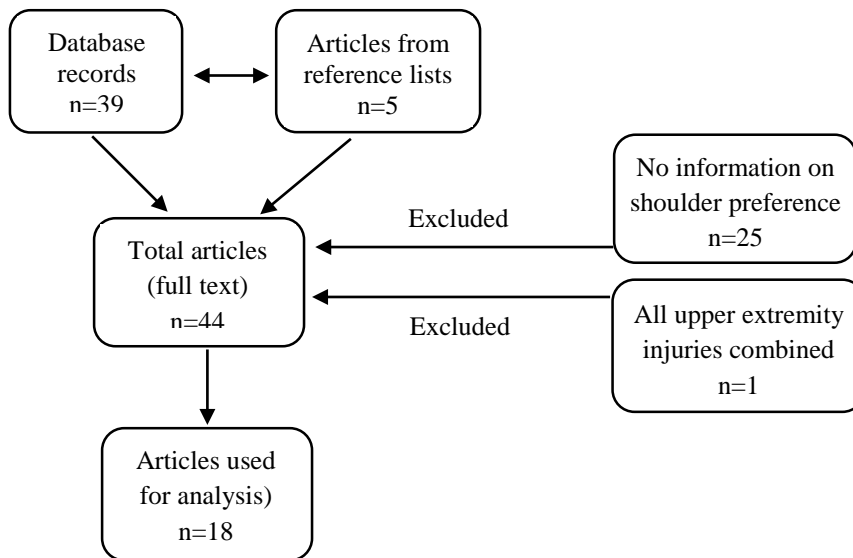


Figure 1. SUMMARY ON THE LITERATURE SEARCH METHODOLOGY

A meta-analysis was conducted to calculate appropriate summary statistic for each of a set of studies and combining these statistics into a weighted range. The Mantel-Haenszel method was used for combining results across studies. The relative risk of the combined studies was calculated using the Mantel-Haenszel summary risk ratio equation (Deeks & Higgins, 2010):

$$RR_{MH} = \frac{\sum W_{MH,i} RR_i}{\sum W_{MH,i}}$$

'RR' represents the risk ratio of the study; 'W' represents the weight of each study's risk ratio and 'i' represents the counter from one to the number of results/papers included in the meta-analysis. The weight of each study's risk ratio was calculated with the equation (Deeks *et al.*, 2008; Deeks & Higgins, 2010):

$$W_{MH,i} = [c_i (a_i + b_i)] / N_i$$

In the above equation: 'a' represents experimental group who experience an event; 'b' represents the experimental who do not experience an event; 'c' represents the control group who experience an event; and 'N' represents the sample size.

RESULTS AND DISCUSSION

A total of 44 articles on musculoskeletal disorders among teachers were identified; 39 on database searches, and a further five in reference lists of identified articles. However, 25 of these articles did not include information on the prevalence of shoulder musculoskeletal disorders (MSDs) and were therefore excluded. One study was excluded because it considered the prevalence of all upper limb MSD, but not shoulder MSD, specifically. In total, 18 articles were found to be relevant and were obtained in full text for analysis.

Prevalence of shoulder musculoskeletal disorders

Studies have reported a prevalence of shoulder MSDs among school teachers. These include primary, secondary, high school, special education, nursery school and music teachers. The results of different studies were reported as either shoulder pain solely or neck and/or shoulder pain, which in this study will be referred to as neck/shoulder pain. Three studies were found in Sweden, two in Saudi Arabia, and one for each in Taiwan, Egypt, Turkey, Hong Kong, Malaysia, Brazil, China, Japan, Botswana and South Africa. Table 1 presents the prevalence of shoulder MSDs among teachers in different countries.

The highest prevalence of shoulder MSD was reported in Hong Kong in a 2010 study, with a prevalence of 73.4% (Chong & Chan, 2010). The study included 1702 participants and assessed the subjective health complaints of primary and secondary school teachers using a questionnaire-administered survey. Shoulder pain was reported among the top ten (6th) complaints, and among the top three musculoskeletal problems. In a more recent study, the prevalence of shoulder MSD among special education teachers was reported to be 63.4% (Cheng *et al.*, 2016). The study was conducted in Taiwan and consisted of 388 participants, who completed a questionnaire on work-related musculoskeletal disorders. The lower back, shoulder and wrist were the three most affected regions.

Among the reviewed articles, the country which reported the lowest prevalence of shoulder MSD was Egypt, with 250 primary school teachers reporting a 15% prevalence (El-Sayed Ebied, 2015). A South African study on the prevalence of neck/shoulder pain reported the highest prevalence of 83.1% (Eggers, 2016). The study was conducted among 97 primary school teachers and used a self-administered questionnaire. A Malaysian study reported a lower prevalence of 60.1% among 1482 secondary school teachers who participated in the study (Zamri *et al.*, 2017). The lowest prevalence of neck/shoulder MSD was reported in Japan among nursery school teachers, with a prevalence of 25% to 35.4% in a study that included 959 participants (Ono *et al.*, 2002).

There is no specific trend over the years in the prevalence of shoulder MSD among teachers as the prevalence fluctuates. However, it is worth noting that more recent studies have reported a higher prevalence compared to older studies (Chong & Chan, 2010; Cheng *et al.*, 2016; Eggers, 2016; Zamri *et al.*, 2017).

The prevalence of shoulder musculoskeletal disorders (MSDs) is reported in various nations. The prevalence of shoulder MSDs ranges between 15% and 73.4%; and up to 83.1% for neck/shoulder MSDs, depending on the location of the study, as well as the sample population used in the study. This suggests that, while shoulder MSDs are under-researched among teachers, they are one of the most common occupational problems for teachers. Variations in the prevalence of shoulder injuries in various countries could be related to different study locations, modes of data collection, sample sizes and exposure to risk factors.

Table 2. PREVALENCE OF SHOULDER AND NECK/SHOULDER INJURIES AMONG TEACHERS IN VARIOUS COUNTRIES

Body site	Prevalence %	Sample size	School Teacher	Study design	Country	Author & Year
SHOULDER	63.4	388	Special Education	Cross-sectional	Taiwan	Cheng <i>et al.</i> , 2016
	38.0	371	Public School	Cross-sectional	Sweden	Arvidsson <i>et al.</i> , 2016
	31.6	525	Elementary & Kindergarten	Cross-sectional	Brazil	De Cellabos & Santos, 2015
	15.0	250	Primary School	Cross-sectional	Egypt	El-Sayed Ebied, 2015
	52.5	1732	Primary, Jr & Sr Secondary	Cross-sectional	Botswana	Erick & Smith, 2014
	20.6	486	Primary, Secondary & High School	Cross-sectional	Saudi Arabia	Abdulmonem <i>et al.</i> , 2014
	45.4	240	Secondary School	Cross-sectional	Saudi Arabia	Darwish & Al-Zuhair, 2013
	28.7	900	Primary, Secondary & High School	Cross-sectional	Turkey	Korkmaz <i>et al.</i> , 2011
	73.4	1702	Primary & Secondary	Cross-sectional	Hong Kong	Chong & Chan, 2010
	28.0	47	Music Teachers	Cross-sectional	Sweden	Edling & Fjellman-Wiklund, 2009
	55.0	208	Music Teachers	Cross-sectional	Sweden	Fjellman-Wiklund <i>et al.</i> , 2003
	21.8	855	Nursery School	Cross-sectional	Japan	Nagira <i>et al.</i> , 1981
	39.0-56.0	36	Music Teachers	Cross-sectional	Sweden	Fjellman-Wiklund & Sundelin, 1998
NECK AND/OR SHOULDER	60.1	1482	Secondary School	Cross-sectional	Malaysia	Zamri <i>et al.</i> , 2017
	83.1	97	Primary School	Cross-sectional	South Africa	Eggers, 2016
	48.7	893	Primary, Secondary & High School	Cross-sectional	China	Yue <i>et al.</i> , 2012
	25.0-35.4	959	Nursery School	Cross-sectional	Japan	Ono <i>et al.</i> , 2002
	33.0	18	Pre-School	Case report	United States	Grant <i>et al.</i> , 1995

Elementary=Primary school

Kindergarten=Pre-primary school

A meta-analysis was further conducted to calculate the prevalence of shoulder MSD across the studies. The average prevalence of shoulder MSD was determined to be 58% (95% CI=0.54-0.62). The associated risk factors were further researched to determine what contributes to shoulder MSD among teachers.

Associated risk factors

Gender

Female teachers have been reported to experience more MSDs than male teachers (Erick & Smith, 2014). Females teachers were 1.69 times more likely to report shoulder MSDs compared to male teachers in Botswana (Erick & Smith, 2014). In Hong Kong, female teachers were more likely to suffer from shoulder pain (75.3% versus 53.5%) compared to males (Chong & Chan, 2010). The higher prevalence of MSDs in female versus male teachers was attributed to nutritional status, age, teaching experience and the school level they are teaching (Erick & Smith, 2014). Yue *et al.* (2012) suggested that women were more likely to suffer from emotional exhaustion and, therefore, had a higher prevalence of MSDs compared to male teachers.

Erick and Smith (2014) found that females were older than their male colleagues, had longer teaching experience, were overweight and that a higher proportion of female teachers taught in primary schools. Additionally, male teachers were more likely to be involved in physical exercise compared to female teachers, which would provide some protection against developing MSDs (Erick & Smith, 2014). Women also had a lower pain threshold compared to men, and therefore reported more pain (Beyen *et al.*, 2013).

Relative risk was calculated from data of previous studies to determine whether females were more likely to develop shoulder MSD than males. The results showed that females are 1.40 likely to develop shoulder MSD than males (95% CI=1.31-1.50). The current study could not determine the cause of increased risk on females. However, previous studies have reported on possible risk factors that could potentially expose females to shoulder MSD compared to males, as mentioned above.

Age

Increasing age has been positively correlated with MSDs, with teachers of 40 years and older experiencing more MSDs than those younger than 40 years (Cardoso *et al.*, 2009). Yue *et al.* (2012) found that the age of teachers with the highest prevalence of neck/shoulder pain was from 40–49 years. Similarly, Korkmaz *et al.* (2011) reported an increase in the prevalence of MSDs with age, with the highest prevalence observed in the age group 40–49 years. The age risk factor has been associated with the natural wear-and-tear of the body with age (Erick & Smith, 2014), as well as less physical fitness and slower psychological response of older teachers compared to younger teachers (Samad *et al.*, 2010). The higher prevalence of MSDs among the older group is also associated with longer time spent teaching (Korkmaz *et al.*, 2011).

Body mass index/weight

Increased body mass index (BMI) and weight are regarded as contributing factors in the development of MSDs. Darwish and Al-Zuhair (2013) reported an increase in pain with an increase in the weight in secondary school teachers. A correlation was found between musculoskeletal pain and obesity, where obesity increases the prevalence of musculoskeletal

pain (El-Sayed Ebied, 2015). However, it is unclear whether increased BMI is directly correlated with shoulder MSD specifically.

Psychosocial factors

Psychological job demands are associated with shoulder pain (Erick & Smith, 2014, Zamri *et al.*, 2017). Teachers who reported high psychological job demands were 1.3 times more likely to experience shoulder pain when compared to teachers reporting low psychological job demands (Erick & Smith, 2014). Some studies have also reported that high perceived stress levels (Mesaria & Jaiswal, 2015), less social support (Ariens *et al.*, 2001), low job satisfaction (El-Sayed Ebied, 2015), high work load (Ono *et al.*, 2002) and depression (Crawford, 2007) are associated with MSDs.

Work-related factors

Work-related MSDs are caused by the work itself or the working environment of the employees (Mesaria & Jaiswal, 2015). The demands of the teaching profession increase the risk of teachers developing MSDs. The length of employment is associated with MSDs (Erick & Smith, 2011). Teachers with more years of experience in the teaching profession have been reported to have a higher prevalence of MSDs, compared to teachers with fewer years of teaching experience (Erick & Smith, 2014).

The prevalence of neck and shoulder pain increased with an increase in length of employment among nursery school teachers in Japan (Ono *et al.*, 2002). Teachers with 14 or more years of teaching experience had a higher prevalence of MSDs in all parts of the body, compared to those with less than 14 years of teaching experience (Cardoso *et al.*, 2009). Teachers who were employed for longer than five years were more likely to develop work-related MSDs, compared to colleagues who had worked for less than five years (Cheng *et al.*, 2016). This could be due to the longer exposure to unhealthy posture and repetitive movement, which cause injuries from over-use over time.

Prolonged periods spent standing during classes, and time spent sitting in a head down position while marking, have also been associated with MSDs among teachers (Yue *et al.*, 2012). The awkward arm posture, which is assumed for prolonged periods during chalk/whiteboard writing, is associated with both neck and shoulder pain (Erick & Smith, 2014). Teachers who reported their work as physically demanding were 1.44 times more likely to develop shoulder pain (Erick & Smith, 2014). Teachers reported that standing for long periods (51.1%), awkward posture (29.0%), school furniture (16.5%) and excessive workload (12%) were all aggravating factors in the development of MSDs (El-Sayed Ebied, 2015). This was based on the teachers' opinion according to what they felt worsened the pain and were not diagnosed/confirmed by the professional. Female teachers reported that the severity of shoulder pain increased with overhead reaching (Korkmaz *et al.*, 2011).

A study was conducted to determine the association between blackboard writing and scapular position and shoulder pain among teachers (Rahman & Warikoo, 2013). School teachers were grouped according to their years of teaching experience (5-10 years, 10-15 years, more than 15 years) and shoulder pain was assessed via a questionnaire. The lateral scapular position was measured using Vernier callipers. The study found a significant change in the scapular position in teachers using a blackboard for more than two hours a day. The presence of pain was associated with scapular alteration, and increased with years of teaching experience (Rahman & Warikoo, 2013).

The lateral scapular position was associated with increased overhead movement during blackboard writing. Lateral scapular position increased excessive protraction and elevation which caused muscle imbalance and a reduction in sub-acromial space, resulting in pain and possible impingement of shoulder structures (Rahman & Warikoo, 2013). Rahman and Warikoo (2013) concluded that rehabilitation is required among school teachers to maintain muscle strength and scapular position, to reduce pain and disability among teachers. The study recommended that there should be intervention on ergonomic correction and work environmental modifications.

Other socio-demographic characteristics of the schools may have an effect on the musculoskeletal disorders (MSD). A study reported that there was a higher prevalence of MSD in teachers in rural schools compared to teachers in urban school (Solis-Soto *et al.*, 2017). The study however was not specific to shoulder MSD, but to any region in the body. However, the major limitation of the study was the lack of inclusion of risk factors to explain the differences between the rural and urban areas. One could speculate that different working conditions and different demands could have an influence on the results. Schools in rural areas tend to be more disadvantaged than schools in urban areas, which could influence the results.

It is worth taking note that the questions asked in the questionnaires in the studies reviewed might influence the results. The reviewed studies used self-administered questionnaires that alone could result in reporting bias by the participants. Different questionnaires were also used in the studies reviewed, which may also affect the consistency of the results. The lack of standardisation of the questionnaires within the reviewed studies may result in irregularity of the data presented in the studies.

CONCLUSION

Musculoskeletal disorders, in particular shoulder MSD, are prevalent among school teachers. The prevalence of shoulder MSD differs in various countries around the world. Associated risk factors are both individual and work-related. This study provides a basis that musculoskeletal problems exist among teachers. Further research, pertaining to shoulder MSD among teachers, would provide more insight regarding the contributing factors, risk factors and management of shoulder MSD among teachers.

Recommendations for practice: Changing positions to reduce prolonged posture and taking breaks in between when writing on the board is recommended to manage shoulder MSD among teachers. Improved job satisfaction, reducing stress levels and increased social support is recommended as these were all associated with the increasing prevalence of shoulder MSD on previous studies.

Recommendations for research: Further research is recommended to extensively study factors associated with shoulder MSD among school teachers. This could include assessing posture, the height of the chalkboards for teachers, biomechanics of writing and ergonomics. Furthermore, research is recommended to determine intervention procedures to prevent and manage shoulder MSD among teachers.

LIMITATIONS

The studies reviewed have used self-administered questionnaires as a method of data collection, either self-developed or adapted. Therefore, subjective self-reporting and recall bias are limitations of the studies. Additionally, self-reporting of shoulder musculoskeletal pain and

disorders by participants might not be accurate, as not all pain experienced in the shoulders could be musculoskeletal. The study would have been more accurate if the musculoskeletal complaints were diagnosed by the healthcare professional rather than self-reported. Selected studies have also used small sample sizes and therefore results cannot be generalised to the whole population.

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