J Orthop Sci (2015) 20:410–417
DOI 10.1007/s00776-014-0682-4

ORIGINAL ARTICLE

Preliminary study of the patterns and physical risk factors of work-related musculoskeletal disorders among academicians in a higher learning institute

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Received: 23 June 2014 / Accepted: 28 November 2014 / Published online: 27 December 2014

Abstract
Background Research has been conducted on the prevalence and physical risk factors of work-related musculoskeletal disorders (WMSDs) among occupations such as agriculture workers, office workers, school teachers, and health care professionals. However, a paucity of research exists on the patterns and physical risk factors of WMSDs among the academicians in a higher learning institution. This study was conducted to determine the patterns and physical risk factors of WMSDs among the academicians.
Methods A cross-sectional study was conducted among 228 subjects with a mean age of participants of 32.3 ± 7.8 for a period of 1 year from December 2011 until December 2012. An extended neordic musculoskeletal questionnaire (NMQ-E) was used to assess the patterns of work-related musculoskeletal disorders. The short version of the Dutch musculoskeletal questionnaire (DMQ) was used to determine the physical risk factors of WMSDs among the academicians. Descriptive statistics and Pearson Chi square test were used for data analysis.
Results The 1-year pattern of WMSDs among the academicians were neck pain (44.7 %), followed by shoulder pain (40.4 %), upper and lower back pain (33.3 %), and the least common region was elbow pain (3.5 %). Among 20 common physical activities in DMQ, 15 physical activities performed by the academicians in their workplace were considered as a physical risk factors for neck, shoulder, and back pain at $p < 0.05$.
Conclusion The preliminary study demonstrated that neck pain, shoulder pain, and back pain were the most common WMSDs among the academicians in a higher learning institution.

Introduction

Work-related musculoskeletal disorders (WMSDs) is defined as injuries or disorders of the musculoskeletal system, which includes muscles, nerves, tendons, joints, cartilages, and spinal discs that may be associated with exposure to risk factors in the workplace [1]. The World Health Organization (WHO) has described that multifactorial risk factors were responsible for WMSDs among workers all over the world [2]. Physical demands that are imposed on the body at the work place such as awkward or fixed posture for a long time, heavy lifting, and repetitive tasks are reported to be the causes or aggravating factors for WMSDs [2]. These factors may lead to disability, which are responsible for poor quality of life, and may predispose workers to a substantial amount of health care costs, and it has been projected that these disabilities by 2020 will predispose workers to serious societal and public health issues [3, 4].

WMSDs are common among agricultural workers, office workers, health care professionals, and school teachers [5–12]. Past studies have revealed the prevalence range for neck pain (69.3 %), neck shoulder pain (48.7 %), low back

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pain (45.6 %), and upper limb pain (35.8 %) among school teachers in Asian countries [9, 10]. Further, a population-based study conducted by Chaiklieng et al. [11] found that a six-month prevalence of musculoskeletal disorders (MSDs) was 73.7 % among Thailand school teachers with a high prevalence of lower back pain, shoulder, upper back pain, neck pain, and arm pain, which ranged between 24 % and 54 %. In Malaysia, the prevalence of lower back pain was at 40.4 % among school teachers in Klang Valley, Selangor [12]. Various researches suggested that repeated activities performed by school teachers in a prolonged sitting posture such as reading, marking of assignments, computer usage, prolonged standing posture such as teaching in class, and repetitive overhead writing on board were the causes of WMSDs [10–13].

In our opinion, the working environment of academicians who are working in higher learning institutions like universities is quite similar to the school teachers and office workers. Data on academic staff throughout Malaysia showed that 64,882 are involved in teaching professions in the higher learning institutions [14]. In addition, the academician populations are on a steady rise due to the commencement of various new universities, university colleges, and colleges to produce highly qualified graduates in line with the vision and mission of the Ministry of Higher Education, Malaysia. Moreover, our patient database showed that academic staff visiting the physiotherapy clinic at Universiti Teknologi Mara (UiTM) for musculoskeletal illnesses has steadily increased in the last few years. Hence, it was hypothesized that academic staff involved in higher learning institutes may be at risk of WMSDs as with other teaching professionals. However, there exists a paucity of research conducted on the patterns of WMSDs and their physical risk factors among the academicians in higher learning institutions as compared to school teachers. Therefore, a study was conducted to determine the patterns of WMSDs and physical risk factors among the academicians.

Methods

This was a cross-sectional study conducted among academicians from December 2011 to December 2012. All the study subjects were recruited across 5 faculties such as Health Sciences, Information Technology, Hotel Management, Business Management, Pharmacy, and the Centre for Foundation Studies from a public university in Malaysia. Among 24 faculties, five faculties were selected as a pilot sample zone and were located in the same campus. Hence, we adapted universal sampling with convenient samples for the pilot study to recruit the samples. The inclusion criteria were the following: all staff who worked as a full-time academician with at least 1 year of teaching experience and those aged between 23 and 60-years-old. Subjects who reported any systematic disorder or any other musculoskeletal injuries such as fracture and soft tissue injuries in any of the regions of the body prior to entering academia were excluded. The researcher visited the subjects' work place to brief them about the whole study process, including objectives of the study, and obtained informed consent from all subjects prior to the collection of data. This study was approved by the Research and Ethics Committee of Universiti Teknologi MARA (UiTM).

Measurement tools

The researcher distributed the Extended Nordic Musculoskeletal Questionnaire and the short version of the Dutch musculoskeletal questionnaires to all subjects of 5 faculties. The data were collected in a subject's respective workplace. It took about 15 min to complete both questionnaires. Prior to the collection of data, a pilot testing of both questionnaires was carried out among 15 subjects from 3 of each of all the five faculties who responded well to the questions, thus, indicating the clarity of the questions.

Extended Nordic Musculoskeletal Questionnaire

The patterns of musculoskeletal symptoms among the subjects were measured using the Extended Nordic Musculoskeletal Questionnaire (NMQ-E). The NMQ-E consists of general questions on the history of having trouble in any of the 9 body regions: neck, upper back, lower back, shoulder, elbow, hand/wrist, hip, knee, and ankle/foot in a 1-year duration. This questionnaire is accompanied by a body map diagram, which facilitated the subjects locating their pain or discomfort sites in their bodies. In addition, questions were also asked regarding the subject's lifetime ("ever"), followed by the prevalence questions, and, lastly, on the items related to consequences of pain in the whole year. The response categories were restricted to "yes" and "no." The NMQ-E has been shown to be reliable for collecting information about the onset, prevalence, and consequences of musculoskeletal pain in the 9 body regions among students [15].

Dutch Musculoskeletal Questionnaire

The physical risk factors associated with the working conditions in the current job were measured by using the shortened version of the Dutch Musculoskeletal Questionnaire (DMQ). The short version of the DMQ consists of the areas of general, health 2, work 1, and work 2 from the standard version of the DMQ. We identified 20 questions according to the job nature of the academicians from the standard version of DMQ and listed the same in work 1 of the shortened

version of DMQ [16]. The scoring was rated under 4 categories: never (1 point), sometimes (2 point), often (3 point), and always (4 point). The maximum score obtained was 80 and least score was 20 in this questionnaire.

Statistics

The data obtained were analyzed using the SPSS 18 version software. Descriptive statistics were used to quantify the prevalence of the WMSDs. Data were analyzed for normality using the Kolmogorov–Smirnov test. Normally distributed data, including the demographic details, were presented as percentages, mean, and standard deviations (SD). The non-normally distributed data were presented as inter-quartile range (IQR), mode, and median. Cross-tabulation that defines the prevalence of pain in each region was carried out and the Chi square test was used to explore the risk factors among the study subjects. The alpha value was set at 0.05 in this study.

Table 1 Demographic characteristics of the subjects

	n (%) Total 228
Age (years)	
21–40	196 (86)
>40	32 (14)
Gender	
Male	76 (33.3)
Female	152 (66.7)
Marital status	
Single	80 (35.1)
Married	148 (64.9)
Education level	
Degree	22 (9.6)
Master	174 (76.3)
PhD	32 (14.0)
Teaching experience (yrs)	
<11	196 (86)
Mean (range) 5.7(31.0)	
>11	32 (14)

Results

A total of 398 questionnaires were distributed directly to the participants and 239 questionnaires were returned. However, 11 respondents were excluded from this study as the questionnaires were not completed as set by the study criteria. As a result, the total number of respondents included in this study was 228 with a higher proportion of females 66.7 % ($n = 152$) than males 33.3 % ($n = 76$). Mean age of the participants was 32.3 ± 7.8 years. The demographic details and teaching experience are summarized in Table 1. The NMQ-E analysis revealed that among the subjects, the annual prevalence of WMSDs were highest in the neck (44.7 %), followed by shoulder (40.4 %), and upper and lower back (33.3 %) than in other regions of the body. Whereas, in contrast, the lifetime prevalence of WMSDs among subjects was found to be highest in the neck (61.4 %), followed by the shoulder (52.6 %), and the upper back (45.6 %) than in other regions of the body. The annual and lifetime prevalence of WMSDs according to the body region are shown in Fig. 1. The distribution of WMSDs prevalence scores for the NMQ-E among academicians who had ache/pain or discomfort on the day of assessment (point prevalence) exhibited 42 % for the neck and upper back, followed by shoulder (36 %), and low back (32 %) regions, respectively.

Table 2 shows the overall prevalence of WMSDs and presentation of prevalence based on age, gender, teaching experience, marital status, and educational level among subjects for 1 year. The overall prevalence of

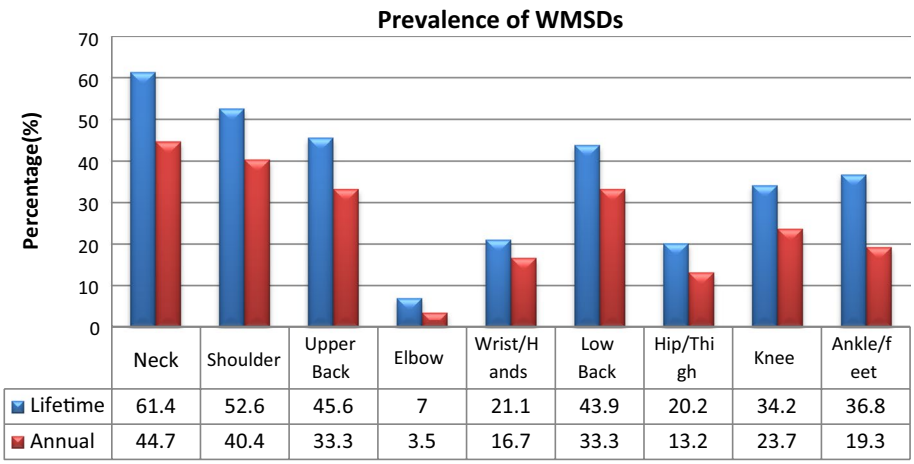

Fig. 1 Prevalence of lifetime and annual WMSD's among academicians

Table 2 Distribution of WMSDs by gender, age, teaching experience, marital status, and educational level

Variables		WMSDs for 1 year		X^2	*p* value*
		Yes *n* (%)	No *n* (%)		
Overall subjects		191 (83.8)	37 (16.2)		
Gender	Male	71 (93.4)	5 (6.6)	6.8	0.009
	Female	120 (78.9)	32 (21.1)		
Age	21–40	162 (82.7)	34 (17.3)	0.7	0.381
	>40	29 (90.6)	3 (9.4)		
Teaching experience	<11	162 (82.7)	34 (17.3)	0.7	0.381
	>11	29 (90.6)	3 (9.4)		
Marital status	Single	66 (28.9)	14 (6.1)	0.03	0.846
	Married	125 (54.8)	23 (10.1)		
Educational level	Degree	12 (5.3)	10 (4.4)	–	0.000
	Master	147 (64.5)	27 (11.8)		
	PhD	32 (14)	0 (0)		

* Significant at $p < 0.05$

pain among the subjects was 83.8 % ($n = 191$). A statistically significant ($p = 0.009$) positive correlation was found between WMSDs and gender. Whereas, no correlation was found between WMSDs, age ($p = 0.381$) and teaching experience ($p = 0.381$). The distribution of points for the physical risk factors associated with working conditions in the current job using DMQ are presented in Table 3.

Chi square analyses of the short version DMQ revealed that the lists of activities, which are presented in Table 4, performed by the subjects were the contributing factors for the neck, shoulder,back,elbows,wrist,hip, knee, and ankle pain ($p < 0.05$). Furthermore, other activities such as standing for long periods ($p = 0.180$), climbing up and downstairs ($p = 0.544$), and slipping or falling during transport of loads ($p = 0.416$) were not statistically significant. These findings suggest that these activities did not contribute to the development of pain in the neck, shoulder, and back pain among subjects.

Discussion

Lifetime and one year prevalence

This study found that the lifetime prevalence rates of WMSDs among academicians were neck pain (61.4 %), shoulder pain (52.6 %), upper back pain (45.6 %), low back pain (43.9 %), ankle pain (36.8 %), knee pain (34.2 %), wrist and hand pain (21.1 %), hip pain (20.2 %), and elbow pain (7 %), respectively. Whereas, the 1-year prevalence rates of WMSDs among academicians were neck pain (44.7 %) followed by shoulder pain (40.4 %), and upper and lower back pain (33.3 %), respectively. These findings were consistent with literature reports conducted among school teachers in other

Table 3 Distribution of scores for the Dutch Musculoskeletal Questionnaire (DMQ)

	Never (%)	Sometimes (%)	Often (%)	Always (%)
Standing for long periods	1 (4)	81 (35.5)	82 (36)	64 (28.1)
Sitting for long periods	–	48 (21.1)	102 (44.7)	78 (34.2)
Long periods of Video Display unit work(i.e., Computer)	22 (9.6)	44 (19.3)	80 (35.1)	82 (36)
Walking for long periods	–	144 (63.2)	60 (26.3)	24 (10.5)
Working with your hands above shoulder height	76 (33.3)	98 (43)	42 (18.4)	12 (5.3)
Working with your hands below knee height	102 (44.7)	98 (43)	28 (12.3)	–
Reaching far	50 (21.9)	144 (63.2)	34 (14.9)	–
Lifting or carrying loads (below 5 kg)	26 (11.4)	98 (43)	56 (24.6)	48 (21.1)
Lifting or carrying loads (over 5 kg)	42 (18.4)	140 (61.4)	32 (14)	14 (6.1)
Pushing or pulling loads (over 5 kg)	50 (21.9)	128 (56.1)	48 (21.1)	2 (0.9)
Slipping or falling during transport of loads	144 (63.2)	64 (28.1)	20 (8.8)	–
Regularly applying force with hands or arms	70 (30.7)	90 (39.5)	56 (24.6)	12 (5.3)
Driving in vehicles	–	44 (19.3)	20 (8.8)	164 (71.9)
Bending and/or twisting with your upper body many times per hour	76 (33.3)	100 (43.9)	30 (13.2)	22 (9.6)
Working in awkward positions	76 (33.3)	100 (43.9)	30 (13.2)	22 (9.6)
Working prolonged periods in the same posture	16 (7)	86 (37.7)	72 (31.6)	54 (23.7)
Repeating the same movement of your arms or hands many times per minute	24 (10.5)	102 (44.7)	62 (27.2)	40 (17.5)
Ascending and descending the stairs	10 (4.4)	102 (44.7)	78 (34.2)	38 (16.7)
Working on head down posture (i.e., correcting the assignment, marking paper)	–	44 (19.3)	84 (36.8)	100 (43.9)
Working with overhead posture (i.e., writing on the board)	10 (4.4)	110 (48.2)	66 (28.9)	42 (18.4)

Table 4 Distribution of WMSDs associated with physical risk factors across the body regions in the last 12 months

Body region	Physical factors	x^2	*p* value
Neck	**Long period of computer usage.**	10.9	**0.012**
	Working with hands above shoulder height	6.9	0.074
	Driving vehicles	1.9	0.376
	Working in awkward posture	5.1	0.165
	Working prolonged periods in the same posture	3.4	0.329
	Working on head down posture (i.e., correcting the assignment, marking paper)	19.7	**0.000**
	Working with overhead posture (i.e., writing on the board)	10.9	**0.012**
Shoulder	Long period of computer usage	5.7	0.160
	Working with hands above shoulder height	15.6	**0.001**
	Working with hand below the knee height	0.6	0.756
	Reaching far	11.4	**0.003**
	Lifting or carrying loads (below 5 kg)	2.8	0.423
	Lifting or carrying loads (over 5 kg)	12.8	**0.005**
	Pushing or pulling over loads (over 5 kg)	8.7	**0.034**
	Slipping or falling during transport of loads	3.4	0.181
	Regularly applying force with force with hand or arms	0.9	0.835
	Driving vehicles	11.4	**0.003**
	Working in awkward posture	6.7	0.82
	Working prolonged period in the same posture	6.7	0.83
	Working on head down posture (i.e., correcting the assignment, marking paper)	28.7	**0.000**
	Working with overhead posture (i.e., writing on the board)	10.7	**0.013**
Upper back	**Long period of computer usage**	9.1	**0.028**
	Reaching far	5.4	0.066
	Lifting or carrying loads (below 5 kg)	2.8	0.419
	Lifting or carrying loads (over 5 kg)	4.8	0.184
	Pushing or pulling over loads (over 5 kg)	4.1	0.256
	Slipping or falling during transport of loads	1.4	0.497
	Driving vehicles	5.7	0.057
	Bending and/or twisting with upper body many times per hour	2.3	0.506
	Working in awkward posture	7.3	0.063
	Working prolonged period in the same posture	7.5	0.057
	Working on head down posture (i.e., correcting the assignment, marking paper)	23.6	**0.000**
Elbows	Sitting for long period	3.6	0.161
	Long period of computer usage	4.3	0.229
	Working with hand above shoulder height	5.7	0.126
	Working with hand below the knee height	1.7	0.559
	Reaching far	1.5	0.483
	Lifting or carrying loads (below 5 kg)	18.4	**0.000**
	Lifting or carrying loads (over 5 kg)	17.7	**0.001**
	Pushing or pulling over loads (over 5 kg)	4.8	0.183
	Regularly applying force with hands or arms	1.9	0.597
	Driving vehicles	0.8	0.645
	Repeating the same movements of arms or hands many times per minute	3.4	0.328
Wrist/hands	Long period of computer usage	0.9	0.810
	Reaching far	0.8	0.669
	Lifting or carrying loads (over 5 kg)	32.3	**0.000**
	Pushing or pulling loads (over 5 kg)	7.9	**0.047**
	Regularly applying force with hands or arms	5.0	0.171

Table 4 continued

Body region	Physical factors	x^2	*p* value
	Working in awkward posture	2.7	0.440
	Repeating the same movements of arms or hands many times per minute	3.6	0.302
Low back	Standing for long period	4.9	0.180
	Sitting for long period	4.3	0.116
	Long period of computer usage	10.2	**0.017**
	Walking for long period	3.4	0.180
	Lifting or carrying loads (below 5 kg)	3.6	0.311
	Lifting or carrying loads (over 5 kg)	1.9	0.583
	Pushing or pulling over loads (over 5 kg)	7.7	**0.053**
	Slipping or falling during transport of loads	1.8	0.416
	Driving vehicles	11.5	**0.003**
	Working in awkward posture	10.4	**0.015**
	Working in prolonged period with the same posture	10.9	**0.012**
	Ascending and descending stairs	2.1	0.544
Hip/thigh	**Standing for long period**	11.1	**0.011**
	Sitting for long period	5.2	0.074
	Long period of computer usage	8.5	**0.037**
	Walking for long period	5.2	0.073
	Lifting or carrying loads (below 5 kg)	2.5	0.473
	Lifting or carrying loads (over 5 kg)	1.3	0.728
	Pushing or pulling over loads (over 5 kg)	3.0	0.377
	Slipping or falling during transport of loads	7.8	**0.020**
	Driving vehicles	3.4	0.187
	Working in awkward posture	22.1	**0.000**
	Working in prolonged period with the same posture	2.0	0.566
	Ascending and descending stairs	4.1	0.249
Knees	Standing for long period	6.3	0.097
	Sitting for long period	0.4	0.812
	Long period of computer usage	1.4	0.704
	Walking for long period	3.7	0.156
	Lifting or carrying loads (below 5 kg)	7.3	0.063
	Lifting or carrying loads (over 5 kg)	3.4	0.330
	Pushing or pulling over loads (over 5 kg)	14.2	**0.003**
	Slipping or falling during transport of loads	12.3	**0.002**
	Driving vehicles	2.4	0.297
	Working in awkward posture	7.7	**0.052**
	Working in prolonged period with the same posture	14.9	**0.002**
	Ascending and descending stairs	14.4	**0.002**
Ankles/feet	Standing for long period	2.0	0.563
	Walking for long period	0.7	0.681
	Slipping or falling during transport of loads	6.2	**0.045**
	Working in awkward posture	11.7	**0.009**
	Working in prolonged period with the same posture	5.6	0.124
	Ascending and descending stairs	8.5	**0.037**

Bold values indicate statistically significant ($p < 0.05$)

countries such as China, Hong Kong, Thailand, and Malaysia [9–12]. Further, based on the short version of DMQ as mentioned in the Table 3, we found that 15 physical activities performed by academicians are the contributing factors for their neck pain, shoulder pain, and back pain.

Individual factors

Two hundred and twenty-eight subjects out of 398 subjects participated and completed both questionnaires. Among them, 191 academicians were found to acquire WMSDs in the past 1 year viz 78.9 % (120 persons) female and 93.4 % (71 persons) male. These findings were contradictory to the literature report conducted among school teachers, in which they stated that female teachers had a higher prevalence of WMSDs than male teachers [9, 11, 13]. It was anticipated that those people who are less than 10 years of experience may predispose to a lesser impact of musculoskeletal disorders as compared to those who had more than 11 years of experience, and this is in line with a review article [17]. However, our results suggested that age and teaching experience of the academicians were not statistically significant to the contribution of WMSDs. These results were also not consistent with reported literature on WMSDs among school teachers reporting that age and teaching experience also influences the WMSDs [10]. Apart from that, in our study the majority of the male academicians were young with less teaching experience when compared to the female academicians. This may be the possible reason for the contradictory results with the available literature among the school teachers [9, 11, 13].

The present study reported that physical risk factors associated with WMSDs among academicians are head down posture, long period of computer usage, overhead posture, working with hands above shoulder height, reaching far, lifting or carrying loads, pushing or pulling overloads, driving vehicles, working with an awkward posture, and working for a prolonged period with the same posture. The pathways associated with this type of changes in the musculoskeletal system towards WMSDs are due to behavior consequences. The behavioral consequences can be due to the task that induced changes, which may cause microtrauma and tissue injury and, in turn, leads to motor dysfunction, mental depression, and chronic WMSDs [18–23]. Tasks performed by academicians are grouped under (1) performance of repeated tasks (2) maintenance of static posture, and (3) carrying a low load during work. The repeated performance of the task by the academicians would have predisposed them to microtrauma and tissue injury of their muscles, ligaments, tendons, nerves, and bones due to mechanical, ischemic, and inflammatory influences. The impact of tissue injury on these structures demonstrates signs and symptoms such as pain, weakness, clumsiness, and fatigability and progressed to a behavior decrement including a decrease in their performance during work [18–23]. These structural and behavioral consequences also incline to psychosocial involution such as stress and anxiety among these populations, and this sort of involution has been noticed among palm plantation workers who are inclined to WMSDs [23]. Anticipating the psychosocial involvement, future studies are to be carried out to learn the level of involvement of the psychosocial factors such as stress and anxiety to improve the quality of life among academicians who are inclined to WMSDs.

This study had a few limitations. The sample size of this study was small in comparison with the previous studies on school teachers, and most of the male academicians were older than the female academicians. As such, we recommend that further study needs to be conducted with a larger sample size among the academicians throughout Malaysia to confirm the findings of this preliminary study, which can provide information regarding the management and strategies to prevent the occurrence of WMSDs among the academicians. This study suggests that, if these physical risk factors are focused while treating musculoskeletal pain of neck, shoulder, and back regions among academicians, we may obtain significant improvement in the outcome of the treatment.

Conclusion

This preliminary study found that shoulder pain and back pain were the common pattern of the occurrence of WMSDs among the academicians who are teaching in a higher learning institution. Nevertheless, the pattern and physical risk factors for neck pain remains at the highest percentage compared to other musculoskeletal pain.

Acknowledgments This study was supported by the Research Management Institute (RMI), Universiti Teknologi MARA (UiTM) Malaysia [600-RMI/DANA 5/3/CIFI (146/2013)].

Conflict of interest The authors declare that they have no conflict of interest.

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