ORIGINAL ARTICLE

WORK-RELATED MUSCULOSKELETAL DISORDER (WRMSD): FINDINGS AMONG EMPLOYEES OF A HEALTHCARE RESEARCH INSTITUTE

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ABSTRACT

Work-related musculoskeletal disorder (WRMSD) is a universal problem that varies across professions. It has been recognized as the most common and difficult occupational health issue by literature. This study aimed to examine the prevalence of self-reported positive WRMSD symptoms and its associated risk factors among healthcare personnel in research institute in Malaysia. All staffs from the major research institute were invited to participate in the study. A pre-validated self-administered Medical History and Symptoms Survey Checklist from Canadian Centre for Occupational Health and Safety was adapted as a study tool. Data was analyzed using SPSS 20.0 employing descriptive analysis and multivariable logistic regression. The response rate was 82% (516/630). Almost half of the respondents reported neck (48.7%), shoulder (54.2%), upper back (42.2%) and lower back pain (47%) which lasted at least two days in the past year. Multivariable logistic regression substantiated prolonged computer use was significantly more likely to cause neck pain (aOR 2.63, 95%CI 1.32-5.63), shoulder pain (aOR 2.87, 95%CI 1.44-5.74), and lower back pain (aOR 2.97, 95%CI 1.14-5.63); while respondents with abnormally high body mass index (BMI) were more likely to report lower limb pain (aOR 0.57, 95%CI 0.36-0.92). Substantial proportion of high risk employees exposed to the workplace ergonomics hazard was identified therefore specific tailored preventive and rehabilitation measures is of paramount importance to ensure the ergonomics wellness among employees.

Keywords: *WRMSDs, Research Institute employees, Medical History and Symptoms Survey Checklist, self-administered*

INTRODUCTION

Occupational related musculoskeletal complaints are common among workers exposed to static task including prolong sitting or standing, task that require repetitive movement as well as those exposed to long hours of computer use (Gerr, Marcus & Monteilh, 2004; Wahlström, 2005). Computer tasks have been widely reported to cause high level of musculoskeletal pain or discomfort (Andersen, Fallentin, Thomsen & Mikkelsen, 2011) typically neck, upper extremities and lumbar spine (Ghanbary & Habibi, 2015; Moom, Sing & Moom, 2015; Wu et al., 2011).

Healthcare research institute consists of medical, science, research and management professionals as well as medical laboratory technicians, nurse and other administrative support staff. The nature of daily tasks performed can be categorized as sedentary and static. Laboratory tasks for both research and diagnostic require workers to maintain inappropriate body postures or movements over period of several or long working hours, which include various task such as specimen processing, results analysis, data entry, validation, interpretation, data analysis and report writing. On the other hand, researchers spend over hundreds of man-hours interacting with the complex dimensions of physical working environment or equipment such as speedy data entry and to complete the manuscript write up utilizing computers, in which the nature of work are strongly related to some WRMSD risk factors (awkward postures, prolong static sitting, repetitive works and non-neutral postures of the upper limbs and spine) (Korhan, 2012; Bolton and Cox, 2015), not forgotten other related tasks such as meetings, discussions, and even office desk work which limits their movement much more. As a result, muscular activity focuses at spine and shoulder stabilizer will be abnormally increased in line with the work duration (Ming, Närhi & Siivola, 2004), even during low workload (Visser & van Dieën, 2006).

The complex physical working environment of the research institute pose ergonomic risk, secondary to the interaction between workers with the work environment or components and tasks present at workstation. Besides contributing to significant musculoskeletal symptoms, these risk factors also play an important role in expediting obesity among employees especially for those with sedentary working hours due to prolong static posture. Obesity has been reported to have causal association with low back pain (Dario et al.,

2015). A meta-analysis study documented that obesity may further increase the mechanical loading and compressive force on the spine, hence increase shear on the spine structures (Shiri et al., 2010).

Early prevention of WRMSD is essential before it progresses into chronic disorder. The preventive measures thus can be implemented through the accurate identification of exposure and risk of workplace ergonomics hazard. The risk assessment associated with development of musculoskeletal complaints can be performed via several approaches: observation, self-reports from workers and also direct measurement (objective assessment). It has been reported that there is a positive association between the subjective measurement (self-report of discomfort) and objective measurement (direct posture measurement) (Kee and Lee, 2012) hence strengthen the value of workplace self-administered survey. The workplace survey is therefore aimed to determine the prevalence and identify associated risk factors with risk of WRMSD.

METHODS

Sampling
The cross-sectional survey was conducted in a healthcare research institute in Malaysia, involving all working groups of researchers and laboratory technicians. The final total sample size obtained was 516 (82% response rate).

Instruments and Measures
All the 630 employees were invited to participate in the survey which employed the self-administered Medical History Checklist for Symptoms Survey for Work-Related Musculoskeletal Disorders (WMSDs), adapted from the ergonomic program for the prevention of WMSDs prepared by the Canadian Centre of Occupational Health and Safety. A symptoms survey has been reported to be helpful to workers experiencing discomfort, pain or disability over musculoskeletal system that may be related to workplace activities (Pransky, Snyder, Dembe & Himmelstein, 1999). The checklist comprises of a few sections: first demographic data including body mass index (BMI), thorough occupational exposure history exploring nature of task, exposure magnitude, tool utilization and body posture at work. Secondly respondents were asked to report on musculoskeletal symptoms (job related pain or discomfort that lasted at least two days, in past one year) according to body sites namely: neck, shoulder, elbow, forearm/wrist, hand, upper back, lower back, knee, ankle and foot. In addition, for each body site where pain or discomfort is experienced, workers would report on perception of work-related symptoms (pain at work/ pain after shift or pain after a week away from work) as well as the perceived effects of symptoms on the wellbeing of work (has the pain interfered with daily work, the life outside work, and sleep in the past year. Workers were also questioned on time off work in the past year due to pain or discomfort. The objective and scope of the survey as well as details of each item in the questionnaire were entirely explained to all respondents before data collection was initiated. All participation was on voluntary basis with consent.

Statistical Analysis
The statistical analysis was performed using SPSS version 20 and results were presented with a 95% confidence interval (CI) and p-values of 0.05 for the statistical significance. Data cleaning was conducted prior to analysis. The socio-demographic attributes and overall prevalence of WRMSD complaints were illustrated by descriptive analyses. The associations between positive WRMSD symptoms with associated risk factors (prolong computer use, prolong static posture, BMI) were determined via multivariable logistic regression (MLR). Respondent's complaint of pain or discomfort over knee, ankle and foot were all categorized as lower limb pain. The MLR was carried out by 'Enter method' to determine the 'real effect' of each independent variable with dependent variable, after controlling for the confounding effects of other independent variables. The x2 test of goodness-of-fit revealed the overall fitness of model.

RESULTS

The present survey achieved a response rate of 82% (516/630). A major proportion of the respondents were female (69%), Malay ethnic (72.1%), and within the productive age group of 25-44 years (62.4%). Besides, majority of the respondents comprises of officers (47.2%) and medical laboratory technicians (36.3%). About two-fifth of the respondents reported abnormally high BMI (41.1%), as shown in Table 1.

Table 1: Respondents' demographic profile

Variables	Overall	
	n	%
Gender		
Male	170	33.0
Female	356	69.0
Ethnic		
Malay	372	72.1
Others	144	27.9
Age group (years)		
Less than 25	77	14.9
25-44	322	62.4
More than 45	117	22.7
Educational level		
Secondary	85	16.5
Tertiary	431	83.5
Job Title		
Officers (medical, science, research)	244	47.2
Medical Laboratory Technicians	187	36.3

Others (attendant, administrative)	85	16.5
Body Mass Index (BMI)		
23 kg/m2 and below	304	58.9
>23 kg/m2 (overweight and obese)	212	41.1

Approximately three-quarter (75.8%) of the respondents reported positive musculoskeletal symptoms at one body site or more, which lasted at least two days in the past one year. Among those with at least one symptom, one-third (30.9) admitted symptoms at only one body site, while about half (51.7%) documented symptoms at two to three body sites and one-fifth (17.4%) reported pain or discomfort at four body sites or more. The most commonly reported body parts with symptoms were shoulder (56.2%), neck (48.7%), lower back (47%) and upper back (42.2%). On the other hand, the most frequently reported symptomatic body parts perceived due to the work activity, when arranged in descending order were: upper back (81%), shoulder (78%), lower back (77%), neck (64%), lower limbs (42-51%) and hand (35%). Part of those symptoms had affected the overall wellbeing of workers at work. More than three-quarter (77%) of the respondents complained of at least one positive WRMSD symptoms and claimed that the suffering experienced had posed negative impact on their occupational wellness As shown in Table 2.

Table 2: Positive musculoskeletal symptoms at different body sites

Variables	Overall	
	n	%
Pain or Discomfort		
Neck	250	48.7
Shoulder	279	54.2
Elbow	38	7.5
Wrist	154	30.1
Hand	131	25.6
Upper back	216	42.2
Lower back	240	47
Knee	142	27.7
Ankle	89	17.6
Foot	149	29.1
Positive WRMSD complaint of at least one site	391	75.8
Symptoms at one body site	121	30.9
Symptoms at 2-3 body sites	202	51.7
Symptoms at 4 body sites and above	68	17.4
Body parts with symptoms Perceived due to work activity		
Neck	160	64
Shoulder	217	78
Elbow	3	8.2
Wrist	34	22
Hand	46	35
Upper back	175	81
Lower back	185	77
Knee	72	51
Ankle	43	49
Foot	65	42
Symptoms affecting wellbeing at work		
Yes	301	77
No	90	23

Multivariable logistic regression further substantiated that workers exposed to long duration computer works of more than four hours a day were significantly more likely to develop neck pain (aOR 2.63, 95%CI 1.32-5.32), shoulder pain (aOR 2.87, 95%CI 1.44-5.74), upper back pain (aOR 2.97, 95%CI 1.14-5.63) and lower back pain (aOR 2.87, 95%CI 1.44-5.74). Similarly, prolong static posture either long hours standing or sitting were reported more likely to cause neck pain (aOR 2.22, 95%CI 1.21-3.95), shoulder pain (aOR 2.42, 95%CI 1.04-4.28), upper back pain (aOR 2.12, 95%CI 1.22-3.98), lower back pain (aOR 2.54, 95%CI 1.23-4.07), and even lower limb pain (aOR 0.62, 95%CI 0.21-0.89). In addition, elderly age group (aOR 0.43, 95%CI 0.22-0.84) as well as those obese or overweight (aOR 0.57, 95%CI 0.36-0.92) were also more likely to develop pain or discomfort at lower limbs (knee, ankle and foot) as presented in Table 3.

Table 3: Risk factors associated with WRMSD

Variables	Likelihood of developing pain or discomfort		
	aOR	95 CI	p value
Neck Pain			
Computer use > 4 hours per day	2.63	1.32-5.32	0.026
Computer use 1-4 hours per day	2.04	1.10-3.78	
Computer use < 1 hour or none	Ref		
Prolonged static posture	2.22	1.21-3.95	<0.001
Shoulder Pain			
Computer use > 4 hours per day	2.87	1.44-5.74	<0.014
Computer use 1-4 hours per day	2.25	1.22-4.16	
Computer use < 1 hour or none	Ref		
Prolonged static posture	2.42	1.04-4.28	<0.001
Upper Back Pain			
Computer use > 4 hours per day	2.97	1.14-5.63	<0.001
Computer use 1-4 hours per day	2.25	1.21-4.25	
Computer use < 1 hour or none	Ref		
Prolonged static posture	2.12	1.22-3.98	<0.001
Lower Back Pain			
Computer use > 4 hours per day	2.97	1.14-5.63	<0.001
Computer use 1-4 hours per day	2.25	1.21-4.25	
Computer use < 1 hour or none	Ref		
Prolonged static posture	2.54	1.23-4.07	<0.001
Lower Limb Pain			
Age less than 25 years	Ref		
Age 25-44 years	0.28	0.18-0.91	0.022
Age more than 45 years	0.43	0.22-0.84	
BMI normal	Ref		
BMI abnormally high	0.57	0.36-0.92	0.018
Prolonged standing	0.62	0.21-0.89	0.015

DISCUSSION

Approximately three quarter (75.8%) of the respondents had at least one symptom. This finding was in consistent with a local study conducted among employees in a shared service Centre in Kuala Lumpur where 74.4% of the respondents complaint at least one positive musculoskeletal symptoms at the most common body part namely the shoulder, neck and lower back (prevalence at each body part ranging from 42-59%) (Jefferelli et al., 2016). Our study revealed almost half (42%-54%) of the workers in a healthcare research institute where laboratory and office work is their core task, reported musculoskeletal symptoms involving neck, shoulder, upper and lower back for at least two consecutive days in past a year. In addition, the findings was in congruent with studies in Australia (Ariëns et al., 2001), Lithuania (Kaliniene et al., 2016), New Zealand (James et al., 2018) and Estonia (Oha et al., 2014) while examining WRMSD among office computer users over a period of 12 months, documented prevalence of WRMSD in the (please check) neck, upper back, lower back and upper extremities at the range of 20%-68%. In addition, it has been proposed that investigation of prevalence over a 12 months period reflects a more realistic WRMSD outcome. A one-year prevalence of neck, shoulder pain and low back pain among university office workers was also reported in Thailand similar to figures in our study: 42%, 63% (Chaiklieng, Suggaravetsir & Muktabhant, 2010) and 83%, respectively (Chaiklieng, Suggaravetsiri & Stewart, 2014).

Extended hours of computer use and inappropriate posture or negative work-related attitudes were significantly increased the likelihood of WRMSD. Hedge and Ruder (2003) reported computer use of more than four hours per day significantly exposing workers to high ergonomic risk. Rahman and Atiya (2009) also disclosed an increased risk of WRMSD by 7.5 times among workers exposed to computer works more than five hours a day. The severity of pain positively associated with a more static muscle load and postural disturbances with prolonged computer usage time. The present study documented that 64%-81% among the staff who reported positive musculoskeletal symptoms perceived pain experience at neck, shoulder and back were occupational related, in line with study carried out in Australia which reported the perceived work-related pain at 60%-70% (Ariëns et al., 2001). Shoulder and neck pain arising from non-neutral posture especially during shoulder abduction (the mouse not placed in alignment with shoulder) and flexion (Wahlström, 2005). Therefore, a constant and intensive mouse use over a long period more than four hours typically increased WRMSD (Cook, Burgess-Limerick and Chang,2000) as the continuous use results in constant large muscle recruitment particularly the trapezius muscle at neck and shoulder region which can later lead to more severe WRMSD (Szeto, Straker and O'Sullivan2005). Introducing frequent active break is hence essential and helpful in muscle relaxation. Moreover, it was concluded from 20 epidemiological studies that sustained posture at shoulder with more than 60 degree of abduction or flexion highly associated with shoulder symptoms (Bruce, 1996). Workers who spend their working days in a working environment that promotes awkward postures together with inappropriate muscle movements may be a risky factor to the development of WRMSD. Correct working posture is another element in promoting workplace ergonomics wellness. The sitting postures adopted by computer workers throughout the day, while interacting with other components (keyboard, mouse) in the workstation may significantly cause muscle tension especially at the neck and shoulder segments. In addition, the static posture is maintained during laboratory or computer work easily overload and injure the neck and upper extremities, leading to muscle tension, fatigue, weakness and shortening of soft tissue structure which may in later stage cause pain or discomfort (Ming, Närhi and Siivola, 2004). On the other hand, prolong sitting has been documented to precipitate in low back pain via inter-discal pressure increase as well as the intervertebral disc degradation (Lotz, Fields and Liebenberg, 2013). Hakala et al. (2006) also reported the risk of developing low back pain following prolonged computer related activities that, in comparison to non-computer users, the risk of low back pain was 2.0 times higher when using computers above 5 hours per day. While for the upper back symptoms, James et al. (2018) concluded those office workers who sat upright without back support or those who sat in kyphotic posture sloping forward were more prone to upper back ergonomics problem compared to workers who sit in appropriate posture. As a result, these WRMSD can be improved via posture regulating as well as the optimization of ergonomics intervention in laboratory and office environment as the important preventive measure.

It has been documented in our survey that elderly age group of more than 45 years were more likely to develop musculoskeletal symptoms compared to lower limbs (knee, ankle or foot), compared to their counterparts. This finding was supported by King, Huddleston and Darragh, 2009). The elderly population are more prone to musculoskeletal disorders due to aging and degeneration of the entire musculoskeletal system, including loss of bone density, thinning of cartilage and connective tissue within joint, weakening of ligament and tendon, loss of muscle mass as well muscle strength (Loeser, 2010). These vulnerable factors, while matched with workstation's risk factor especially prolonged standing during certain laboratory

procedure, will exacerbate the development of WRMSD among the elderly workers. Moreover, workers with abnormally high BMI (obese or overweight) were also reported more likely to experience lower limb pain. Prolong sedentary or static tasks may also precipitate obesity (Hu, 2003). The health risks associated with being overweight and obese are well publicized. Obesity may raise odds for painful leg condition as excess weight may result in osteoarthritis over knee (Heidari, 2011), muscle or tendon flare-ups and even plantar fasciitis (Irving et al., 2007), which causes pain in the soles of the feet. When obesity is combined with prolonged static posture at work especially standing, this will increase musculoskeletal disorders in lower extremity due to excessive and high magnitude loading (Aspden, 2011). On the other hand, individual factors such as gender, ethnicity, educational level and job title were found not to have any significant association with WRMSD.

The WRMSD will progress into chronic disorder and disability if the affected workers are not identified and provided with early rehabilitation (Nastasia, Coutu and Tcaciuc, 2014). As high as 36.3% of the sufferers reported recurrent episodes within three years after they experienced the first manifestation of occupational musculoskeletal symptoms. When it progresses into the chronic phase, both costs (compensation, sickness absenteeism) and disability (impact on Fitness to Work and psychosocial stress following WRMSD) will increase even more significantly (Nunes and Bush, 2012). As for the present study, two-thirds of the sufferers reported that their wellbeing at workplace were affected. The relationship between musculoskeletal pain and disability, particularly computer use induced disability exists. Daily computer usage was significantly associated with the severity of pain in those body regions that mainly cause disability by restricting ADLs (Harcombe et al., 2009).

Based on the findings of the current study, there is an urgent need to introduce a comprehensive ergonomic program. In fact, the principle of safety management systems emphasizes on reducing the risk of occupational injuries, illnesses and fatalities. Therefore, as the idea postulated by Deming (1982) "Manage the cause, not the results", one must control or prevent the underlying causes of musculoskeletal diseases in order to improve workplace ergonomics. This principle when applied in our context, the overall institutional ergonomic wellness should be enhanced via provision of adequate resources, scheduled work activity as well as awareness on appropriate working postures and behaviors. The early preventive measures are of paramount importance. Good ergonomics practices should be incorporated into the OSHMS system at the planning phase itself.

Work related musculoskeletal pain is normally self- limiting. Levanon et al. (2012) reported that 70% of the cases will heal spontaneously within four weeks, while 95% will recover within six months. Nonetheless, the recurrence rate of the episodic WRMSD pain is significant. 36.3% of the sufferers reported recurrent episodes within three years after they experienced the first manifestation (Koehoorn et al., 2006; Zain et al.,2018). When it progresses into the chronicphase, both costs and disability will even increase more significantly. In addition, the mode of treatment is often aimed for symptoms relief. Hence, prevention program is most important in order to raise awareness among employees on the ergonomic friendly postures, detection of early warning signs and symptoms; and also the importance of short breaks with stretching exercises in between work activity. The adoption of an occupational gym program is another option which focuses on exercises to relax the muscle groups especially the neck, shoulder and back as well as to decrease fatigue; subsequently minimizing musculoskeletal pain with increased employees' flexibility. The establishment of an Ergonomics committee in the research institute can be considered which will be responsible to incorporate formal and documented ergonomics policies as well as implementation of the ergonomics program as part of the organizational safety and health policies and program (Yazdani, 2015).

Early rehabilitation program will be another helpful measure for those who diagnosed with WRMSD which holds the objective to prevent disability. A multidisciplinary rehabilitation program should employ occupational program which comprises of physical fitness, and also the psychological or cognitive-behavioral approach. The objective of this post-incidence management program is to target an earlier, safer and stable return to work opportunity for the staff. It is ideal to combine both ergonomics (improving the workplace) and clinical interventions (improving the functional capacities of workers) such as the Sherbrooke model which is a comprehensive model for musculoskeletal pain management, combined with clinical rehabilitation and occupational interventions (Loisel et al., 2002). Loisel and colleagues (2002) had demonstrated the proven efficacy by returning workers to regular work 2.4 times quicker compared to subjects in that standard care method, by utilizing the Sherbrooke model. This model is also shown to be the most cost beneficial tool as it proposes an early investment through appropriate interventions for the prevention of disability, thus reducing compensation cost.

CONCLUSION

The preliminary workplace survey had detected a significant proportion of workers involved in laboratory and research tasks with positive

WRMSD complaint, and most of them presented with pain or discomfort at two or more body sites. A huge proportion of symptomatic workers perceived that the pain occurred has influenced their wellbeing at work. Therefore, a practical, adequate and cost-effective prevention and control strategies through incorporation of new policies and programs as well as ergonomic committee are required in order to minimize work related ergonomics risk factors. The strategic and comprehensive ergonomic wellness program should be implemented throughout the organization to identify and address WRMSD in daily operations, incorporate workers' awareness on ergonomics risk, periodic active surveillance of WRMSD for early detection, early preventive training program at each work station, improvement in the working behavior as well as early rehabilitation for those suffering from WRMSD in order to prevent chronic disability.

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COMPETING INTERESTS

The authors declare that they have no competing interests.

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