

ORIGINAL ARTICLE

Association between prevalence of work-related musculoskeletal disorders and work-related ergonomic factors of special education teachers in Kota Bharu, Kelantan

Nur Atikah Mohamad Adnan , Mohd Suleiman Murad

Centre of Occupational Therapy Studies, Faculty of Health Sciences, Universiti Teknologi MARA (UiTM), Kampus Puncak Alam, 42300 Bandar Puncak Alam, Selangor, Malaysia

Abstract:

Work-related musculoskeletal disorders (WMSDs) have become increasingly common among health-related professionals, including special education personnel who serve students with disabilities; however, WMSDs have been overlooked in this population. This study was conducted to investigate the association between the prevalence of WMSDs and work-related ergonomic factors among special education teachers in Kota Bharu, Kelantan. WMSDs questionnaires with three domains were used in this cross-sectional study involving 103 special education teachers. Result: Approximately 72% of the 103 special education teachers experienced musculoskeletal disorders. The lower back, shoulder and neck were the three most affected regions. Results revealed that assisting in diaper changing ($p=0.011$) and toileting ($p=0.007$), having no teaching partners ($p=0.046$), no nap habit ($p=0.001$) and duration of working experience >5 years ($p=0.001$), were strongly associated with the prevalence of WMSD. The present study revealed an association between WMSDs and work-related ergonomic factors among special education teachers. Future efforts should emphasize on measure to reduce high prevalence of WMSDs among this group, in order to improve their health status and avoid harmful impact on their personal and working productivity.

Keywords: Ergonomics, special education, work-related musculoskeletal disorders,

*Corresponding Author

Mohd Suleiman Murad, PhD
Sulaiman450@Uitm.edu.my

1. INTRODUCTION

Work-related musculoskeletal disorder (WMSDs) has been used to indicate musculoskeletal disorders that caused by occupational exposures [1]. WMSDs are commonly characterized by musculoskeletal symptoms of pain, stiffness, paraesthesia, swelling, weakness, redness, numbness and tingling. The commonly affected body regions in WMSDs are low back, shoulder, neck, hand, and forearm [2][5].

Musculoskeletal disorders (MSDs) negatively impact individual well-being, having consequences on all aspects in personal and working life [3]. Among the various populations vulnerable to MSDs, teachers have been concurrently identified as one of the working populations at very high risk of developing MSDs, by virtue of the physical and mental stress inherent in their occupation [7]. A study conducted by Cheng, Wong, Yu and Ju [2] stated that the prevalence rate among special education teachers in Taiwan who have WMSDs symptoms was approximately 85.8%.

In the teaching profession, besides from regular teaching, teachers in special education schools are involved in nursing care for students with physical and mental disabilities which some of them mostly unable to be independent in control and adapt themselves with the daily need. Thus, the teachers are required for frequently carrying and lifting students, assisting them in positioning, transferring students from one place to another, changing the diapers, feeding, pulling and pushing and prolonged standing [2][5][12]. Therefore, the special education teachers have been found to be at high risk of getting WMSDs. According to Cheng et al. [2], they found that, in Taiwan, there are 85.8% of prevalence rate among special education teachers reported WMSDs symptoms and the most frequent task performed were assisting in toileting, grooming, changing diaper, feeding, transferring, rehabilitating and getting in and out from the vehicle.

To date, there is inadequate research regarding the association between WMSDs and work-related ergonomic factors in special education teacher's population in Kota

Bharu area of Kelantan. Therefore, there is a need to identify the association between work-related ergonomic factors and WMSDs in this population, in order to develop prevention strategies and health promotion interventions to control the emergence of MSDs in this population

2. MATERIALS AND METHOD

2.1 Instrumentation

A WMSD questionnaire was used consisting of the basis of the job specifics of special education teachers [2]. It included three domains personal and institutional data, information regarding present WMSDs, and work-related ergonomic factors. The first domain was about obtaining personal information (sex, age, marital status, child-bearing history, body mass index [BMI], and academic major), work-related information (years of experience in special school, work days per week, work hours per day, break between lessons, nap habit, exercise habit, type of special school service provided, age range of student served, diagnosis of students, teaching partners in the same class, supportive device usage while working, and feeling of stress), and information regarding past WMSDs (injury history, injury regions, duration since onset, treatment history, and relapse situation). The second domain captured information on WMSDs, including musculoskeletal injury prevalence based on the injury regions, severity, duration since onset, duration of symptoms, frequency of prevalence, causing sick leaves, considering a job change, affecting work performance, and participation in related continuing education courses. The design of this domain was in accordance with the Standardized Nordic Musculoskeletal Questionnaire. The term “musculoskeletal disorders” here refers to work-related injuries that have occurred at any time during teachers’ work hours, lasted one or more days, and affected daily activities in the last 6 months. The investigation covered nine body regions: neck, shoulder, upper back, elbow, hand and wrist, lower back, thigh, knee, and ankle and foot. The pain resulting from the symptoms ranged from 0 (no pain) to 4 (unbearable pain). Participants responding with scores ≥ 1 were considered as experiencing WMSDs. The third domain involved information regarding work-related ergonomic factors (assistance in diaper changing, feeding, toileting, grooming, transferring, rehabilitation, and transporting) and the body regions with symptoms. Moreover, information on the requirement of improvements in the current job, namely work environment modifications, knowledge regarding the use of personal protective equipment, postural education, work-time adjustment, and muscle strengthening was collected.

2.2 Sample and procedure

The study surveyed special education teachers working in special education schools for at least half a year. Those who had musculoskeletal injuries within the preceding six months caused by sources other than the workplace were excluded. Data from the Ministry of Education Malaysia indicated that there were 133 special education teachers in primary schools while in secondary schools, there were 98 special education teachers. Seventeen schools with Program

Pendidikan Khas Integrasi were selected through purposive sampling, and 145 teachers were surveyed.

The survey was conducted during break time to avoid disturbing the school routine. The questionnaires were included with cover page explaining the purposes and procedure of the study. The participants who were agreed to participate provided their signatures as informed consents. Three parts of the questionnaires were answered by the participants. The questionnaires were left and were collected two weeks after.

2.3 Data processing and analysis

All the data obtained were analysed using Statistical Package for Social Science (SPSS) version 25. The data was entered into the SPSS and data cleaning was ran. After that, normality testing was conducted by using Shapiro-Wilk to determine either parametric or non-parametric statistical testing will be used to analyse the data. The socio-demographic data and prevalence of WMSDs among special education teachers in Kota Bharu were documented using descriptive statistic. The frequency and percentage of the information were presented and tabulated in the table. Pearson Chi-Square and Fisher’s exact tests were used to identify the association between the work-related ergonomic factors with WMSDs. Both independent and dependent variable significance level were set at $p < 0.05$.

3. RESULTS

3.1 Descriptive statistics of demographic characteristics

As shown in Table 1, a total of the 13 primary and secondary schools with Program Pendidikan Khas Integrasi (PPKI) that were visited, there were 150 questionnaires distributed, and 103 questionnaires were completed and returned after two weeks. A response rate of 68.7% was thus achieved. There were 52.4% of the participants from secondary school, while 47.6% from primary schools. Women represented most of the population studied (69.9%); 46.6% were 31 to 40 years old, and 96.1% of the participants were married. More than fifty per cent of female participants had history of child bearing ($n = 56$; 54.4%) and 86.4% of them have degree in education. Besides, majority of the students diagnosed with multiple disabilities ($n = 88$; 21.7%), followed with Down’s syndrome ($n = 76$; 18.8%), ADHD/ADD ($n = 69$; 17.0%), autism ($n = 68$; 16.8%), intellectual disabilities ($n = 53$; 13.1%) and physical disabilities ($n = 51$; 12.6%).

Table 1: Frequency of participants' demographic data (n = 103).

Socio-Demographic Data	Total, n (%)
Type of school	
Primary	49 (47.6)
Secondary	54 (52.4)
Gender	
Male	31 (30.1)
Female	72 (69.9)
Age (years old)	
31 – 40	48 (46.6)
41 – 50	44 (42.7)
> 50	11 (10.7)
Marital status	
Single	3 (2.9)
Married	99 (96.1)
Divorce	1 (1.0)
History of child bearing (female only)	
Yes	56 (54.4)
No	16 (15.5)
Education level	
Diploma	5 (4.8)
Degree	89 (86.4)
Master	9 (8.7)
Diagnosis of students in the class being taught	
Physical disabilities	51 (12.6)
Down's syndrome	76 (18.8)
ADHD / ADD	69 (17.0)
Multiple disabilities	88 (21.7)
Autism	68 (16.8)
Intellectual disabilities	53 (13.1)

3.2 Socio-demographic characteristic of special education teachers in Kota Bharu with WMSDs among gender.

As shown in Table 1, a total of 74 special education teachers from Kota Bharu area was present with WMSDs (71.8%), 51 (49.5%) females and 23 males (22.3%). As many as 35 special education teachers in primary school (47.3%) was present with WMSDs, 26 females (35.1%) and 9 males (12.2%), while in secondary school, there were 39 teachers with WMSDs (52.7%), 25 females (33.8%) and 14 males (18.9%). 48.6% of the participants (n = 36) were in the age group 31 to 40 years, while the majority (n = 71; 95.9%) of the participants were married. More than half (n = 66; 89.2%) of the participants had degree in teaching. Similarly, majority (n = 59; 79.7%) of the participants had teaching experience in special education of more than five years.

3.3 Characteristics of work environment of the special education teachers in with WMSDs .

This study also assessed the work environment of the participant in term of hours of administrative and student-related tasks, days of working in a week, breacktimes between classes, nap habit during recess time, number of students in class and present of partner in teaching.

The result in Table 3 shows that nearly half of the participants have less than 20 hours in administrative work in a week (47.3%), while 35.1% and 33.8% of the

participants spent less than 20 hours per week (n = 26) and 20 to 30 hours per week (n = 25) in student-related task

Other than that, the result shows that the majority of the teachers (n = 62; 83.8%) working five days in a week, and 66 of them had breacktime between classes in a day (89.2%). With regards to nap habit during recess time, almost 99 per cent (n = 73; 98.6%) of teachers did not have nap habit in working time. Furthermore, more than half (n = 48; 64.9%) of the teachers have more than 21 students in their class while 14.9% (n = 11) teaching less than 12 students, 14.9% (n = 11) have 16 to 20 students in class and 5.4% have 13 to 15 students in a class respectively. In addition, 27.0% of teachers (n = 20) had teaching partner in class while 73.0% did not have teaching partners (n = 54). Moreover, 39 of the p who did not exercise and have WMSDs were 35 participants (47.3%).articipants who exercise have WMSDs (52.7%) while those

Table 2: Prevalence of WMSDs in socio-demographic characteristic among gender

Variable	Total population n (%)	Present WMSDs with	
		Female n (%)	Male n (%)
Gender	74 (71.8)	51 (49.5)	23 (22.3)
Type of school			
Primary	35 (47.3)	26 (35.1)	9 (12.2)
Secondary	39 (52.7)	25 (33.8)	14 (18.9)
Age			
31-40	36 (48.6)	26 (35.1)	10 (13.5)
41-50	31 (41.9)	20 (27.0)	11 (14.9)
>50	7 (9.5)	5 (6.8)	2 (2.7)
Marital Status			
Single	2 (2.7)	1 (1.4)	1 (1.4)
Married	71 (95.9)	49 (66.2)	22 (29.7)
Divorce	1 (1.4)	1 (1.4)	0 (0.0)
Level of Education			
Diploma	3 (4.1)	3 (4.1)	0 (0.0)
Degree	66 (89.2)	46 (62.2)	20 (27.0)
Masters	5 (6.8)	2 (2.7)	3 (4.1)
Working experience in Special Education			
6 – 12 mths	9 (12.2)	8 (10.9)	1 (1.4)
1 – 3 years	3 (4.1)	2 (2.7)	1 (1.4)
3 – 5 years	3 (4.1)	2 (2.7)	1 (1.4)
> 5 years	59 (79.7)	39 (52.7)	20 (27.0)

3.4 The distribution of WMSDs prevalence in different anatomical regions.

Results of the regional WMSDs occurrence, as indicated in Figure 1 below, shows that the three regions that were most affected by WMSDs are lower back (n=32; 43%), neck (n = 22; 30%) and shoulder (n = 18; 24%). Severe and

moderate pain at lower back region were the most felt by the respondents (n = 22; 29.7%) where almost fifty of them experienced the pain at every day (n = 34; 45.9%). In addition, severe pain was experienced the highest in percentage by the respondents at neck every day while for the shoulder region, they experienced moderate pain the highest every day. The results of frequency occurrence and severity of pain were tabulated in Table 3.4.

Table 3: Prevalence of WMSDs in work-environment characteristic among gender

Characteristics	Total population n (%)	Present WMSDs	
		Female n (%)	Male n (%)
Hours of administrative work (hours/week)			
<20	35 (47.3)	27 (36.5)	8 (10.8)
20-30	16 (21.6)	10 (13.5)	6 (8.1)
30-40	17 (23.0)	9 (12.2)	8 (10.8)
40-50	6 (8.1)	5 (6.8)	1 (1.4)
Hours of student related task (hours/week)			
<20	26 (35.1)	21 (28.4)	5 (6.8)
20-30	25 (33.8)	17 (23.0)	8 (10.8)
30-40	16 (21.6)	8 (10.8)	8 (10.8)
40-50	7 (9.5)	5 (6.8)	2 (2.7)
Days of working in a week (days)			
<5	3 (4.1)	3 (4.1)	0 (0.0)
5	62 (83.8)	44 (59.5)	18 (24.3)
>5	9 (12.2)	4 (5.4)	5 (6.8)
Have breaktime between classes			
Yes	66 (89.2)	43 (58.1)	23 (31.1)
No	8 (10.8)	8 (10.8)	0 (0.0)
Have nap habit during rest in school			
Yes	1 (1.4)	0 (0.0)	1 (1.4)
No	73 (98.6)	51 (68.9)	22 (29.7)
Number of students in a class (students)			
<12	11 (14.9)	7 (9.5)	4 (5.4)
13 – 15	4 (5.4)	2 (2.7)	2 (2.7)
16 – 20	11 (14.9)	7 (9.5)	4 (5.4)
> 21	48 (64.9)	35 (47.3)	13 (17.6)
Have partner in teaching			
Yes	20 (27.0)	10 (13.5)	10 (13.5)
No	54 (73.0)	41 (55.4)	13 (17.6)
Perform daily exercises			
Yes	39 (52.7)	21 (28.4)	18 (24.3)
No	35 (47.3)	30 (40.5)	5 (6.8)

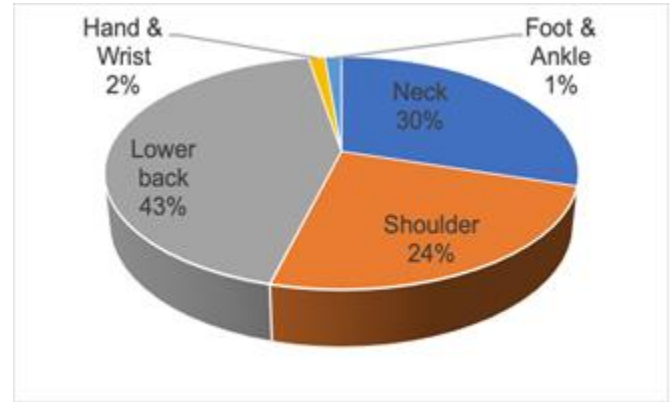


Figure 1 Regional WMSDs Occurrence

3.5 Association between work-related ergonomic factors and WMSDs according to type of school.

More than fifty per cent of the special education teachers from primary schools experienced WMSDs by performing the tasks included assistance in toileting (n = 31; 63.3%) while there were 49.0% of the participants who involved for assistance in transferring and diaper changing have WMSDs. The chi-square and fisher’s exact tests indicate that there is significant relationship between assisting in diaper changing and toileting with the presence of WMSDs in special education teachers in primary schools, (p = 0.011) and (p = 0.007) respectively. Meanwhile, number of the students more than 21 people in a class showed p-value <0.001 for both primary (n = 22; 44.9%) and secondary schools (n = 26; 48.1%), implying that those who took care of students more than 21 were more likely to experience WMSDs. By contrast, the participants who without nap habit during recess time produced p<0.001 where there were 69.4% of primary school special education teachers and 72.2% of secondary school special education teachers, indicating that those who did not nap habit were associate with having WMSDs. Those who had no teaching partners in the same class also produced p-value <0.001, where in primary school (n = 30; 61.2%) and secondary school (n = 24; 44.4%), implying that there is an association of having no teaching partners in the same class with the presence of WMSDs.

In work-related ergonomic factors for both type of schools (assistance in feeding, grooming, transferring, rehabilitation, transporting and years of working in special education), the results demonstrated p-value > 0.05, implying that there is no significant relationship between all those stated work-related ergonomic factors with presence of WMSDs among special education teachers in Kota Bharu. The summary of the chi-square and fisher’s exact results is presented in Table 4

Table 4: Association between work-related ergonomic factors and WMSDs according to type of school

Work-related Ergonomic Factors		Primary Schools		Secondary Schools	
		n (%)	P-value	n (%)	p-value
Diaper changing	Yes	24 (49.0)	0.011	6 (11.1)	0.659 ^a
	No	11 (22.4)		33 (61.1)	
Toileting	Yes	31 (63.3)	0.007^a	10 (18.5)	0.153 ^a
	No	4 (8.2)		29 (53.7)	
Nap habit	Yes	1 (2.0)	<0.001^a	0 (0.0)	<0.001^a
	No	34 (69.4)		39 (72.2)	
Teaching partners	Yes	32 (65.3)	0.548 ^a	29 (53.7)	0.046^a
	No	3 (6.1)		10 (18.5)	
Number of students	< 21	13 (26.5)	<0.001	13 (24.1)	<0.001
	> 21	22 (44.9)		26 (48.1)	

Note: Chi-square test used unless otherwise noted. ^aFisher's exact test used. Bold value indicated significant value

4. DISCUSSION

4.1 Factors associated with WMSDs prevalence

Special education teachers in primary and secondary schools in Kota Bharu are not spared from WMSDs. The current study found a high prevalence of 71.8% for WMSDs among special education teachers in Kota Bharu, Kelantan, in that moreover the females were more affected. It is important to note that the study population could significantly contribute to the varied prevalence rate of WMSDs amongst the teaching population. The daily activities and work environment of school with PPKI in Kota Bharu for instance differs vastly to that of mainstream primary and secondary schools. In addition, teachers working with students with physical and mental challenges [13] are also more exposed to demanding and tiring activities at work, and therefore the high prevalence rates of 76.7% and 86% are understandable when compared to the lower rates of 48.0% amongst Malaysian secondary school teachers [14].

4.2 WMSDs and gender

The current study had a sample of 103 special education teachers in primary and secondary schools with PPKI working in Kota Bharu city, Kelantan, of which 69.9% were females. This higher tendency of females in the current study is not unexpected as most of the school teachers globally are female.

Although the data shows that, female teachers were mostly suffered WMSDs, it cannot be decided that the majority of the special education teachers experiencing WMSDs in the Malaysian setting, are female. The sample of the current

study was only representative of one district of Kelantan where the data was collected. The current study could not suggest that gender could be a contributing factor to WMSDs as there is no significant association was found for gender and presence of WMSDs.

However, the fact of majority of the respondents who were having WMSDs were female might be caused of double working shift between school and household chores [10]. Furthermore, those who were involved with household chores, they have children and child care will be automatically presents itself as a duty performed by the teachers, especially female teachers. There several factors could decrease women's health, for example physical work overload and greater psychological, lack of time for leisure, as well as insufficient in rest and sleep hours [10]. Other studies have also linked the demands of household duties and work to poor physical and mental health as the respondents produced little life satisfaction and high levels of stress [14].

4.3 Factors related to regional WMSDs

In this current study, the most affected regions were lower back, neck and shoulder where the frequency of the pain occurred the highest was every day between ranges of pain moderate to severe pain. This is similar with the results reported in the study conducted by Cheng et al. [2], Muto et al.[2] and Vedovato and Monteiro [10] , which involved special education teachers.

Anatomically, the upper quadrant of human body was consisted of shoulder, upper back, neck, hand and wrist. In upper extremity involving activities like assisting in carrying to go to the toilet or diaper changing tasks, all these body parts in upper quadrant worked together for better performance [2]. During these activities, the back will act as a stabilizer, whereas the primary movers which were the neck, shoulder, hand and wrist will work together. Considering these biomechanical links with repetitive stress and work overload will impact their bodies and can result in work-related injury [2]. Furthermore, prolonged working nature like bending the neck and lower back forward might have caused this significant percentage of special education teachers to complain neck and lower back pain. This is due to long hours of stooping while attending the students, recurrent twisting and bending of neck and waist and postural overloads in the classroom [8]. Overwork may also accumulate the effects of performance on musculoskeletal systems and make the development of disorders more rapid [9].

4.4 Association between work-related ergonomic factors and WMSDs.

Teaching in special education is physically and mentally demanding. Special education teachers occupy a large portion of their working hours at school in tasks involving postures and movements daily compared to regular school teachers, therefore these will stress on their bodies and prone to develop WMSDs [1]. Furthermore, the highest number of diagnosis of the students in the current study were multiple disabilities (n = 88; 85.4%), which needed the care most from the teachers, thus the workload of the teachers

will be increased, while reducing the rest period [12].

Cheng et al. (2013) indicated that teaching partners can help special education teacher in sharing the workloads they had to manage the students with disabilities, therefore the possibility of acquiring WMSDs can be reduced. Findings of the study by Vieira et al. (2016) specified that a high biomechanical demand such as manual handling, heavy lifting, and/or repetitive motions were a few of the factors that caused WMSDs in their study participants. It is realistic to predict that the participants who had high number of students, no helpers and no nap time during working hours, have more physical demands than regular teachers, consequently decreasing the time for their bodies to recover from any pain. Therefore, these factors were related to a significant association with presence of WMSDs.

Moreover, participants who involved daily in additional students' caregiving duties like assisting in diaper changing and toileting were more likely to associate with the presence of WMSDs. Generally, the students diagnosed with multiple disabilities were in need of more assistance in the classroom, thus all the duties performed may affect their bodies substantially, especially the musculoskeletal systems. This study is consistent with the findings of studies conducted by Cheng et al. (2016) and Yamamoto et al. (2003), however for other work-related ergonomic factors such as assistance in feeding, grooming, transferring, rehabilitation and getting in and out from the vehicle, the result showed that there were no significant association with the presence of WMSDs. Keating and O'Connor (2012) indicated that teacher's assistants or aides were mostly covers in two areas at schools which are classroom duties and within classroom and outside school infrastructure. Their job duties may include physically assisting students with duties regarding eating, using the bathroom and moving from one class to another. Hence, the presence of teacher's aides was helpful and can minimize the risks of having WMSDs among the special education teachers.

In this study, a high number of participants with WMSDs had more than five years of working experience. Based on research by Cheng et al. (2016), it is stated that teachers who worked for more than five years were more prone to have WMSDs compared to the other colleagues who worked less than five years period. Their research included with qualitative feedback from the participants, where it was reported that experienced teachers were normally assigned to handle difficult students and cases. Thus, due to daily caregiving duties, it would cause them to develop microtrauma which accumulated over time^{2,8}. The severity of WMSDs was intensified when there were work overload and persisting, repetitive stress occurred.

5 CONCLUSION

The results of the current study demonstrated a high prevalence (71.8%) of WMSDs among special education teachers. Assisting in diaper changing and toileting were significantly related to presence of WMSDs for primary school teachers ($p=0.011$) and ($p=0.007$) respectively. With regard of having no nap habit and high number of students, there were significant association with the presence of WMSDs in both type of schools where all were $p<0.001$. In

addition to secondary school, having no teaching partners in the same class was associated with presence of WMSDs ($p=0.046$). With regard to the most affected anatomical region, lower back, shoulder and neck were the most prominent in moderate and severe pain that occurred almost every day among the participants who present with WMSDs.

There are a few limitations to the present study. First, it was a cross-sectional study; therefore, it may consistently describe patterns of association, but it is a poor indication of causation. Small sample size also cannot represent all population of special education teachers. The presented data in this study was based on self-reported data and may be subject to sources of errors. There were more than 30% ($n = 47$) out of 150 the participants (did not return their questionnaires; only 103 participants returned the survey. Thus, the results of that quantity were not reflected in this study.

There were some recommendations based on the findings obtained from this study. Larger sample size should be used to represent all population of special education teachers and stronger association between WMSDs and work-related ergonomic factors. Further recommendation is to emphasize the analysis regarding the specifics of teachers' job features, for example type of work the teachers did besides assisting tasks for students. Lastly, measures to reduce high prevalence of WMSDs among special education teachers in school should be implemented to improve their health status and avoid harmful impact on their personal and working productivity

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