

Factors Influencing Work-Related Musculoskeletal Disorders in Public Primary Care Services

M.S.A. Rahim, S.M. Yasin, L.S. Suddin

Faculty of Medicine, Universiti Teknologi MARA, Malaysia msyahir.1510@gmail.com, smunira@uitm.edu.my,
leny@uiitm.edu.my

FACTORS INFLUENCING WORK-RELATED MUSCULOSKELETAL DISORDERS IN PUBLIC PRIMARY CARE SERVICES

Abstract: Despite the increasing trend in the prevalence of Work-Related Musculoskeletal Disorders in Malaysia, it is essential to remember that they are preventable. This study aimed to determine the prevalence of WMSDs among healthcare workers and its associated factors in public primary care services in East Malaysia. A cross-sectional study using an online validated questionnaire was conducted among primary care healthcare workers at the study site. Logistic regression analysis was used to assess the factors associated with WMSDs. In total, 170 primary care healthcare workers participated in this study. The prevalence of WMSDs was 79.4%. The factors found to be significantly associated with WMSDs were tertiary education level (Adj. OR: 2.92 [95%CI:1.078 – 7.940]), poor safety culture (Adj. OR: 4.031 [95%CI:1.358 – 11.969]), twisting body position (Adj. OR: 12.754 [95%CI:1.396 – 116.528]), lack of safety training (Adj. OR: 4.545 [95%CI:1.683 – 12.276]), ex-smokers (Adj. OR: 0.108 [95%CI:0.025 – 0.47]) and smoker (Adj. OR: 0.062 [95%CI:0.009 – 0.431]). The prevalence of WMSDs in this study aligns with previous research and provides valuable insights into the health of healthcare workers. These findings underscore the need for control and prevention strategies to reduce the prevalence of WMSDs. Notably, this study identifies safety culture as a significant factor in WMSDs, emphasizing the importance of safety training to foster a positive safety culture and prevent WMSDs. WMSDs.

Keywords: Factors; Primary Care; Work-Related Musculoskeletal Disorders; Services

Introduction

Work-related musculoskeletal disorders (WMSDs) are disorders or discomfort sustained by workers in the musculoskeletal, peripheral nerve, and neurovascular systems due to prolonged exposure to workplace hazards (Bernard, 1997). WMSDs are also known to include Repetitive Motion Injuries (RMI), Cumulative Trauma Disorder (CTD), and Repetitive Strain Injuries (RSI). It is a non-communicable, non-infectious, and non-transmissible chronic disease resulting from multiple physiological, environmental, and behavioural factors. Most WMSDs are cumulative disorders caused by repeated exposure to high-intensity or low-intensity loads over a long period. These disorders mainly affect the back, neck, shoulders, upper limbs, and lower limbs, with common symptoms including back pain, arthritis, and carpal tunnel syndrome.

In Malaysia, the number of WMSD cases reported to the Department of Occupational Safety and Health (DOSH) and compensated by the Social Security Organization (SOC SO) shows an increasing trend every year (2020). Health workers including medical officer, assistant medical officer, trained nurse, community nurse, pharmacist, assistant pharmacist, physiotherapist, occupational therapist, nutritionist, radiographer, laboratory technician, healthcare assistant, and drivers are engaged in promoting, protecting, or improving population health (2006). WMSDs among healthcare workers are a primary concern worldwide, with a prevalence of 33.0%–88.0% (Soylar and Ozer, 2018). Local studies have shown that the prevalence of WMSDs among healthcare workers is 69–80%. However, WMSDs among healthcare workers in Malaysia are underreported, with only one case reported among public servants in 2019 (2020). WMSDs affect individuals, employers, and society (Piedrahita, 2006). Approximately 20-25% of expenditures on medical care, sick leave, and sickness pensions are related to musculoskeletal conditions, of which 20-80% are work-related (Hansen and Jensen, 1993). Nursing personnel with musculoskeletal problems of the neck, shoulders, or knees are more likely to leave nursing care (Fochsen *et al.*, 2006). A minimum of 80% of nurses with WMSDs in Malaysia miss work due to this problem, with absenteeism prevalence ranging from 6.2% to 18% (Amin *et al.*, 2016). In terms of primary care healthcare workers, primary care refers to the delivery of comprehensive, accessible medical services by doctors and their teams. They address most individual healthcare needs, form long-lasting relationships with patients, and work within the patient's family and community context. Care at this level is person-centred, team-based, community-aligned, and aims to achieve better health, better care, and lower costs. In Malaysia, public healthcare facilities providing primary care

services include health clinics, maternal and child health clinics, community clinics, and rural mobile clinics. These facilities offer outpatient, emergency, maternal, childcare, rehabilitation, radio imaging, medical laboratory, pharmacy, and dental services (Malaysia, 2019). WMSDs are preventable; it is crucial to study their associated factors. While several studies have discussed the prevalence of WMSDs among healthcare workers in Malaysia, more knowledge is needed regarding public primary care services. While WMSD prevalence among Malaysian healthcare workers has been explored, unique organizational and environmental determinants in public primary care are understudied. Investigating these factors is essential for tailoring interventions to this setting. Specifically, studies on WMSDs among healthcare workers other than nurses in Malaysian public primary care services are limited, indicating a need for further research. Thus, this study aimed to determine the prevalence and factors associated with WMSDs among healthcare workers in one of the districts of East Malaysia's public primary care facilities.

Methodology

Study Design

This is a cross-sectional study. The study location included all public primary care healthcare facilities in Tawau district of Sabah, Malaysia. A total of 16 healthcare facilities, which comprised of 9 health clinics, one maternal child health clinic, one mobile clinic, and five rural clinics, were included as study sites. This study was conducted between November 2020 and July 2021.

Study Population

The target population consisted of all healthcare workers in public primary care healthcare facilities in Malaysia. The study population was all healthcare workers in one district of Sabah which is the Tawau district. The district was chosen due to logistic reason for the conduct of the research by the research team. The sampling frame consisted of healthcare workers working in all 16 public primary care facilities with 350 workers in total. Study respondents were selected if they fulfilled the eligibility criteria. The inclusion criteria were; working as a healthcare worker in public primary care health facilities; working experience of at least one year in public primary care services, aged between 19 and 60 years, and literate in Malay or English; with the job title of either medical officer, assistant medical officer, trained nurse, community nurse, pharmacist, assistant pharmacist, physiotherapist, occupational therapist, nutritionist, radiographer, laboratory technician, healthcare assistant, and driver. Meanwhile, the exclusion criteria were those with a history of musculoskeletal disorders before the study; pregnant or at the post-menopausal stage during data collection; declined to participate in the research and staff on extended leave such as maternity or study leave.

Study Size and Sampling Method

The sample size was calculated using OpenEpi sample size software. With an estimated population size of 350, anticipated frequency of 73% prevalence of WMSDs (Amin *et al.*, 2016), absolute precision of 5%, design effect of 1.0, and confidence level of 95%, the minimum sample size required was 163. Accounting for a 20% attrition rate, the sample size required for sampling was 204.

Convenience sampling was used to sample the respondents from the public primary care facilities in close collaboration with administrative staff in human resources section at the selected District Health Office (DHO). The research team started with obtaining the permission from the District Health Director of the DHO to retrieve information on healthcare workers from the Administrative and Human Resource Office of the DHO. After that, the team then contacted each 16 public primary care facilities' administrative office to inform about the study and to distribute the link to the online questionnaire to all the healthcare workers in each of the facilities.

Study Variables

Dependent Variable: WMSD was the dependent variable. The results were divided into two categories; those who had WMSDs and those who did not.

Independent Variables: Our study encompassed a wide range of factors, including sociodemographic, biomechanical, work-related, psychosocial, and safety culture factors.

Study Instruments

This study used self-administered online questionnaires comprising five sections.

Section 1: Sociodemographic and Work-Related Characteristics

- The information collected in this section included age, gender, ethnicity, marital status, educational status, type of job, monthly household income, weight, height, smoking status, number of cigarettes per day, number of years of working experience in primary care, physical exercise category, type of working hours, number of days absent from work due to WMSDs symptoms in the past year, and whether they had previously received safety training at the workplace. Questionnaires were available in both Malay and English.

Section 2: Work-related Musculoskeletal Disorders (WMSDs)

- Data on WMSDs were collected using a validated Standardized Nordic Musculoskeletal Questionnaire (SNMQ) initially developed by Kuorinka *et al.* (Kuorinka *et al.*, 1987). The Malay-translated questionnaire was validated (Amin *et al.*, 2016), with Kappa agreement indicating a good reliability level available in both Malay and English versions. An anatomical diagram of nine body regions (neck, shoulder, upper and lower back, hands/wrists, arms, knee, thighs, and feet) was attached to the questionnaires to facilitate precise identification of the presence of musculoskeletal symptoms for the lifetime, preceding 12 months and last seven days.

Section 3: Physical Activity at Workplace

- The third section of the questionnaire collected data on biomechanical factors using the validated Physical Activity questionnaire developed by Rahmah *et al.* (Rahmah *et al.*, 2008). It consisted of 11 items with yes/no answers. There was one question for each risky physical activity of WMSDs in the workplace (continual repetition of movement, work that required a lot of physical strength, moving or lifting a heavy load, bending body position, body twisting, neck extension, neck flexion, neck twisting, work that required a lot of walking, prolonged standing, and prolonged sitting). Every 'yes' answer indicates presence of the particular risky physical activity and translated into variable of biomechanical factors. The questionnaire was available in both Malay and English.

Section 4: Psychosocial Factors

- The fourth section of the questionnaire was used to collect data on psychosocial factors, based on the Copenhagen Psychosocial Questionnaire. This questionnaire was developed to explore psychosocial factors in the workplace. It was first developed by Kristensen *et al.* (Kristensen *et al.*, 2005). It consists of four domains with 14 items using a 5-point scale. The Malay-translated questionnaire was validated by Chin *et al.* (Chin *et al.*, 2018) with a good level of reliability, and Cronbach's alpha values ranged from 0.83 to 0.87. The questionnaire used in this study was available in Malay and English languages.

Section 5: Safety Culture

• The last section of the questionnaire was on workplace safety culture, using the Safety Attitude Questionnaire. The Safety Attitude Questionnaire (SAQ) has been adapted and validated in a Malaysian setting and was used to explore safety culture in the workplace. The Malay version has been validated in the Malaysian healthcare setting in the past (Hamid *et al.*, 2016), with good construct validity and internal consistency. The SAQ comprises 36 items assessing six safety culture domains: teamwork climate (items 1–6), safety climate (items 7–13), job satisfaction (items 15–19), stress recognition (items 20–23), perceptions of management (items 24–28), and working conditions (items 29–32). Items 14 and 33–36 are not among the scales mentioned above. All items were closed-ended questions, and respondents were required to indicate their agreement level on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Before the analysis, three negatively worded items (Items 2, 11, and 36) in the SAQ were reversed. Each item's score was calculated by converting the 5-point Likert scale into a 100-point scale: 1=0, 2=25, 3=50, 4=75, and 5=100. Each item's score was summed and divided by the number of items available to obtain a score of 0–100. If the respondent's overall mean score was >75, they will be categorized into good safety culture. (Ismail & Khalid, 2022)

Data Collection Technique

Online questionnaires were distributed among the study respondents in Google Forms via representatives from each public primary care facility involved in the study. Only the researcher had access to the email that received the answers sent by the respondents for the online questionnaires.

Results

Respondents' Characteristics

A total of 170 respondents completed the online survey giving the response rate of 49%. Most healthcare workers were young adults of native Sabah/Sarawak ethnicity and female. The majority of respondents were nurses, with more than half of the respondents being trained nurses or community nurses. The majority of patients were non-smokers. The characteristics of healthcare workers in the selected districts' public primary care facilities are shown in Table 1.

Table 1: Characteristics of the Respondents (N=170)

Variables	% (n)	Mean (SD)
Age (years old)		35.4 (7.3)
Gender		
Male	25.9 (44)	
Female	74.1 (126)	
Ethnicity		
Malay	37.1 (63)	
Chinese	4.7 (8)	
Indian	2.3 (4)	
Sabah & Sarawak Native	55.9 (95)	
Marital Status		
Single	21.2 (36)	
Widow / widower	3.5 (6)	
Married	75.3 (128)	
Educational Status		
Secondary education	22.4 (38)	
Tertiary education	77.6 (132)	
Job		

Community nurse	24.7 (42)	
Trained nurse	26.5 (45)	
Assistant medical officer	16.5 (28)	
Pharmacy staff	14.1 (24)	
Medical officer	8.8 (15)	
Others	9.4 (16)	
Monthly household income (RM)		5175.09 (3309.29)
BMI (kg/m ²)		25.1 (4.9)
Smoking status		
Non-smoker	87.7 (149)	
Ex-smoker	8.2 (14)	
Current smoker	4.1 (7)	
Number of cigarette/days (N=7)		10 (5)
Years of working experience in primary care		8.9±7.3
Physical exercise		
Regularly more than 150 min/week	7.0 (12)	
Regularly less than 150 min/week	26.5 (45)	
No regular physical exercise	66.5 (113)	
Have chronic disease		
No	90.6 (154)	
Yes	9.4 (16)	
Diabetes		
No	96.5 (164)	
Yes	3.5 (6)	
Hypertension		
No	92.4 (157)	
Yes	7.6 (13)	
Family history of chronic musculoskeletal disorder		
No	78.2 (133)	
Yes	21.8 (37)	

Based on Table 2, most respondents had WMSDs, and the most predominant site was the lower back.

Table 2: Prevalence of WMSDs and Prevalence by Anatomical Site (N=170)

Variables	%(n)
WMSDs	
No	20.6 (35)
Yes	79.4 (135)
Neck	
No	70.6 (120)
Yes	29.4 (50)
Shoulder	
No	64.1 (109)
Yes	35.9 (61)
Elbow	

No	97.1 (165)
Yes	2.9 (5)
Wrist	
No	77.6 (132)
Yes	22.4 (38)
Upper back	
No	69.4 (118)
Yes	30.6 (52)
Lower back	
No	50.6 (86)
Yes	49.4 (84)
Hip	
No	90.6 (154)
Yes	9.4 (16)
Knee	
No	77.6 (132)
Yes	22.4 (38)
Ankle	
No	81.2 (138)
Yes	18.8 (32)

Table 3 shows the distribution of respondents' biomechanical factors, psychosocial factors, and safety culture. The most risky physical activities at the workplace were prolonged sitting and walking. Most respondents experienced burnout, stress, and poor job demands, both quantitatively and emotionally. The majority of the respondents had a good safety culture in the workplace.

Table 3: Distribution of Biomechanical Factors, Psychosocial Factors and Safety Culture (N=170)

Variables	%(n)
Continual repetition of movement	
No	66.5 (113)
Yes	33.5 (57)
Required a lot of physical strength	
No	77.1 (131)
Yes	22.9 (39)
Move or lift heavy load	
No	78.2 (133)
Yes	21.8 (37)
Bending body position	
No	74.7 (127)
Yes	25.3 (43)
Body twisting	
No	78.2 (133)
Yes	21.8 (37)
Neck extension	
No	88.2 (150)
Yes	11.8 (20)
Neck flexion	
No	74.1 (126)
Yes	25.9 (44)
Neck twisting	
No	88.8 (151)

Yes	11.2 (19)
A lot of walking	
No	53.5 (91)
Yes	46.5 (79)
Prolonged standing	
No	75.3 (128)
Yes	24.7 (42)
Prolonged sitting	
No	32.9 (56)
Yes	67.1 (114)
Quantitative job demand	
Good	37.6 (64)
Poor	62.4 (106)
Emotional job demand	
Good	34.1 (58)
Poor	65.9 (112)
Burnout	
No	22.9 (39)
Yes	77.1 (131)
Stress	
No	31.8 (54)
Yes	68.2 (116)
Safety culture	
Good (Score ≥ 75)	54.7 (93)
Poor (Score < 75)	45.3 (77)

Factors and Predictors of WMSDs

Simple logistic regression analysis showed that 14 factors were significantly associated with WMSDs: age, sex, educational status, type of job, years of work experience in primary care, weight, smoking, family history of chronic musculoskeletal disorder, safety training, bending body position, body twisting, prolonged sitting, stress, and safety culture. All 14 variables were included in multiple logistic regression analysis. From the multiple logistic regression results, only five factors were significant and included in the final predictor model for WMSDs. These factors are level of education, body twisting, safety culture, safety training, and smoking status. From the multiple logistic regression results shown in Table 4, we may infer that those who have a tertiary level of education have 2.9 times the odds of developing WMSDs compared to those who only have a secondary level of education, those who have never received any safety training at the workplace had 4.5 the odds of developing WMSDs compared to those who have received safety training at the workplace, those who have a twisting body position during working had 12.8 times odds of developing WMSDs compared to those who had no twisting body position during working, and those who had a poor safety culture had 4.0 times odds of developing WMSDs compared to those who had a good safety culture. On the other hand, ex-smokers and current smokers were noted to have protective benefits from getting WMSDs compared to non-smokers, in which ex-smokers only had 0.1 times the odds of developing WMSDs. In contrast, current smokers had 0.1-time odds of developing WMSDs compared with non-smokers.

Table 4: Simple and Multiple Logistic Regression Analysis of Associated Factors with WMSD

Variables	Crude OR (95%CI)	Adjusted OR (95%CI)
Age	0.947 (0.9 – 0.996)	0.991 (0.923 – 1.064)
Gender		
Male	1	1
Female	2.333 (1.060 – 5.134)	1.394 (0.21 – 9.262)
Educational status		
Secondary education	1	1
Tertiary education	3.083 (1.375 – 6.913)	2.926 (1.078 – 7.940) *
Job		
Community nurse	1	1
Trained nurse	7.778 (2.056 – 29.424)	2.060 (0.18 – 23.54)
Asst medical officer	1.173 (0.462 – 3.232)	3.266 (0.178 – 60.091)
Pharmacy staff (pharmacist, assistant pharmacist)	6.111 (1.26 – 29.644)	3.076 (0.19 – 49.709)
Medical officer	7.778 (0.929 – 65.101)	0.767 (0.027 – 21.536)
Others (Lab technician, health care assistant, physiotherapist, radiographers, nutritionist, driver)	1.222 (0.357 – 4.187)	1.102 (0.097 – 12.555)
Years of working experience in primary care	0.946 (0.9 – 0.995)	1.035 (0.929 – 1.154)
Weight	0.976 (0.954 – 0.998)	0.996 (0.87 – 1.14)
BMI		0.913 (0.832 – 1.001)
Smoking status		
Non-smoker	1	1
Ex-smoker	0.363 (0.112 – 1.175)	0.108 (0.025 – 0.47) *
Current smoker	0.081 (0.015 – 0.439)	0.062 (0.009 – 0.431) *
Family history of chronic musculoskeletal disorder		
No	1	1
Yes	3.591 (1.033 – 12.478)	2.407 (0.572 – 10.133)
Safety training at workplace		
Yes	1	1
No	4.019 (1.845 – 8.758)	4.545 (1.683 – 12.276)
Bending body position		
No	1	1
Yes	4.491 (1.3 – 15.516)	3.448 (0.753 – 15.794)
Body twisting		
No	1	1
Yes	12.364 (1.632 – 93.653)	12.754 (1.396 – 116.528)
Prolonged sitting		

No	1	1
Yes	3.145 (1.464 – 6.759)	1.318 (0.432 – 4.016)
Stress		
No	1	1
Yes	2.150 (1.002 – 4.613)	1.87 (0.611 – 5.723)
Safety culture		
Good	1	1
Poor	5.362 (2.091 – 13.75)	4.031 (1.358 – 11.969)

The model is fit. No interaction between the five variables. No multicollinearity. The variance inflation factors were all less than 10. From the result of the Cox and Snell R², it can be concluded that 26.5% variance of WMSDs is associated with the model. The result of the Hosmer and Lemeshow test, p-value was 0.745, indicate that the data set fits well to the model. The sensitivity of the model is 93.3%, with 51.4% specificity and overall prediction rate of 84.7%. Based on the result of the area under the receiver operating characteristics curve (AUROC), the models discriminate 85.5% (95% CI: 78.7 – 92.3) of the predicted of having WSMDs. *p value of <0.05.

Discussion

The prevalence of WMSDs among healthcare workers in this study was almost the similar to another previous study on WMSDs among healthcare workers (Amin *et al.*, 2016). The study respondents generally had average health profiles, mostly non-smokers but slightly overweight and lacking physical exercise. Only a small proportion of patients had chronic diseases, such as diabetes and hypertension. The biomechanical factor found in this study was prolonged sitting, most likely due to the nature of their work, which mainly involved treating patients in outpatient settings that required them to sit long. This explains why WMSD symptoms mostly occurred at the lower back of the respondents' bodies. Most respondents needed better psychosocial factors, most probably because the study was conducted during the pandemic, so they were probably overwhelmed with a lot of work, which affected their psychosocial well-being.

The twisting body position, which is also part of uncomfortable body posture, and lack of safety training in the workplace were the significant factors associated with WMSDs in the study, which corresponded with the results of previous studies result (Yi *et al.*, 2022, Yang *et al.*, 2020, Chinedu *et al.*, 2020). The workplace's twisting body position among healthcare workers probably occurred because of poor ergonomic practices or workstation design. Ideally, workplace assessment should be performed on the study population to further explore this significant factor. In this study, a poor safety culture was significantly associated with WMSDs. This finding corresponds to that of a previous study on WMSDs. However, this factor has not been widely explored among healthcare workers. Therefore, the significant finding found in this study may be a good starting point for future research to explore this factor further among healthcare workers in different settings.

Tertiary level of education was also found to be a significant factor in a previous study. However, the authors did not include multiple logistic regression analysis factors for unknown reasons (Farhaduzzaman S.M., 2018). The protective effect of smoking against WMSDs found in this study also did not correspond to previous studies that found that smokers were more prone to WMSDs. However, a small proportion of the study population consisted of smokers or ex-smokers. Therefore, this most probably resulted in bias during the data analysis compared to another study on WMSDs, with a higher proportion of smokers who found smoking to be significantly associated with WMSDs (Sedilla, 2018). Age was not a significant risk factor in this study due to the lack of older respondents. A previous study found that those aged 55 years or older were more susceptible to WMSDs than younger people. However, in this study sample, there were more respondents aged 55 years or older, which included

only three respondents within the age group. Female sex was not found to be significantly associated with WMSDs in this study compared to previous studies, most probably due to an earlier study that found females to be a significant factor in the nurse-only population in hospital-based settings, in which they were commonly involved with manual patient handling in their daily work. In the primary care setting, the staff were less likely to be involved in manual patient handling in their daily work. Family history was significant in a previous study of lower back pain (Tanzil *et al.*, 2019). This factor was not significant in this study, most likely due to the dependent variable being WMSDs, which not only included low back pain.

This is a cross-sectional study. Therefore, the causes and effects of the factors associated with WMSDs could not be established. In addition, this study only involved self-administered questionnaires with no physical examination, investigation, or workplace assessment. Therefore, the prevalence of WMSDs may need to be established as respondents may have symptoms due to conditions other than WMSDs. However, to minimize such bias, those who had been diagnosed with musculoskeletal disorders before the study were excluded from the study. As the sample was not randomly selected, this may have resulted in selection bias in the study, and the results may not be generalizable to healthcare workers working in other places.

Conclusion

The prevalence of WMSDs among healthcare workers in the selected study site of public primary care health facilities corresponded to the prevalence of WMSDs among health care workers in a previous study. In this study, poor safety culture was found to be a significant factor associated with WMSDs. Safety culture involves knowledge, attitudes, and practices regarding safety among health care workers. Therefore, for recommendation, the policy maker may want to make safety training a mandatory requirement in the workplace to provide health care workers with proper knowledge, attitudes, and practices regarding safety, thus preventing WMSDs. In addition, a lack of safety training was also found to be a significant factor associated with WMSDs. For future studies, a prospective cohort study may be conducted to establish the causative effect and involve more holistic data collection, such as physical examination, investigation, and workplace assessment, so that the study may provide more in-depth results.

Acknowledgements

The authors would like to express our appreciation to the former Director of Sabah Health State Department, Datuk Dr. Christina Rundi, and all staff from the District Health Officer of Tawau District Health Office who have provided facilities and assistance during sampling and data collection.

References

- ABD hamid, H. S., Kar, C. S. C. & Murad, N. S. (2016) 'Adaptation and validation of the safety attitude questionnaire (SAQ) in Malaysian healthcare setting', *Jurnal Psikologi Malaysia*, 30.
- Amin, N. A., Nordin, R. B., Noah, R., Oxley, J. & Fatt, Q. K. (2016) 'Work-related musculoskeletal disorders in female nursing personnel: prevalence and impact', *International Journal of Collaborative Research on Internal Medicine & Public Health*, 8, pp. 294–315.
- Bernard, B. (1997) *Musculoskeletal disorders and workplace factors: A critical review of epidemiologic evidence for work-related musculoskeletal disorders of the neck, upper extremity, and lower back*, National Institute of Occupational Safety and Health, pp. 97–141.
- Chin, R. W. A., Chua, Y. Y., Chu, M. N., Mahadi, N. F., Wong, M. S., Yusoff, M. S. & Lee, Y. Y. (2018) 'Investigating validity evidence of the Malay translation of the Copenhagen Burnout Inventory', *Journal of Taibah University Medical Sciences*, 13, pp. 1–9.
- Chinedu, O. O., Henry, A. T., Nene, J. J. & Okwudili, J. D. (2020) 'Work-related musculoskeletal disorders among office workers in higher education institutions: A cross-sectional study', *Ethiopian Journal of Health Sciences*, 30.
- Farhaduzzaman, S.M. & Q. Z. H. (2018) 'The association between musculoskeletal disorders and work-related risk factors in hospital employees of Bangladesh', *Asia Pacific Environmental and Occupational Health Journal*, 4, pp. 10.
- Fochsen, G., Josephson, M., Hagberg, M., Toomingas, A. & Lagerström, M. (2006) 'Predictors of leaving nursing care: a longitudinal study among Swedish nursing personnel', *Occupational and Environmental Medicine*, 63, pp. 198–201.
- Hansen, S. & Jensen, P. (1993) *Arbeidsmilj. o og samfundsekonomi i Norden (Working environment and national economies in the Nordic Countries)*. Report.
- Ismail, A. & Khalid, S. N. M. (2022) 'Patient safety culture and its determinants among healthcare professionals at a cluster hospital in Malaysia: A cross-sectional study', *BMJ Open*, 12(8), e060546. DOI: 10.1136/bmjopen-2021-060546.
- Kristensen, T. S., Hannerz, H., Høgh, A. & Borg, V. (2005) 'The Copenhagen Psychosocial Questionnaire—a tool for the assessment and improvement of the psychosocial work environment', *Scandinavian Journal of Work, Environment & Health*, pp. 438–449.
- Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G. & Jørgensen, K. (1987) 'Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms', *Applied Ergonomics*, 18, pp. 233–237.
- Malaysia, Ministry Of Health. (2019) *Klasifikasi Klinik Kesihatan*. Available at: <https://fh.moh.gov.my/v3/index.php/klasifikasi-klinik-kesihatan>.
- Piedrahita, H. (2006) 'Costs of work-related musculoskeletal disorders (MSDs) in developing countries: Colombia case', *International Journal of Occupational Safety and Ergonomics*, 12, pp. 379–386.

Rahmah, M., Rozy, J., Halim, I., Jamsiah, M. & Shamsul, A. (2008) 'Prevalence of back pain among nurses working in government health clinics and hospitals in Port Dickson, Malaysia', *Journal of Community Health*, 14, pp. 11–18.

Sedilla, K. (2018) 'Manual handling in fish port: An ergonomic assessment on the porters "Kargadors" in Navotas Fishing Port Complex', *Advances in Physical Ergonomics & Human Factors: Proceedings of the AHFE 2018 International Conference on Physical Ergonomics & Human Factors*, July 21–25, Loews Sapphire Falls Resort, Universal Studios, Orlando, Florida, USA. Springer, pp. 111.

Soylar, P. & Ozer, A. (2018) 'Evaluation of the prevalence of musculoskeletal disorders in nurses: A systematic review', *Med Sci*, 7, pp. 479–485.

Tanzil, S., Jamali, T., Inam, S. & Abbas, A. (2019) 'Frequency and severity of low back pain among healthcare providers and associated factors in a tertiary care, public hospital in Karachi', *Occup Med Health Aff*, 7, 1000285.

The World Health Report. (2006) *The World Health Report*. Available at: <https://apps.who.int/iris/handle/10665/43432>.

Yang, S., LI, L., Wang, L., Zeng, J. & LI, Y. (2020) 'Risk factors for work-related musculoskeletal disorders among intensive care unit nurses in China: A structural equation model approach', *Asian Nursing Research*, 14, pp. 241–248.

YI, Y. Z., Pillai, S., Ramalingam, V. & Hui, O. J. (2022) 'Prevalence of work-related musculoskeletal disorders (WRMSD) and the associated risk factors among Malaysian physiotherapists: A cross-sectional study', *Journal of Physical Education and Sport*, 22, pp. 2636–2641.