



INTERNATIONAL JOURNAL OF RESEARCH IN PHARMACEUTICAL SCIENCES

Published by Pharmascope Publications

Journal Home Page: www.pharmascope.org/ijrps

Predictors of work-related musculoskeletal disorders of neck and shoulders among nurses

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Article History:

Received on: 02.10.2018
 Revised on: 16.12.2018
 Accepted on: 19.12.2018

Keywords:

Emotional distress,
 Nurse,
 Psychosocial,
 WRMSD

ABSTRACT

Work-related musculoskeletal disorders (WRMSD) in the neck or shoulders are common occupational health problems among nursing professionals. This study aimed to identify potential predictors of WRMSD in neck and shoulders, namely workplace condition, emotional distress and work engagement, among Malaysian nurses in public hospitals. A cross-sectional study was conducted among female nurses working in public hospitals around Klang Valley, Malaysia. Predictors of WRMSD in the neck and shoulders were identified using multivariate logistic regression analysis. A total of 550 out of 660 nurses returned the questionnaire (83.3% response rate). However, the analysis was based on 376 nurses who reverted with completely answered questionnaires. 73.1% of nurses suffered from WRMSD in at least one site in the past 12 months. Of these, 48.9%, 36.9% and 55.6% reported symptoms in the neck alone, shoulders alone and any of these regions respectively. When all significant predictors ($p < 0.10$) were simultaneously included in the final model, the odds of WRMSD in neck or shoulders were higher among nurses perceiving high physical demand (AOR: 1.18, 95% CI 1.02-1.30) and high psychological job demand (AOR: 1.08, 95% CI 1.01-1.15). Anxious and stressful nursing personnel possess 22.6% and 11.6% greater odds of WRMSD in neck or shoulders in comparison to nurses without the symptoms. Married nurses were also at higher odds (AOR: 2.12, 95% CI 1.27-3.55), whereas being engaged to work, significantly reduced the risk of WRMSD in any of the areas. This study indicated that the neck or shoulders WRMSD are prevalent among nurses. Psychological job demand, physical demand, anxiety and stress were the significant predictors of WRMSD in the studied anatomical areas.



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ISSN: 0975-7538

DOI: <https://doi.org/10.26452/ijrps.v9iSPL2.1752>

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INTRODUCTION

Worldwide, an estimated two million men and women die each year as a result of work-related injuries or illnesses, and a further 268 million non-fatal workplace injuries result after work each year. Of these, it is estimated that there are 160 million new cases of work-related illnesses each year (International Labour Organization, 2012). Nurses are required to perform diversified tasks and juggle many jobs at various units. The nurses' routines include providing direct care to patients, such as conducting assessments of patients, attending to patients' and relatives' needs, adminis-

tering daily medications, monitoring patients' conditions, and being involved in administrative works, thus making nurses an asset in the healthcare delivery system. There is good evidence attesting to the association between patient care activities and risks of work-related musculoskeletal disorders (WRMSD) (Abedini *et al.*, 2008; Pompeii *et al.*, 2009). A number of literature documented the high annual prevalence of WRMSD among nurses in at least one body region (Rahmah *et al.*, 2008; Carugno *et al.*, 2012; Anap *et al.*, 2013). Lower back (Rahmah *et al.*, 2008; Munabi *et al.*, 2014), neck (Choobineh *et al.*, 2010; Mehrdad *et al.*, 2010; Anap *et al.*, 2013), and shoulders (Abedini *et al.*, 2008; Reed *et al.*, 2014) were among the most prominent affected areas.

In Malaysia, less attention was given to WRMSD, as compared to other occupational diseases. In 2013, out of 1,821 reported workplace accidents, only 6% were attributable to WRMSD (Ministry of Human Resource, 2014), which was much lower than those documented in other countries (Piedrahita, 2006; United States Bureau of Labor statistics, 2013). This difference is expected because of under-reporting due to lack of awareness and knowledge in developing countries, compared with developed countries (Lee and Ismail, 2005).

A high proportion of investigators agree that WRMSD is multifactorial. Therefore, combined effects of potential factors intensified the risks of WRMSD among nursing professionals (Mehrdad *et al.*, 2010; Widanarko *et al.*, 2014) in comparison to the exposure to a single risk factor (Kim *et al.*, 2010). These risk factors include the workplace environment such as psychosocial stressors (Sembajwe *et al.*, 2013) and physical demands (Choobineh *et al.*, 2010), organization (Ovayolu *et al.*, 2014), emotional health (Blozik *et al.*, 2009), and personal characteristics (Abedini *et al.*, 2008; Chung *et al.*, 2013). However, the issues surrounding the risk of WRMSD for nurses in Malaysia is poorly elucidated. Thus, the present study aimed to predict neck or shoulders WRMSD among nurses.

METHODOLOGIES

Study Design and Subject Population

This study was approved by the Monash University Human Research Ethics Committee (MUHREC)(CF12/1506-2012000809) and the Medical Research and Ethics Committee (MREC), Ministry of Health, Malaysia (NMRR12-234-11176). The cross-sectional study focused on four tertiary hospitals located in the area of Klang Valley, Malaysia. The selection of the participating hospitals was based on convenience sampling and support received from the respective hospital's

management. The participants included in this study were female nurses aged 23 to 50 years old, presently working in a shift in the clinical area for at least one year at the participating hospitals, and free from any musculoskeletal symptoms. Nurses who were pregnant, menopause, or breastfeeding during data collection were excluded. Upon subject recruitment, a briefing session with potential participants was conducted and the study package consisted of the questionnaires, explanatory statements and consent forms were distributed. The reverted questionnaires were thoroughly examined.

Sample Size Estimation

The sample size was estimated using a single proportion calculation (Daniel, 1999). Based on the WRMSDs prevalence rate of 78% (Tinubu *et al.*, 2010), the sample size was estimated at 264 nurses. With an estimation of 80% response rate, a minimum sample of 330 was calculated for this study. A total of 660 questionnaires were distributed to nurses and only 550 of the distributed questionnaires were returned (response rate of 83.3%). Out of all reverted questionnaires, 112 nurses were excluded from the study because of pregnancy (45), breastfeeding (45), menopause (2), and another 20 were self-perceived as having lifetime non-occupational MSD. 62 questionnaires were found to be incomplete, making the final sets that eligible for further analysis was 376.

Survey Questionnaire Instrument

Section A: Demographic and Job Information

This section was designed to elicit participants' socio-demographic and job information. Socio-demographic data include age, marital status, income and Body Mass Index (BMI), while job information collected from respondents were years of employment, average weekly working hours, work unit attached, and numbers of years attached to the current hospitals and unit. In addition, the nurses were requested to report if they were pregnant, breastfeeding or have menopause. History of non-occupational MSDs was also reported.

Section B: Symptoms of WRMSD

WRMSD symptoms were measured using the Malay validated the version of the self-reported Standardised Nordic Musculoskeletal Questionnaire (M-SNMQ). An anatomical diagram of nine body regions (neck, shoulder, upper and lower back, hands/wrists, arms, knees, thighs and feet) was appended to facilitate identification of the location and presence of the WRMSD symptoms over the past 12 months (Kuorinka *et al.*, 1987). The

participants were requested to indicate 'Yes' or 'No' to any encountered symptoms of WRMSD (pain, numbness, tingling, aching, stiffness, or burning) at any anatomical site which lasted for more than one day over the past 12 months prior to the study (Kuorinka *et al.*, 1987). Next, to perform further analysis, the anatomical sites were grouped into four body regions, namely region one (neck and shoulders), region two (wrists, arms, and hands), region three (upper and lower back), and region four (thighs, knees, ankles, and feet).

Section C: Assessment of Workplace Factors

The validated Malay version of the Job Content Questionnaire (M-JCQ) was used to extract information on the psychosocial stressors and physical demand perceived at the workplace. In our previous validation and reliability study, the Cronbach's alpha values for all subscales (except for psychological job demand) yielded more than 0.70, indicating acceptable internal consistency (Nur Azma *et al.*, 2015). Exploratory Factor Analysis (EFA) also confirmed only 33 items of the subscales were loaded in designated factors and uni-dimensional (Nur Azma *et al.*, 2015). This indicated that the M-JCQ is a reliable and valid instrument to measure psychosocial and physical stressors among the nursing population in Malaysia.

Section D: Assessment of Work Engagement

Information on the individuals' work engagement level was measured using the Malay-validated version of the Utrecht Work Engagement Scales (M-UWES) (Schaufeli *et al.*, 2006).

M-UWES of 9 items (M-UWES9) was chosen to assess the level of work engagement among the nursing population. The total work engagement scale consists of three subscales of vigour, dedication, and absorption, with three items each as in the original version (Schaufeli and Bakker 2004). The items were scored on a seven-point Likert scale ranging from 0 ("never") to 6 ("always"). The total scores of M-UWES9 were estimated by averaging items scores ranging between 0 and 6. A higher score indicates a higher level of work engagement.

Section E: Assessment of Emotional Distress

The status of the participants' level of emotional distress was examined using the validated self-reported Malay version of the Depression Anxiety Stress Scale (M-DASS) (Nur Azma *et al.*, 2014). M-DASS20 consists of three subscales to measure the symptoms of depression (six items), and seven items each for anxiety and stress, over the last seven days. Each item comprised of a statement and four ordinal responses that ranged from 0

("did not apply to me at all") to 3 ("applied to me very much, or most of the time"). Scores from each set of subscales were summed to yield a single subscale score and were interpreted according to a predetermined criterion based on cut-off percentiles as either 'normal' (0-78), 'mild' (79-87) 'moderate' (88-95) 'severe' (96-98) to 'extremely severe' (99-100). Higher scores indicate greater severity of depression, anxiety, or stress disorder. Next, the scores were further simplified into two categories: "normal" (scores of 0-78) versus "emotional distress" (scores of 79-100) (Lovibond and Lovibond, 1995).

Statistical Analysis

Data entry and analysis were performed using the IBM SPSS Statistics version 24.0. The data were checked for completeness and examined for normality distribution using the stem-and-leaf plot and the Kolmogorov-Smirnov Test. For continuous parameters, means and standard deviations were computed for normally distributed variables while frequencies and percentages were computed for ordinal and nominal data. The occurrence of WRMSD was presented as prevalence rate. A series of analyses were performed to model the predictive factors of WRMSD in each of the four body regions. First, in univariate analysis, simple logistic regression (SLR) was used to assess the association between the socio-demographic variables and each of the predictive factors and WRMSD. Second, a multivariate logistic regression (MLR) was used to identify significant predictors of WRMSD after adjustment for potential confounding factors (age, wards, BMI, marital status, and weekly average working hours). Third, all significant predictors ($p < 0.10$) in step 2 were entered into the final model with adjustment for the remaining covariates to identify significant and independent predictors of WRMSD in each of the four body regions. To assess the magnitude of the effect sizes, crude odds ratio (OR) and adjusted odds ratio (AOR), 95% confidence intervals (95% CIs) for AORs and p-values were determined. Hosmer-Lemeshow Goodness-of-fit test was used to assess the fitness of the models; if the p-value was not significant ($p > 0.05$), the model is deemed a good fit to the data (Hosmer and Lemeshow, 2000).

RESULTS AND DISCUSSION

Socio-Demographic Characteristics of the Nurses

Majority of the nurses were Malay (94.1%) with an average age of 30.58 ± 5.25 years and two-thirds of them were married. Over 50% of the nurses had been in service for more than five years, with an

Table 1: Socio-demographic characteristics of respondent nurses (N=3

Variables	Mean \pm SD	% (n)
Age (yrs.)	30.58 \pm 5.25	
Years of employment as a nurse (yrs.)		
\leq 5	7.38 \pm 4.94	42.80 (161)
$>$ 5		57.20 (215)
Years of working at the current hospital (yrs.)		
\leq 5	5.26 \pm 3.67	68.90 (259)
$>$ 5		31.10 (117)
Working hours/week (hrs.)		
\leq 48	45.04 \pm 5.40	85.90 (323)
$>$ 48		14.10 (53)
Level of education		
Tertiary	--	87.80 (330)
Non-tertiary		12.20 (46)
Marital status		
Married		76.60 (288)
Unmarried	--	23.40 (88)
Type of ward		
Medical/General	--	78.50 (295)
Intensive care units		21.50 (81)
Body Mass Index (BMI) (Kg/m ²)	24.18 (4.48)	
Underweight-normal		59.00 (222)
Overweight		41.00 (154)

Table 2: Predictors of WRMSD in the neck or shoulders for the last one year

Variables	Univariate analysis	Multivariate analysis ^a	Multivariate analysis ^b
	OR (95%CI)	AOR (95%CI)	AOR (95%CI)
Age (< 30 yrs.)	0.75 (0.50-1.13)		
Years in service (> 5 yrs.)	1.02 (0.68-1.54)		
Body Mass Index (BMI)	1.33 (0.88-2.02)***		
Working > 48 hours week (hrs.)	0.92 (0.51-1.66)		
Married	1.56 (1.03-2.51)**	1.78 (1.04-3.05)*	2.12 (1.27-3.55)**
Assigned to intensive care unit	1.69 (1.01-2.81)*	1.68 (1.00-2.83)*	
<i>Workplace factors</i>			
High psychological job demand	1.55 (1.03-2.34)*	1.61 (1.06-2.43)**	1.08 (1.02-1.15)*
Low job control	1.01 (0.67-1.52)	1.08 (0.71-1.64)	
Low social support	1.69 (1.05-2.74)*	1.76 (1.11-2.79)*	1.18 (1.02-1.30)**
High physical demands	1.50 (1.20-2.98)*	1.83 (1.18-2.82)**	
<i>Emotional health</i>			
Depression	1.10 (0.72-1.69)	1.14 (0.74-1.76)	
Anxiety	2.40 (1.52-3.79)**	2.39 (1.48-3.71)*	2.26 (1.33-3.55)*
Stress	1.20 (0.34-0.78)*	1.89 (1.25-2.86)**	1.16 (1.03-1.26)*
<i>Work engagement</i>			
Vigour	0.77 (0.62-0.94)*	0.78 (0.63-0.95)*	0.76 (0.60-0.97)*
Dedication	0.75 (0.59-0.94)**	0.75 (0.59-0.94)**	
Absorption	0.82 (0.66-0.99)*	0.92 (0.67-1.01)	

an average of 7.38 \pm 4.94 years. In addition, at least half of the nurses had worked in their current hospital and unit for less than five years, with a mean length of employment of 5.26 \pm 3.67 and 4.26 \pm 3.02 years, respectively. The average weekly working hours at the hospital was 45.04 \pm 5.40 hours, and most of the nurses worked 48 hours a week or less. Continuous variables including age, number of service years and years working in the current

hospital and unit were dichotomized according to the respective median cut-offs. The nurses' self-reported BMI showed an average value of 24.18 \pm 4.48, with over half of the nurses Table 1 summarized the sociodemographic characteristics of the participant. Summarized the socio-demographic characteristics of the participants.

Prevalence of WRMSD

The results of the present study suggested that the nurses frequently suffer from WRMSD (73.1%), consistent with other findings (Chung *et al.*, 2013; Anap *et al.*, 2013). The annual prevalence was slightly lower than those documented among Iranian (95.0%) (Mehrdad *et al.* 2010) and Brazilian (96.3%) (Souza & Alexandre 2012) nurses. Of these, 48.9% (n=184), 36.9% (n=139) and 55.6% (n=209) reported symptoms in the neck alone, shoulders alone and any of these anatomical sites respectively. The differences in prevalence rates and ranking of the anatomical area could be explained by several factors. Perception of WRMSD can be influenced by the unique society and culture characteristics of the respective countries. For example, a comparative study among Brazilian and German populations concluded that although the same technique and study instrument was applied, German respondents reported a higher prevalence than the Brazilian group (Raspe *et al.*, 2004). Comparison of prevalence data between studies must be interpreted with caution for a number of reasons, including different terminologies used to define WRMSD (Trinkoff *et al.*, 2002), and the type of research instruments used in the data collection.

Predictors of WRMSD in Neck and Shoulders

As shown in Table 2, this study revealed that the ability of nurses to tolerate WRMSD was factored by psychological job demand (AOR: 1.08, 95% CI 1.01-1.15) and physical demands (AOR: 1.18, 95% CI 1.02-1.30). In the context of the nursing profession, high psychological job demand is characterized by nurses being required to work longer hours, undertake excessive workload due to insufficient staffs, working at a fast pace, and insufficient breaks. This is in line with findings observed among Greek nurses where those experiencing high psychological job demand were prone to suffer WRMSD in the neck and shoulders (de Barros and Alexandre, 2003).

Another important finding of this study is that anxious nursing personnel were at 22.6% greater odds of WRMSD in neck and shoulders in comparison to nurses without the symptoms. An anxious person tends to over-react in various situations, particularly when avoiding potentially threatening environment. This leads to non-adaptive responses, which can intensify pain resulting in fear that can further increase the functional disability of the musculoskeletal system (Louw *et al.*, 2011). Likewise, a cross-sectional survey of 448 patients in Germany reported consistent evidence that anxiety was significantly associated with neck pain (Blozik *et al.* 2009).

Our study results also build up existing findings suggesting that stressed nurses are more likely to suffer WRMSD in the neck or shoulders (AOR:1.16 95% CI 1.03-1.26). The presence of sources of stress in the hospital environment including workstation (Terakado and Matsushima 2015), having to deal with death and dying patients (Melvin, 2012), lack of social support from supervisor and colleagues (Sveinsdottir *et al.*, 2006), and shift rotation (Lin *et al.*, 2015) have been suggested as significant factors contributing to the occurrence of stress among nursing personnel. Married nurses were at higher odds (AOR: 2.12, 95% CI 1.27-3.55) whereas being engaged to work significantly reduced the risk (AOR:0.76, 95% CI 0.60-0.97) of WRMSD in the neck and shoulders which is in agreement with previous studies (Lela and Frantz, 2012; Abedini *et al.*, 2008). This was an expected finding because married nurses have more responsibilities at home, such as domestic work and taking care of children which can be physically and emotionally demanding. These strenuous responsibilities of married nurses may result in lack of rest leading to the development of WRMSD. The presence of work engagement may contribute to the positive attitudes in the individuals such as inculcating proactive behaviour (Salanova and Schaufeli, 2008), also increases job commitment and reduce turnover intentions (Hakanen *et al.*, 2006). The above-identified predictive factors account for 15.2% of the variance of WRMSD in region one. From the Hosmer-Lemeshow test, it can be concluded that the goodness-of-fit indicator is satisfactory ($\chi^2=5.53$, $df = 8$, $p>0.05$).

This study identified several limitations. First, it is well known that the cross-sectional study design is unlikely able to establish a causal relationship between working conditions and WRMSD. Hence, a longitudinal study is advised for future studies to validate the present findings. Second, this study only recruited female nurses which created a bias because females are more prone to experiencing pain than males due to certain hormones. In particular, women may experience more pain during menstruation due to a lower level of estrogen (Aloisi and Bonifazi, 2006). Third, the data were collected using self-reported techniques (M-SNMQ and M-JCQ), therefore, the responses may be biased because respondents may attempt to provide more socially acceptable answers rather than accurate information of their true experiences (Cook, 2010).

CONCLUSION

Despite several limitations, this study revealed a high prevalence of WRMSD among Malaysian nurses. This study highlighted the relationship be-

tween high psychological job demand, high physical demand, anxiety and stress, with the development of WRMSD. This relationship corroborates the theory of multi-etiological characteristics of WRMSD and confirms the existing hypotheses that the contributing risk factors varied within the involved anatomical regions (Widanarko *et al.*, 2014). The current study also revealed the mediating effects of work engagement and stress in reducing the risk of WRMSD. Thus, building on these findings, an intervention programme to alleviate WRMSD among nurses may include design components to reduce the physical and psychological job demand, and also to enhance nurses' work engagement. The intervention programme may also include strategies to improve nurses' emotional health.

REFERENCES

- Abedini, R., Choobineh, A. and Hasanzadeh, J. 2008. Musculoskeletal Load Assessment in Hospital Nurses with Patient Transfer Activity. *International Journal of Occupational Hygiene*, 5(2), 39–45.
- Aloisi, A. M. and Bonifazi, M. 2006. Sex hormones, central nervous system and pain. *Hormones and behaviour*, 50(1), 1–7.
- De Barros, E.N.C and Alexandre, N.M.C. 2003. Cross-cultural adaptation of the Nordic musculoskeletal questionnaire. *International nursingreview*, 50(2), 101–108.
- Blozik, E., Laptinskaya, D., Herrmann-Lingen, C., Schaefer, H., Kochen, M. M., Himmel, W. and Scherer, M. 2009. Depression and anxiety as major determinants of neck pain: a cross-sectional study in general practice. *BMC Musculoskeletal Disorders*, 10(13), 1-8
- Carugno, M., Pesatori, A. C., Ferrario, M. M., Martins, A. C., Elisa, V., Felli, A. and Coggon, D. 2012. Physical and psychosocial risk factors for musculoskeletal disorders in Brazilian and Italian nurses. *Artigo*, 28(9), 1632–1642.
- Choobineh, A., Movahed, M., Tabatabaie, S. H. and Kumashiro, M. 2010. Perceived Demands and Musculoskeletal Disorders. *Industrial Health*, 48, 74–84.
- Chung, Y.-C., Hung, C.-T., Li, S.-F., Lee, H.-M., Wang, S.-G., Chang, S.-C., Pai, L. W., Huang, C. N. and Yang, J. H. 2013. Risk of musculoskeletal disorder among Taiwanese nurses cohort: a nationwide population-based study. *BMC Musculoskeletal Disorders*, 14, 144.
- Cook, C. 2010. Mode of administration bias. *The Journal of Manual & Manipulative Therapy*, 18(2), 61–3.
- Daniel, W. W. 1999. *Biostatistics: A foundation for analysis in the health sciences*, New York: John Wiley & Sons. Inc.
- Hakanen, J. J., Bakker, A. B., Demerouti, E., and Schaufeli, W. B. 2006. Burnout and work engagement among teachers. *Journal of School Psychology*, 43(6), 495–513.
- Hosmer, D. W and Lemeshow, S. 2000. *Applied Logistic Regression*, New York: John Wiley & Sons. Inc.
- International Labour Organizational, 2012. *Estimating the Economic Costs of Occupational Injuries and Illnesses in Developing Countries: Essential Information for Decision-Makers*, Geneva: International Labour Office.
- Kim, I. H., Geiger-Brown, J., Trinkoff, A. M., and Muntaner, C. 2010. Physically demanding workloads and the risks of musculoskeletal disorders in homecare workers in the USA. *Health & social care in the community*, 18(5), 445–55.
- Kuorinka, I., Jonsson, B., Kilbom, A., Vinterberg, H., Biering-Sørensen, F., Andersson, G., and Jørgensen, K. 1987. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied Ergonomics*, 18(3), 233–7.
- Lee, L. K. and Ismail, N. H. 2005. The implication of the Prevalence of Needlestick Injuries in a General Hospital in Malaysia and Its Risk in Clinical Practice. *Environmental Health and Preventive Medicine*, 10, 33–41.
- Lela, M. and Frantz, J. M. 2012. The Relationship Between Low Back Pain and Physical Activity Among Nurses in Kanombe Military Hospital. *African Journal of Physiotherapy and Rehabilitation Services*, 4(June), 63–66.
- Lin, P. C., Chen, C. H., Pan, S. M., Chen, Y. M., Pan, C. H., Hung, H. C and Wu, M. 2015. The association between rotating shift work and increased occupational stress in nurses. *Journal Of Occupational Health*. 57(4), 307-15.
- Louw, A., Diener, I., Butler, D. S., and Puentedura, E. J. 2011. The Effect of Neuroscience Education on Pain, Disability, Anxiety, and Stress in Chronic Musculoskeletal Pain. *Archives of Physical Medicine and Rehabilitation*, 92(12), 2041–2056.
- Lovibond, P. F. and Lovibond, S., 1995. *Manual for the Depression Anxiety Stress Scales.*, Sydney, Australia: School of Psychology, University of New South Wales.
- Mehrdad, R., Dennerlein, J. T. and Haghigat, M. and Aminian, O. 2010. Association Between

- Psychosocial Factors and Musculoskeletal Symptoms Among Iranian Nurses. *American Journal of Industrial Medicine*, 53(10), 1032–1039.
- Melvin, C. S. 2012. Professional compassion fatigue: what is the true cost of nurses caring for the dying? *International Journal of Palliative Nursing*, 18(12), 606–611.
- Ministry of Human Resource, 2014. *Statistik pekerjaan & perburuhan 2013*, Putrajaya, Malaysia.
- Munabi, I. G., Buwembo, W., Kitara, D. L., Ochieng, J. and Mwaka, E. S. 2014. Musculoskeletal disorder risk factors among nursing professionals in low resource settings: a cross-sectional study in Uganda. *BMC Nursing*, 13, 7.
- Nur Azuma, B. A., Rusli, B. N., Quek, K. F. and Noah, R. M. 2014. Psychometric properties of the Malay version of the Depression Anxiety Stress Scale-21 (M-DASS21) among nurses in public hospitals in the Klang Valley. *International Journal of Collaborative Research on Internal Medicine & Public Health*, 6(5), 109–120.
- Nur Azma, B. A., Quek, K. F., Oxley, J. A., Noah, R. M. and Rusli, B. N. 2015. Validity and reliability of Malay version of the Job Content Questionnaire among public hospital female nurses in Malaysia. *International Journal of Occupational and Environmental Medicine*, 6, 232–242.
- Ovayolu, O., Ovayolu, N., and Genc, M. 2014. Frequency and severity of low back pain in nurses working in intensive care units and influential factors. *Pakistan Journal of Medical Sciences*, 30(1), 70–76.
- Piedrahita, H. 2006. Costs of work-related musculoskeletal disorders (MSDs) in developing countries: Colombia case. *International journal of occupational safety and ergonomics : JOSE*, 12(4), 379–86.
- Pompeii, L. A., Lipscomb, H. J., Schoenfisch, A. L. and Dement, J. M. 2009. Musculoskeletal Injuries Resulting From Patient Handling Tasks Among Hospital Workers. *American Journal of Industrial Medicine*, 52(5), 571–578.
- Rahmah, M. A., Rosy, J., Halim, I., Jamsiah, M. and Shamsul, A. 2008. Prevalence of Back Pain among nurses working in government health clinics and Hospital in Port Dickson Malaysia. *Journal of Community Health*, 14(2), 11–18.
- Raspe, H., Matthis, C., Croft, P. and O'Neill, T. 2004. Variation in back pain between countries: the example of Britain and Germany. *Spine*, 29(9), 1017–1021.
- Reed, L. F., Battistutta, D., Young, J. and Newman, B. 2014. Prevalence and risk factors for foot and ankle musculoskeletal disorders experienced by nurses. *BMC Musculoskeletal Disorders*, 15(1), 196.
- Salanova, M. and Schaufeli, W. B. 2008. A cross-national study of work engagement as a mediator between job resources and proactive behaviour. *The International Journal of Human Resource Management*, 19(1), 116–131.
- Schaufeli, W. B. and Bakker, A. 2004. *Utrecht Work Engagement Scale: Preliminary Manual*, The Netherlands: Department of Psychology. Utrecht University.
- Schaufeli, W. B., Bakker, A. B. and Salanova, M. 2006. The Measurement of Short Questionnaire A Cross-National Study. *Educational and Psychological Measurement*, 66(4), 701–716.
- Sembajwe, G., Tveito, T. H., Hopcia, K., Kenwood, C., O'Day, E. T., Stoddard, A. M., Dennerlein, J. T., Hashimoto, D. and Sorensen, G. 2013. Psychosocial stress and multi-site musculoskeletal pain: a cross-sectional survey of patient care workers. *Workplace Health & Safety*, 61(3), 117–25.
- Souza, A. C. and Alexandre, N. M. C., 2012. Musculoskeletal symptoms, work ability, and disability among nursing personnel. *Workplace health & safety*, 60(8), 353–60.
- Sveinsdottir, H., Biering, P. and Ramel, A. 2006. Occupational stress, job satisfaction, and working environment among Icelandic nurses: a cross-sectional questionnaire survey. *International journal of nursing studies*, 43(7), 875–89.
- Terakado, A. and Matsushima, E. 2015. Work stress among nurses engaged in palliative care on general wards. *Psycho-Oncology*, 24, 63–69.
- Tinubu, B. M. S., Mbada, C. E., Oyeyemi, A. L. and Fabunmi, A. A. 2010. Work-related musculoskeletal disorders among nurses in Ibadan, South-west Nigeria: a cross-sectional survey. *BMC musculoskeletal disorders*, 11(12), 1–8.
- Trinkoff, A. M., Lipscomb, J. A., Geiger-brown, J. and Brady, B. 2002. Musculoskeletal Problems of the Neck, Shoulder, and Back and Functional Consequences in Nurses. *American Journal of Industrial Medicine*, 41, 170–178.
- United States Bureau of Labor Statistics, 2013. *Nonfatal Occupational Injuries and Illness Requiring Days Away from Work*.

Widanarko, B., Legg, S., Devereux, J. and Stevenson, M. 2014. The combined effect of physical, psychosocial/organisational and/or environmental risk factors on the presence of work-related musculoskeletal symptoms and its consequences. *Applied Ergonomics*, 45(6), 1610–1621.