

# Work-related musculoskeletal disorders among nurses in the intensive care units and respiratory care centres: A pilot cross-sectional descriptive study

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## Research article

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## Abstract

Background To evaluate the prevalence and associated risk factors of work-related musculoskeletal disorders (WMSDs) in nurses working in hospital intensive care units (ICUs) and respiratory care centres (RCCs) and to provide additional information and recommendations.

Methods This pilot cross-sectional descriptive study was conducted in a tertiary medical centre, involving hospital staff working in the ICUs between June 2015 and March 2016. We assessed their Neck Disability Index (NDI) and Oswestry Disability Index (ODI) score grouping by age, care unit types and job tenure.

Results In all, 139 staff members completed the questionnaire. The mean age was  $30.2 \pm 6.0$  years, and the mean body mass index was  $22.5 \pm 3.9$  kg/m<sup>2</sup>. The mean job tenure in the ICU was  $6.5 \pm 5.2$  years, and the mean total job tenure was  $8.1 \pm 6.3$  years. The mean working day per week was  $5.1 \pm 0.5$ . The mean working hours using computer per day was  $4.8 \pm 2.8$ . The mean NDI score was  $7.6 \pm 4.8$ , and the mean ODI score was  $3.4 \pm 5.1$ .

Conclusion Neck and low-back disabilities are prevalent among staff members in the ICUs and RCCs. Staff members may benefit by undergoing rehabilitation programmes, such as therapeutic exercises and postural training. More attention should be paid to the neck and back disability status of staff members in the ICUs and RCCs to improve the working environment and ergonomics. Further research is warranted to evaluate whether WMSDs improve among ICU and RCC staff after performing exercise and receiving physical therapy.

## Background

Musculoskeletal disorder is a common occurrence that causes pain and impaired physical function, which are associated with higher costs to employers because of absenteeism and productivity loss. In 2001, musculoskeletal disorder contributed a median of 8 days away from work compared with 6 days for other illnesses.<sup>1</sup> The daily duties of nurses in the intensive care units (ICUs) and respiratory care centres (RCCs) include performing procedures and offering nursing care. They not only need sufficient physical strength and professional knowledge but also are exposed to the highly stressful working environment in the ICUs. During working hours, nurses in the ICU frequently transfer heavy patients, which require trunk bending and rotational movement assistance. These movements cause pressure load on the neck and low back and make nurses subsequently prone to musculoskeletal disorders.<sup>2</sup> Many staff members suffering from musculoskeletal discomfort continue to work, which might worsen pain and other symptoms.<sup>3</sup> It is imperative for the hospital staff members to prevent occupational injury and to stay healthy in order to provide better care quality for their patients. Musculoskeletal disorders can affect staff members' efficiency and performance. Previous studies have discussed the relationship between hospital staff members (doctors and nurses) and work-related musculoskeletal disorders (WMSDs).<sup>4, 5</sup> To the best of our knowledge, this is the first study to focus especially on both ICUs and RCCs staff members with WMSDs and the relationship between WMSDs and the different types of care units. The aim of our

study was to evaluate the prevalence, severity, and associated risk factors of WMSDs among ICUs and RCCs staff members in order to focus the public's attention on this critical problem that should not be ignored.

## Methods

This pilot cross-sectional descriptive study was conducted at a tertiary medical centre, involving hospital staff members working in the ICUs and RCCs between June 2015 and March 2016. The study was approved by the Institutional Review Board of Changhua Christian Hospital (IRB protocol number 150307) and waived the requirement for informed consent due to the research involved no more than minimal risk to subjects. Self-administered anonymous questionnaires were sent to nursing staff working in the ICUs and RCCs *via* in-hospital e-mail. The questionnaire was designed by our research group, including physicians and physiotherapists of the Department of Physical Medicine and Rehabilitation. The questionnaire contained the following information: (1) characteristics of study subjects, (2) work-related factors, (3) Neck Disability Index (NDI), and (4) Oswestry Disability Index (ODI). All of the statistical analyses were conducted using the Statistical Package for the Social Sciences (version 18.0 for Windows, SPSS Inc., Chicago, IL, USA).

The inclusion criteria were as follows: (1) nurses working in the ICUs and RCCs, (2) age range between 20 and 65 years, and (3) anonymous volunteers to complete the questionnaire. The informal nursing staff members, such as interns, were excluded. The self-administered anonymous questionnaire was sent *via* in-hospital e-mail to nursing staff members who were interested in the study in the ICUs and RCCs of our hospital. A total of 139 staff members completed the questionnaire. Regarding the characteristics of the study subjects, the information on the questionnaire included age, body mass index (BMI), job tenure in the unit, total job tenure, mean working days per week, mean working hours per day, mean working hours using computer per day, NDI and ODI.

ODI, which is one of the most common scoring systems used for patients with low-back pain, consists of 10 questions. Each question is scored from 0 (no disability) to 5 (full disability), and the sum of the scores is expressed as a percentage. The scoring intervals for clinical interpretation were as follows: 0% (no disability),  $\leq 20\%$  (mild disability), 21%–40% (moderate disability), 41%–60% (severe disability), 61%–80% (crippled), and 81%–100% (bed-bound or exaggerative patients).<sup>6</sup>

NDI, which is the most commonly used outcome measure for neck pain, contains five items that are derived from the ODI and another five new items. Each question is scored from 0 (no disability) to 5 (full disability). The index score is calculated by combining the scores of the 10 questions; the total score ranges from 0 to 50. The scoring intervals for clinical interpretation were as follows: 0–4 points (no disability), 5–14 points (mild disability), 15–24 points (moderate disability), 25–34 (severe disability), and 35–50 (complete disability).<sup>7</sup>

We compared the NDI and ODI of the staff members by classifying them into three groups according to age (20–29 years, 30–39 years, and 40–49 years), six groups according to total job tenure (<5 years, 5–10 years, 10–15 years, 15–20 years, 20–25 years, and >25 years) and four groups according to the types of units (medical ICU, surgical ICU, paediatric ICU, and RCCs).

## Results

A total of 139 staff members completed the questionnaire. The mean age was  $30.2 \pm 6.0$  years, and the mean BMI was  $22.5 \pm 3.9$  kg/m<sup>2</sup>. The mean job tenure in the unit was  $6.5 \pm 5.2$  years, and the mean total job tenure was  $8.1 \pm 6.3$  years. The mean working day per week was  $5.1 \pm 0.5$ . The mean working hours using computer per day was  $4.8 \pm 2.8$ . The mean NDI score was  $7.6 \pm 4.8$ , and the mean ODI was  $3.4 \pm 5.1$ . There was a comparable distribution of subjects within the group with age 20–29 years ( $n = 64$ , 46%) and 30–39 years ( $n = 61$ , 43.9%). Approximately 38.9% of the subjects reported a total job tenure of <5 years ( $n = 54$ ), and 23.7% ( $n = 33$ ) worked for 10–15 years. The demographic characteristics and ergonomic factors are presented in Table 1.

The complaint of neck discomfort among ICU and RCC staff is familiar. Nearly all subjects (98.6%) suffered from mild or moderate neck disability, and 1.5% of subjects presented with severe neck disability. We assessed their NDI and ODI score grouping by age, types of care units and total job tenure. The severity of neck disability seemed to increase with age. Nearly 35.7% of subjects suffered from moderate neck disability in the age group of 40–49 years, 19.7% in the age group of 30–39 years and 17.2% in the age group of 20–29 years. As for ODI, 33.8% showed no low-back disability, and 2.9% of subjects presented with severe disability. In general, the prevalence of neck disability among ICU and RCC staff was higher than that of low-back disability (Table 2).

We also compared the NDI and ODI scores from the subjects' total job tenure. The subjects whose total job tenure was between 15 and 20 years presented with more severe neck disability, and moderate or severe neck disability accounted for 37.0% of the subjects in this group (<5 years, 14.8%; 5–10 years, 0%; 10–15 years, 21.2%; 20–25 years, 30.7%; and >25 years, 16.7%). As for ODI, the subjects whose total job tenure was between 5 and 10 years had the highest prevalence (50%) of no low-back disability, and the second highest prevalence was the group whose total job tenure was <5 years (40.7%). Relatively, 41% of the subjects whose total job tenure was >10 years suffered from low-back disability, and 2.9% had severe disability. These factors indicate that the prevalence and severity of low-back disability could increase with age (Table 3).

In the comparison between NDI and ODI scores according to the types of care units among ICU staff, the severity of neck disability in the medical ICU group was higher than in the other three groups; moderate or severe neck disability accounted for 25.9% of the subjects working in medical care units (surgical ICUs, 20.3%; paediatric ICUs, 21.4%; and RCCs, 20.5%). For ODI, the severity was also more serious in the subjects working in the medical care units; 18.5% of subjects working in the medical units presented with

moderate or severe low-back disability (surgical ICUs, 8.5%; paediatric ICUs, 7.1%; and RCCs, 2.6%) (Table 4).

## Discussion

This pilot study found that WMSDs are prevalent among ICUs and RCCs staff members and that nearly all (98.6%) subjects presented with mild or moderate neck disability. To the best of our knowledge, this is the first study to focus on both ICUs and RCCs staff members with WMSDs and on the relationship between WMSDs and the different types of care units. Previous studies have shown that hospital staff members are prone to musculoskeletal disorders, accounting for a substantial economic burden.<sup>8, 9</sup> According to a systematic review, the risk factors recognised for neck WMSD were heavy physical work, awkward posture and frequent lifting. The risk factors for low-back WMSD were heavy physical work, awkward static and dynamic working postures, and lifting.<sup>10</sup> The occupational characteristics of the ICUs and RCCs staff members, such as cumulative stress from transferring dependent or heavy patients, may lead to trunk overexertion. There are studies recognising cumulative stress as a risk factor for spine WMSD.<sup>10–12</sup> Previous studies have shown that low back is the most susceptible to WMSD among healthcare professionals.<sup>13–15</sup> In our study, the prevalence of neck disability among ICU and RCC staff was generally higher than that of low-back disability.

Individual risk factor is another important aspect of WMSDs. Older age was recognised as the risk factor for WMSDs among nurses, who worked and had a longer job tenure.<sup>16, 17</sup> Our study showed that the severity of neck disability seemed to increase with age, with the highest incidence of moderate neck disability in the age group of 40–49 years. Besides, 41% of the subjects whose total job tenure was >10 years suffered from low-back disability.

In our study, all of the subjects suffered from neck disabilities, and 66.23% had low-back disability. However, there are some differences among the subjects in different working environments. In general, the severity of neck disability and low-back disability in medical ICUs was higher than in surgical ICUs, paediatric ICUs and RCCs.

Previous studies have mentioned that poor ergonomic and working environments contribute to musculoskeletal disorders. A cohort study showed that head posture, body posture, and task difficulty were associated with neck complaints.<sup>18</sup> Furthermore, a greater risk for musculoskeletal disorders was found among workers who used computers.<sup>19</sup> Prolonged sitting in a static posture at a workstation computer may also contribute to neck and low-back complaints.<sup>20</sup> Therefore, ergonomic and rehabilitation programmes, such as therapeutic exercises and postural training, seem to be beneficial in the prevention and intervention of WMSDs. In addition, it is also crucial to ameliorate the working environment, and the nursing workload should be allocated appropriately when experiencing WMSDs.<sup>16</sup>

## Study Limitations

This pilot study focuses primarily on the common problems of WMSDs among ICUs and RCCs staff members. However, there were several limitations in our study. First, the relatively small sample size may restrict the generalisation of these findings to other subject populations. Second, several subjects have indicated that filling out the questionnaire alone may not be helpful to improve their stress and ameliorate their working environment and ergonomics. Third, we did not record the psychosocial factors in the study. These limitations indicate that the results of this study should be interpreted with caution. Further research is warranted on the independent predictors for developing WMSDs and the related prevention or intervention measures for providing patients with specific clinical information and potentially reducing the prevalence of WMSDs.

## Conclusion

Musculoskeletal disorder is a common condition reported by hospital staff members.<sup>15</sup> In this study, neck discomfort is familiar among ICUs and RCCs staff members, and nearly all (98.6%) subjects in this study suffered from mild or moderate neck disability. The prevalence of neck disability among ICU and RCC staff was higher than that of low-back disability. Furthermore, we noted that the severity of neck disability was more serious in subjects working in the medical ICUs. We also found that the prevalence and the severity of low-back disability could increase with age and that the severity was also higher in the medical ICU staff. Our study emphasizes WMSDs among ICUs and RCCs staff members in order to improve this problem. Preventive health-promoting measures and rehabilitation programmes might be helpful to manage WMSDs.

## List Of Abbreviations

WMSDs: work-related musculoskeletal disorder

ICUs: intensive care unit

RCC: respiratory care centres

NDI: Neck Disability Index

ODI: Oswestry disability index

## Declarations

### *Ethics approval and consent to participate*

The study was approved by the Institutional Review Board of Changhua Christian Hospital (IRB protocol number 150307) and waived the requirement for informed consent due to the research involved no more than minimal risk to subjects.

### *Consent for publication*

Not applicable

#### *Availability of data and materials*

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

#### *Competing interests*

The authors declare that they have no potential conflicts of interest to disclose.

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There was no funding source for this study.

#### *Authors' Contributions*

All authors have read and approved the manuscript. PHC and KLC conceived and planned the study and interpreted the data. FYK contributed to manuscript drafting and data interpretation.

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## **References**

1. NIOSH workers health chartbook 2004. NIOSH Publication No. 2004-146. Washington, D.C.
2. Moreira RF, Sato TO, Foltran FA, Silva LC, Coury HJ. Prevalence of musculoskeletal symptoms in hospital nurse technicians and licensed practical nurses: associations with demographic factors. *Braz J Phys Ther.* 2014; 18(4): 323–333.

3. Khalid El ahrache, Daniel Imbeau.Comparison of rest allowance models for static muscular work. *International Journal of Industrial Ergonomics*. 2009; 39(1):73–80
4. Smedley J, Egger P, Cooper C, Coggon D. Manual handling activities and risk of low back pain in nurses. *Occup Environ Med*. 1995; 52(3): 160–163.
5. Wang J, Cui Y, He L, Xu X, Yuan Z, Jin X et al. Work-Related Musculoskeletal Disorders and Risk Factors among Chinese Medical Staff of Obstetrics and Gynecology. *Int J Environ Res Public Health*. 2017; 14(6): 562.
6. Fairbank JC, Davies JB, Couper J, O'Brien JP. The Oswestry low back pain disability questionnaire. *Physiotherapy* 1980;66(8):271–3.
7. Vernon H. The Neck Disability Index: state-of- the-art, 1991–2008. *J Manipulative PhysiolTher*. 2008;31(7):491–502.
8. Coyte PC, Asche CV, Croxford R, Chan B. The economic cost of musculoskeletal disorders in Canada. *Arthritis Care Res*. 1998;11(5):315–25.
9. Hafner ND, Milek DM, Fikfak MD. Hospital Staff's Risk of Developing Musculoskeletal Disorders, Especially Low Back Pain. *ZdrVarst*. 2018; 57(3): 133–139.
10. da Costa BR, Vieira ER. Risk factors for work-related musculoskeletal disorders: A systematic review of recent longitudinal studies. *Am J Ind Med*. 2010;53(3):285–323.
11. I.-L. Engkvist, A. Kjellberg, H. E. Wigaeus, M. Hagberg, E. Menckel, L. Ekenvall. Back injuries among nursing personnel - Identification of work conditions with cluster analysis. *Safety Science*. 2001; 37(1), 1–18
12. Byrns G, Reeder G, Jin G, Pachis K. Risk Factors for Work-Related Low Back Pain in Registered Nurses, and Potential Obstacles in Using Mechanical Lifting Devices. *Journal of Occupational and Environmental Hygiene*. 2004; 1(1):11–21.
13. Smith DR, Wei N, Zhao L, Wang RS. Musculoskeletal complaints and psychosocial risk factors among Chinese hospital nurses. *Occup Med (Lond)*. 2004;54(8):579–82.
14. Choobineh A, Rajaeefard A, Neghab M. Association between perceived demands and musculoskeletal disorders among hospital nurses of Shiraz University of Medical Sciences: a questionnaire survey. *Int J OccupSaf Ergon*. 2006; 12(4):409–16.
15. Yasobant S, Rajkumar P. Work-related musculoskeletal disorders among health care professionals: A cross-sectional assessment of risk factors in a tertiary hospital, India. *Indian J Occup Environ Med*. 2014; 18(2): 75–81.
16. Tinubu BM, Mbada CE, Oyeyemi AL, Fabunmi AA. Work-related musculoskeletal disorders among nurses in Ibadan, South-west Nigeria: a cross-sectional survey. *BMC MusculoskeletDisord*. 2010; 11: 12.
17. Yan P, Yang Y, Zhang L, Li F, Huang A, Wang Y et al. Correlation analysis between work-related musculoskeletal disorders and the nursing practice environment, quality of life, and social support in the nursing professionals. *Medicine (Baltimore)*. 2018; 97(9): e0026.

18. Eltayeb S, Staal JB, Hassan A, de Bie RA. Work related risk factors for neck, shoulder and arms complaints: a cohort study among Dutch computer office workers. *J Occup Rehabil.* 2009; 19(4): 315–322.
19. Ortiz-Hernández L, Tamez-González S, Martínez-Alcántara S, Méndez-Ramírez I. Computer use increases the risk of musculoskeletal disorders among newspaper office workers. *Arch Med Res.* 2003; 34(4): 331–42.
20. G Ariens, P Bongers, M Douwes, M Miedema, W Hoogendoorn, G van der Wal et al. Are neck flexion, neck rotation, and sitting at work risk factors for neck pain? Results of a prospective cohort study. *Occup Environ Med.* 2001; 58(3): 200–207.

## Tables

**Table 1. Characteristics of study subjects**

Variables	Total (n = 139)	Minimum	Maximum
Age (years)	30.24 ± 6.07	20.0	45.0
Height (cm)	160.49 ± 6.06	148.0	178.0
Weight (kg)	58.12 ± 10.94	38.0	90.0
BMI (kg/m <sup>2</sup> )	22.54 ± 3.91	15.94	37.78
Job tenure in the unit (years)	6.55 ± 5.28	0.0	24.0
Total job tenure (years)	8.12 ± 6.27	0.2	24.0
Mean working days per week	5.14 ± 5.11	4.0	6.0
Mean working hours per day	9.07 ± 1.34	4.0	20.0
Mean working hours using computer per day	4.79 ± 2.79	1.0	16.0
NDI	7.56 ± 4.76	2	28
ODI	3.43 ± 5.06	0	26

Values are expressed as mean ± standard deviation.

NDI, Neck Disability Index; ODI, Oswestry Disability Index.

**Table 2. NDI and ODI comparison of groups by age**

Age	No.	No	Mild Disability	Moderate Disability	Severe
			Disability	Disability	Disability
NDI	139 (100%)	0	109 (78.4%)	28 (20.2%)	2 (1.4%)
20–29 (years)	64 (46%)	0	53 (38.1%)	11 (7.9%)	0
30–39 (years)	61 (43.9%)	0	47 (33.8%)	12 (8.6%)	2 (1.5%)
40–49 (years)	14 (10.1%)	0	9 (6.5%)	5 (3.6%)	0
ODI	139 (100%)	47 (33.8%)	80 (57.5%)	8 (5.8%)	4 (2.9%)
20–29 (years)	64 (46%)	26 (18.7%)	33 (23.7%)	5 (3.6%)	0
30–39 (years)	61 (44%)	14 (10.1%)	40 (28.8%)	3 (2.2%)	4 (2.9%)
40–49 (years)	14 (10.1%)	7 (5.05%)	7 (5.05%)	0	0

Values are expressed as frequency (%). NDI, Neck Disability Index; ODI, Oswestry Disability Index.

Table 3. NDI and ODI comparison of groups by total job tenure

Total Job Tenure	No.	No	Mild	Moderate Disability	Severe
			Disability	Disability	Disability
NDI	139 (100%)	0	109 (78.4%)	28 (20.2%)	2 (1.4%)
<5 years	54 (38.9%)	0	46 (33.1%)	8 (5.8%)	0
5–10 years	6 (4.3%)	0	6 (4.3%)	0	0
10–15 years	33 (23.7%)	0	26 (18.7%)	7 (5.0%)	0
15–20 years	27 (19.4%)	0	17 (12.2%)	8 (5.8%)	2 (1.4%)
20–25 years	13 (9.4%)	0	9 (6.5%)	4 (2.9%)	0
>25 years	6 (4.3%)	0	5 (3.6%)	1 (0.7%)	0
ODI	139 (100%)	47 (33.8%)	80 (57.5%)	8 (5.8%)	4 (2.9%)
<5 years	54 (38.9%)	22 (15.8%)	28 (20.2%)	4 (2.9%)	0
5–10 years	6 (4.3%)	3 (2.15%)	3 (2.15%)	0	0
10–15 years	33 (23.7%)	7 (5.0%)	22 (15.8%)	3 (2.2%)	1 (0.7%)
15–20 years	27 (19.4%)	6 (4.3%)	17 (12.2%)	1 (0.7%)	3 (2.2%)
20–25 years	13 (9.4%)	5 (3.6%)	8 (5.8%)	0	0
>25 years	6 (4.3%)	4 (2.9%)	2 (1.4%)	0	0

Values are expressed as frequency (%). NDI, Neck Disability Index; ODI, Oswestry Disability Index.

Table 4. NDI and ODI comparison of groups by types of intensive care unit

Care Unit	No.	No Disability	Mild	Moderate Disability	Severe
			Disability	Disability	Disability
NDI	139 (100%)	0	109 (78.4%)	28 (20.2%)	2 (1.4%)
Medical	27 (19.4%)	0	20 (14.4%)	6 (4.3%)	1 (0.7%)
Surgical	59 (42.4%)	0	47 (33.8%)	12 (8.6%)	0
Paediatric	14 (10.1%)	0	11(7.9%)	3 (2.2%)	0
Respiratory care centres	39 (28.1%)	0	31 (22.3%)	7 (5.1%)	1(0.7%)
ODI	139 (100%)	47 (33.8%)	80 (57.5%)	8 (5.8%)	4 (2.9%)
Medical	27 (19.4%)	3 (2.2%)	19(13.6%)	3 (2.2%)	2 (1.4%)
Surgical	59 (42.4%)	26 (18.7%)	28 (20.1%)	4 (2.9%)	1 (0.7%)
Paediatric	14 (10.1 %)	3 (2.2%)	10 (7.2%)	1 (0.7%)	0
Respiratory care centres	39 (28.1%)	15 (10.8%)	23 (16.6%)	0	1 (0.7%)

Values are expressed as frequency (%). NDI, Neck Disability Index; ODI, Oswestry Disability Index.

## Supplementary Files

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