
PUBLIC HEALTH RESEARCH

Musculoskeletal Disorders (MSDs) and Their Related Factors Among Nurses in a Private Hospital in Muar District, Johor

Mohd Khairul Amirin bin Khalid^{1,2} & Mohd Hasni bin Ja'afar^{*1}

¹Department of Public Health Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia, Malaysia

²KPJ Bandar Maharani Specialist Hospital, Muar, Johor, Malaysia.

*Corresponding author: drmhasni@ukm.edu.my

ABSTRACT

Introduction	MSDs are a major occupational health concern among nurses due to the physically demanding nature of their work. Despite global recognition, local data in private hospitals in Malaysia remains scarce. This study aims to address this gap by assessing the prevalence of MSDs among nurses in a private hospital setting. Additionally, it intends to examine the associations between MSDs and various sociodemographic, lifestyle, occupational, and psychosocial factors, while also exploring the potential mitigating role of ergonomic awareness in reducing MSD-related risks.
Methods	A cross-sectional study was conducted from June to July 2024 among nurses at a private hospital in Muar, Johor. A total of 103 nurses (n=103) who met the inclusion criteria were recruited using universal sampling (73% response rate). Data were collected using a set of validated, self-administered questionnaires, including the Modified Nordic Questionnaire (MNQ), the Occupational Factor Questionnaire (OFQ), the Workplace Stress Scale (WSS), and the Ergonomic Knowledge Questionnaire (EKQ). All data were analysed using IBM SPSS Statistics version 27.0 with simple and multiple logistic regression to identify significant associations (p<0.25).
Results	The 12-month prevalence of MSDs was 90.3%, with the lower back (86.7%), neck (86.0%), and shoulder (85.0%) being the most affected regions. In simple logistic regression, repetitive tasks were significantly associated with MSDs, and this association remained significant in the multiple logistic regression model (adjusted OR=4.50, 95% CI: 1.11–18.30, p=0.036).
Conclusions	Stress at work is the strongest determinant of musculoskeletal pain among the ultrasound machine operators, this is followed by uncomfortable use of ultrasound transducers, and lastly the higher number of patients examined in one day.
Keywords	Musculoskeletal disorders; nurses; ergonomic awareness; private hospital, occupational health

Article history:

Received: 27 July 2025

Accepted: 23 February 2026

Published: 5 March 2026

INTRODUCTION

MSDs represent a major occupational health challenge globally, particularly among nursing professionals who are routinely exposed to physically demanding tasks.^{1,2} These activities include patient lifting, prolonged standing, awkward postures, and repetitive movements, all of which place nurses at a high risk of developing MSDs.^{3,4} The World Health Organisation and International Labour Organisation recognise MSDs as a leading cause of work-related disability and absenteeism worldwide.⁵ MSDs affect muscles, joints, tendons, and supporting structures, potentially resulting in chronic pain, functional limitation, and reduced quality of life.⁶

Recent evidence continues to demonstrate a high burden of MSDs among nurses in Southeast Asian healthcare settings. A systematic review and meta-analysis published in 2025 reported that more than 80% of nurses in Asia experienced work-related MSDs, with the lower back, neck, and shoulders being the most commonly affected regions.⁷ In Malaysia, a hospital-based study conducted in 2025 identified a prevalence of work-related MSDs of 95.1% among nurses, with repetitive tasks, manual handling, and prolonged standing emerging as significant contributing factors.⁸ These findings highlight the persistent occupational burden of MSDs in the region and underscore the need for updated and context-specific evidence.

In Malaysia, national statistics consistently report MSDs as one of the top three occupational diseases.⁹ However, most local research has predominantly focused on public healthcare institutions, resulting in a limited understanding of MSDs within private hospital settings. Differences between public and private hospitals in terms of work environment, equipment availability, patient load, and staffing ratios may influence the risk and pattern of MSDs among nurses. Previous Malaysian studies have indicated that variations in workload, physical demands, and ergonomic conditions across healthcare settings may contribute to differences in musculoskeletal health outcomes.⁸

Understanding the prevalence and contributing factors to MSDs within private healthcare settings is essential to inform targeted ergonomic interventions and improve occupational health outcomes. Given that most existing local research has focused on public hospitals, this study addresses a critical gap by evaluating MSDs in a private hospital setting. Differences in workplace conditions, staffing ratios, and ergonomic infrastructure between public and private hospitals may substantially affect the prevalence and risk profile of MSDs among nurses.² His study was conducted in a private hospital in Muar, Johor, to assess the prevalence of MSDs among nurses and to

identify associated sociodemographic, individual lifestyle, occupational, psychosocial, and ergonomic awareness factors. In this study, MSDs were defined as self-reported pain, discomfort, or symptoms such as numbness, tingling, or aching in any of the nine anatomical regions listed in the Modified Nordic Questionnaire (MNQ), occurring within the past 12 months and lasting for at least 24 hours.¹⁰

METHODS

A cross-sectional study was conducted at a private specialist hospital in Muar District, Johor, Malaysia. The hospital has been operational since June 2014 and had 141 nursing staff at the time of the study. The target population comprised all registered nurses working at the hospital. Universal sampling was used to recruit eligible participants based on the inclusion and exclusion criteria. A total of 103 eligible nurses participated in the study, yielding a response rate of 73.0%.

Inclusion criteria include a registered staff nurse who has worked at least three months (completed probation), aged between 20 and 50 years, and provided informed consent. Exclusion criteria included nurses with a prior diagnosis of chronic MSDs before employment, those who were pregnant, on medical or maternity leave, or undergoing post-basic training. Sample size was calculated using the Kish formula based on a 95% estimated prevalence of MSDs by Rahman et al. (2021) with 5% margin of error, and 20% anticipated attrition.¹¹ The final required sample size was 88.

Data were collected using a structured, self-administered online questionnaire comprising five sections: Section A covered sociodemographic and lifestyle characteristics; Section B assessed occupational factors related to work environment and physical workload; Section C utilised the Modified Nordic Questionnaire (MNQ) to assess MSD symptoms; Section D employed the Workplace Stress Scale (WSS) to evaluate psychosocial stress factors; and Section E assessed ergonomic knowledge using the Ergonomic Knowledge Questionnaire (EKQ). These instruments were validated through expert review and pilot testing. The MNQ assessed symptoms in nine anatomical regions over the past 12 months and the past 7 days.

A pilot test involving 10 respondents was conducted to ensure clarity and reliability of the questionnaire. Cognitive debriefing and reliability testing were performed, with all scales demonstrating acceptable internal consistency (Cronbach's alpha >0.7). Questionnaires with incomplete responses were excluded from analysis, and complete-case analysis was performed as there were no significant missing data.

Data was analysed using IBM SPSS Statistics version 27. Descriptive statistics were applied to summarise sociodemographic characteristics. Simple logistic regression (SLR) was used to identify variables associated with MSDs, with factors meeting the $p < 0.25$ criterion included in the multiple logistic regression (MLR) model. Multicollinearity was assessed prior to MLR analysis using variance inflation factor (VIF) and tolerance values, with no evidence of significant multicollinearity observed. A 95% confidence interval and $p < 0.05$ were used to determine statistical significance.

Ethical approval was obtained from the UKM Research Ethics Committee (UKM PPI/111/8/JEP-2023-645) and the KPJ Healthcare Ethics and Research Committee. Informed consent was obtained from all participants before data collection.

RESULTS

Prevalence of MSDs among Nurses

Table 1 12-month prevalence of MSDs among nurses (n=103)

Participant's characteristics	Categories	n (%)
MSDs	No	10 (9.7)
	Yes	93 (90.3)

Table 2 Symptom reported during the last 12 months and 7 days (n=103)

Body region	Symptoms in the last 12 months				Symptoms in the past 7 days			
	No		Yes		No		Yes	
	N	%	n	%	n	%	n	%
Neck	42	40.8	61	59.2	71	68.9	32	31.1
Shoulder	51	49.5	52	50.5	75	72.8	28	27.2
Elbows	97	94.2	6	5.8	98	95.1	5	4.9
Hands/Wrist	68	66.0	35	34.0	84	81.6	19	18.4
Upper back	61	59.2	42	40.8	80	77.7	23	22.3
Lower back	31	30.1	72	69.9	60	58.3	43	41.7
Hip/Thighs	77	74.8	26	25.2	84	81.6	19	18.4
Knee	60	58.3	43	41.7	80	77.7	23	22.3
Foot/ankle	57	55.3	46	44.7	76	73.8	27	26.2

Sociodemographic and Lifestyle Characteristics

The median age of the participants was 32 years (IQR: 28–36), with most being female (94.2%) and Malay (96.1%). The majority were married (69.9%) and had Diploma qualifications (88.3%). Median household income was RM4600 (IQR: RM3000–6000), with 67.0% classified under the B40 income group. In terms of lifestyle, 28.2% of nurses had a normal BMI, while 64.1% were overweight or obese. All participants were non-smokers. However, 62.1% reported insufficient physical activity, with a median Godin leisure-time exercise score of 31 units

The study revealed a high 12-month prevalence of MSDs among nurses, with 90.3% (n=93) of respondents reporting symptoms in at least one body part over the past 12 months (Table 1). The observed burden of MSDs reflected the substantial physical strain encountered by nurses, arising from the demanding nature of nursing tasks such as prolonged standing, repetitive movements, and patient handling.

The 12-month prevalence of musculoskeletal symptoms was highest in the lower back (69.9%), neck (59.2%), and shoulders (50.5%). In the past 7 days, 61.2% of nurses reported symptoms in at least one body region, with the lower back (41.7%) again being the most affected, followed by the neck (31.1%) and shoulders (27.2%). These findings highlighted persistent strain in key body areas commonly engaged during routine nursing tasks (Table 2).

(IQR: 17–48), indicating generally low engagement in regular exercise (Table 3).

Occupational Factors

Most nurses (82.5%) worked in a shift system, with 75.8% performing at least one night shift per month and 12.6% exceeding eight-night shifts monthly. The median work experience was 9 years (IQR: 5–14), and over 63% worked 41–50 hours per week. Nurses reported a median of 2 locum shifts per month (IQR: 1–5) and a short rest period of 20 minutes per shift (IQR: 10–30), with 61.2% reporting physical tiredness after work.

Occupational physical demands were prominent: 77.7% frequently bent their backs, 84.5% performed repetitive tasks, and 68.0% stood for prolonged periods. Though 90.3% received assistance in lifting, 63.1% still frequently

transferred dependent patients. Furthermore, 41.7% reported working beyond their physical limits, and 30.1% maintained the same posture for most of their shift, all of which may contribute to the risk of MSDs.

Table 3 Sociodemographic and lifestyle factors of participants (n=103)

Participant's characteristics	Categories	n (%)	Median (IQR)
<i>Sociodemographic:</i>			
Age (years)			32 years (IQR: 28-36 years)
Age group	21-30 years old	37 (35.9)	
	31-40 years old	54 (52.4)	
	41-50 years old	12 (11.7)	
Gender	Male	6 (5.8)	
	Female	97 (94.2)	
Race	Malay	99 (96.1)	
	Non-Malay	4 (3.9)	
Marital status	Single	28 (27.2)	
	Married	72 (69.9)	
	Widow(er)/Divorcee	3 (2.9)	
Education level	Diploma	91 (88.3)	
	Bachelor	12 (11.7)	
Household income (RM)			RM4600 (IQR: RM3000-6000)
	B40 (<RM5740)	69 (67.0)	
	M40 (RM5740-RM11919)	31 (30.1)	
	T20 (>RM11919)	3 (2.9)	
<i>Lifestyle factor:</i>			
BMI	Underweight	8 (7.8)	
	Normal	29 (28.2)	
	Overweight	35 (34.0)	
	Obese	31 (30.1)	
Smoking status	Non-smoker	103 (100.0)	
Godin Leisure-Time Exercise (units)			31 units (IQR: 17-48 units)
	Active	8 (7.8)	
	Moderate	31 (30.1)	
	Insufficient	64 (62.1)	

Abbreviations: SD standard deviation, RM Ringgit Malaysia, BMI body mass index
Continuous data is presented as median (IQR) due to the skewness

Psychosocial Factors

Based on the Workplace Stress Scale, most participants experienced low to moderate stress levels. Nearly half (49.5%) were categorised as “chilled out or relatively calm,” while 28.1% had low stress. Moderate to severe stress was reported by 21.4%, with only 1.0% falling into the “potentially dangerous” category. These findings suggested psychosocial stress exists but may not be a dominant factor influencing MSD risk in this population. MSDs in this population were more strongly influenced by physical and ergonomic factors, such

as repetitive tasks and manual handling, than by psychosocial stress. Furthermore, the use of self-reported stress measures may have contributed to misclassification, potentially attenuating the observed association.

Awareness of Ergonomic Practices at the Workplace

The study found that most nurses were aware of ergonomic practices, with 58.3% having encountered the term through media and 57.3% via hospital posters. Over 70% reported understanding the meaning of ergonomics, and many

acknowledged its benefit where 45.6% agreed and 25.2% strongly agreed that ergonomics improves comfort, productivity, and job satisfaction. Nearly half agreed it could reduce stress and emotional strain.

Nurses recognised the adverse effects of poor ergonomic practices, including back pain and fatigue, and supported interventions such as forming ergonomic committees (45.6%) and organising awareness programs (40.7%). Despite a high awareness level (mean score: 3.65 for knowledge, 3.79 for benefits), practical application remained moderate (mean: 3.27), indicating the need for improved implementation efforts (overall score: 3.62).

Association between Selected Factors and MSDs

Sociodemographic and Lifestyle Factors

The study found no statistically significant association between MSDs and sociodemographic characteristics such as age, gender, race, marital status, education level, or household income. Although Malay nurses had a higher prevalence of MSDs (91.9 per cent) compared to non-Malays (50.0 per cent), this was not statistically significant (p=0.056). Similarly, BMI was not significantly associated with MSDs despite a higher prevalence among underweight and overweight participants. All participants were non-smokers. Physical activity levels, based on the Godin Leisure-Time Exercise questionnaire, also showed no significant association with MSDs (p=0.541).

Occupational Factors

Work environmental factors such as department, shift work, on-call duties, overtime, and rest time showed no significant association with MSDs. Physical factors, including bending, prolonged standing, repetitive tasks, awkward postures, and lifting tasks, were linked with higher MSD

prevalence but did not reach statistical significance. Notably, working beyond physical limits (97.7 per cent vs. 85.0 per cent, p=0.071) and performing repetitive tasks (93.1 per cent vs. 75.0 per cent, p=0.074) showed trends toward significance.

Psychosocial Factors

Workplace stress levels, categorised using the Workplace Stress Scale, were not significantly associated with the presence of MSDs (p=0.590). Although MSD prevalence was high in those with moderate to high stress levels, the association was not statistically significant.

Awareness of Ergonomic Practices

Awareness of ergonomic practices, including knowledge, perceived benefits, understanding of effects, and steps taken, did not show a significant relationship with MSDs. Despite a high level of awareness among participants, this did not correspond to a lower incidence of MSDs.

Simple and Multiple Logistic Regression Analysis

Simple logistic regression was conducted to identify factors associated with MSDs, focusing on occupational, psychosocial, and ergonomic awareness variables. Performing repetitive tasks was found to be significantly associated with MSDs. Nurses who engaged in repetitive tasks were 4.5 times more likely to experience MSDs (Crude OR=4.50, 95% CI: 1.11–18.30, p=0.036). (Table 4)

Several other variables showed a trend toward significance, including working beyond physical limits (OR = 7.41, 95% CI: 0.90–60.89, p=0.062), standing for long periods (OR = 3.67, 95% CI: 0.96–14.03, p=0.058), and keeping the head low for extended periods (OR = 3.15, 95% CI: 0.64–15.66, p=0.160), though these did not reach statistical significance at the p<0.05 level.

Table 4 Factors associated with MSDs (n=103)

	Simple Logistic Regression			Multiple Logistic Regression		
	B	Crude OR (95% CI)	P-value	B	Adjusted OR (95% CI)	P-value
1. Head remains low for a long time at work (Ref=No)	1.15	3.15 (0.64, 15.66)	0.160			
2. Standing for a long time (Ref=No)	1.30	3.67 (0.96, 14.03)	0.058			
3. Work over physical limits (Ref=No)	2.00	7.41 (0.90, 60.89)	0.062			
4. Perform repetitive task (Ref=No)	1.50	4.50 (1.11, 18.30)	0.036	1.50	4.50 (1.11, 18.30)	0.036

DV: MSDs, Yes=1

Assumptions for multiple logistic regression were met. The model was supported by the Omnibus Test (p=0.081), with a Nagelkerke's R²

of 0.164, indicating that 16.4 per cent of MSD variability was explained by the model. The Hosmer-Lemeshow test (p=0.514) confirmed a good

model fit, and the ROC analysis showed an AUC of 0.768 (95% CI: 0.603–0.933, $p=0.006$), reflecting moderate to good discriminative abilities.

In the final multiple logistic regression model (forward method), repetitive tasks remained a significant predictor of MSDs, with an adjusted OR of 4.50 (95% CI: 1.11–18.30, $p=0.036$). This indicated that repetitive work significantly increases the odds of developing MSDs. Other physical workload factors did not retain significance, suggesting the need for further investigation in larger or more targeted studies.

DISCUSSION

This study found a high prevalence (90.3%) of MSDs among nurses working in a private hospital in Muar, Johor, with the lower back (86.7%), neck (86.0%), and shoulders (85.0%) being the most affected regions. These findings are in line with previous studies conducted at public hospitals in Malaysia, which similarly reported elevated MSD rates among nurses in public healthcare settings.^{2,12} The similarity of findings across public and private institutions suggests that MSDs remain a persistent occupational health issue among nurses regardless of healthcare setting, staffing patterns, or resource availability.

Among the investigated risk factors, repetitive tasks emerged as the only significant variable associated with MSDs in both simple and multiple logistic regression analysis (adjusted OR=4.50; 95% CI: 1.11–18.30). This result suggests that repetitive movement is a critical and independent predictor of musculoskeletal strain, consistent with findings from international studies that demonstrate biomechanical overload as a key contributor to MSDs.^{13,14} Nurses are routinely exposed to task repetition, such as charting, medication preparation, patient repositioning, and wound care, which cumulatively impose physical strain on specific muscle groups.^{3,15,16}

The elevated burden of MSDs identified in this study likely reflects sustained exposure to repetitive tasks, awkward postures, and prolonged standing during routine nursing activities.¹⁷ The significant association between repetitive tasks and MSDs reinforces the role of biomechanical stress in the development of these disorders, supporting findings from earlier research.^{2,13,14}

From a practical perspective, these findings highlight the need for targeted workplace interventions within private hospital settings. Hospital administrators should consider implementing periodic ergonomic risk assessments, structured job rotation systems, and scheduled micro-breaks to reduce repetitive strain. In addition, reinforcing correct body mechanics, providing ergonomic equipment, and integrating ergonomics into routine clinical practice may help translate

existing ergonomic knowledge into sustained behavioural change and reduce the burden of MSDs among nurses.

Contrary to expectations from previous studies, psychosocial stress and ergonomic awareness were not statistically significant in the multivariate analysis.^{16,17} Although nearly half of the participants reported moderate to high stress levels and 92.2% demonstrated good ergonomic awareness, only 48.5% reported consistently applying ergonomic practices. This finding suggests that awareness alone may be insufficient without organisational support, adequate staffing, and feasible opportunities to apply ergonomic principles during routine nursing tasks.¹⁷

Lifestyle and sociodemographic variables such as BMI, smoking, exercise, age were also not significantly associated with MSDs in this study. This is consistent with findings from a study in Vietnam¹⁸ and Turkey¹⁹ in 2022, which suggest that physical workload plays a more prominent role than individual characteristics.

This study has several limitations. The cross-sectional design restricts the ability to establish causal relationships between identified risk factors and MSDs. Data collection relied on self-reported questionnaires, which may be subject to recall or reporting bias. Furthermore, as the study was conducted in a single private hospital, the findings may not be generalisable to all private healthcare settings in Malaysia.

CONCLUSION

This study demonstrates a widespread occurrence of MSDs among nurses in a private hospital setting, particularly involving the lower back, neck, and shoulder regions. Repetitive tasks were the primary factor associated with MSDs, remaining significant even after multivariate analysis. This finding emphasises the need for task redesign, incorporation of micro-breaks, and implementation of structured job rotations to interrupt repetitive work patterns and reduce biomechanical stress.

Although ergonomic awareness among nurses was relatively high, its practical application was limited, suggesting a gap between knowledge and implementation. Institutional policies should therefore focus not only on ergonomic education but also on the enforcement of safe work practices and the provision of scheduled rest breaks.

Improving workplace ergonomics through staff rotation, use of mechanical aids, and ongoing training is essential to mitigate the risk and consequences of MSDs. In the long term, fostering a healthier work environment will help sustain occupational health and enhance workforce productivity.

ACKNOWLEDGEMENT

The author expresses sincere gratitude to all lecturers and staff of the Department of Public Health Medicine, Universiti Kebangsaan Malaysia (UKM), and to the KPJ Bandar Maharani Specialist Hospital management for their support and cooperation during data collection.

Special thanks to Dr. Noor Khairiyah Mustafa, Prof. Rosley Jaafar, and the American Institute of Stress for providing validated research instruments. Deepest appreciation also goes to the author's family, especially parents Haji Khalid bin Abdullah and Hajjah Che Mek Kamariah binti Che Yem, and wife Dr. Nurul Farah Nadia binti Suradi for their unwavering support and encouragement.

CONFLICT OF INTEREST

The author declares no conflict of interest.

REFERENCES

1. Afsharian A, Dollard MF, Glozier N, Morris RW, Bailey TS, Nguyen H, et al. Work-related psychosocial and physical paths to future musculoskeletal disorders (MSDs). *Saf Sci*. 2023;164(July 2022).
2. Krishnan KS, Raju G, Shawkataly O. Prevalence of work-related musculoskeletal disorders: Psychological and physical risk factors. *Int J Environ Res Public Health*. 2021;18(17).
3. NAOUM S, MITSEAS P, KOUTSERIMPAS C, SPINTHOURI M, KALOMIKERAKIS I, RAPTIS K, et al. Musculoskeletal Disorders and Caring Behaviors among Nursing Staff in Greek Hospitals: a Prospective Multicenter Study. *Maedica - A J Clin Med*. 2022;17(1).
4. Dimitriou C, Alegakis A, Karageorgiou I, Mantadaki AE, Symvoulakis EK. Original Paper Stress and Prevalence of Musculoskeletal Disorders Among the Nursing Personnel of a Tertiary Hospital Unit in Greece: A Cross-Sectional Study. *Curr Heal Sci J*. 2023;49(1):45–53.
5. Mehrdad R, Dennerlein JT, Haghghat M, Aminian O. Association between psychosocial factors and musculoskeletal symptoms among Iranian nurses. *Am J Ind Med*. 2010;53(10):1032–9.
6. Punnett L, Wegman DH. Work-related musculoskeletal disorders: The epidemiologic evidence and the debate. *J Electromyogr Kinesiol*. 2004;14(1):13–23.
7. Jacquier-Bret J, Gorce P. Prevalence of Body Area Work-Related Musculoskeletal Disorders among Healthcare Professionals: A Systematic Review. *Int J Environ Res Public Health*. 2023;20(1).
8. Anak Nicholas Felix S, Siew WF. Prevalence, Associated Factors, and Risk Management Practices of Work-Related Musculoskeletal Disorders Among Registered Nurses in Hospitals in Sarawak, Malaysia. *SAGE Open Nurs*. 2025;11(23).
9. Department of Statistics Malaysia. Big Data Analytics: National Occupational Accident and Disease Statistics 2021. *Stat Malaysia [Internet]*. 2022;(June):9. Available from: <https://www.dosm.gov.my/v1/index.php?r=column/pdfPrev&id=YzI2NWE2U0tXS1VEdnFsWHpqM1Fudz09>
10. Zenbaba D, Sahiledengle B, Dibaba D, Tufa T, Mamo A, Atlaw D. Work-Related Musculoskeletal Symptoms and Associated Factors Among Academic Staff in Ethiopian Universities. 2022;
11. Rao JNK, Kish L. Survey Sampling. *Biometrics*. 1969;25(3):603.
12. Rahman SHA, Rasdi I, Karrupiah K, Abdullah AM. Risk Factors of Musculoskeletal Symptoms among Healthcare Workers in a Public Hospital. *Malaysian J Med Heal Sci*. 2021;17(4):80–8.
13. Yan P, Li F, Zhang L, Yang Y, Huang A, Wang Y, et al. Prevalence of Work-Related Musculoskeletal Disorders in the Nurses Working in Hospitals of Xinjiang Uygur Autonomous Region. *Pain Res Manag*. 2017;2017.
14. Jaffar NAT, Rahman MNA. Review on risk factors related to lower back disorders at workplace. *IOP Conf Ser Mater Sci Eng*. 2017;226(1).
15. AzizAli N, Sreedharan J. Ergonomic awareness and practices to prevent musculoskeletal disorder among healthcare workers in UAE: A cross-sectional study. *J Bodyw Mov Ther [Internet]*. 2024 Oct;40:1973–8. Available from: <https://linkinghub.elsevier.com/retrieve/pii/S1360859224004467>
16. Ithnin A, Kong D, Venkataraman S. Occupational Risk Factors for Carpal Tunnel Syndrome among Nurses in Medical. *Int J Public Heal Res*. 2012;2(2):137–43.
17. Sazarina N, Isa M, Baba DM, Sahani M, Ahmad, Rasdan I. Personal and Psychosocial Risk Factor for Low Back Pain among. *Public Heal Res*. 2012;4(1):412–8.
18. Viet Thuy N. Work-related Musculoskeletal Disorders Among Healthcare Workers in a General Provincial Hospital in Vietnam. *Soisuda Kesornthong Nontiya Homkham Int J Ergon*. 2019;(10):2020–38.
19. Serol Deveci CC. Evaluation Of Musculoskeletal Complaints Of Health Workers In Training Material-Method.

2022;7(1):1–14. Available from:
<https://www.proquest.com/docview/2627997413/8A0F279B88C14E5DPQ/34>.