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Factors Determinants of Musculoskeletal Disorders among Nurses in Indonesia: Evidence from A Cross-Sectional Study

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A B S T R A C T

Introduction: Musculoskeletal disorders (MSDs) remain a significant occupational health issue among nurses, influenced by demographic factors, workload, stress, and ergonomic posture. Nurses are particularly vulnerable due to heavy physical demands, non-ergonomic postures, and psychosocial pressures. **Objective:** This study aimed to determine factors that contribute to MSDs among nurses in Indonesia. **Methods:** A quantitative descriptive design was employed with a convenience sampling method. Data were collected from nurses in a one-month period in September–October 2024. Four validated instruments were used consisting of the Nordic Musculoskeletal Questionnaire (NMQ), the NASA Task Load Index (NASA-TLX), REBA (Rapid Entire Body Assessment) and HSE (Health and Safety Executive). Health Data was analyzed using bivariate (ANOVA) with SPSS Version 25. **Results:** A total of 108 participants agreed to participate in this study. The majority of respondents were aged 26–45 years (67.6%), and most were female. Findings revealed a significant relationship between work burden, work stress, and work duration with MSDs. **Conclusion:** Factors contributing to MSDs among nurses are work burden, work stress and work duration with MSDs. Hospital management should implement workload evaluations, shift management, and ergonomic training, while the nursing profession should strengthen awareness of proper working postures, physical health maintenance, and stress management strategies.

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1. INTRODUCTION

Musculoskeletal disorders (MSDs) contribute the highest burden for individual rehabilitation services and remain a significant global health challenge (Cieza et al., 2020). Evidence shows that nurses are particularly vulnerable, with high prevalence rates throughout countries, with more than >70% cases in China, Palestine, Iran, Turkey, and others (Arsalani et al., 2014; Wang et al., 2024; Yilmaz & Isik Andsoy, 2022; Zaitoon et al., 2024). These findings underscore the global and national urgency to address MSDs, particularly among healthcare professionals. A multifaceted impact from MSDs varied from disrupted physical well-being, decreased working ability, professional performance, QoL, and both sickness absence and presence among nursing professionals (Kolovou et al., 2025; Wåhlin et al., 2022)

The injured body parts related to MSDs among nurses are the lower back, neck, and shoulder, caused by non-ergonomic positions, inadequate rest, being overweight, and working long shifts (Alrimali et al., 2024; Sun et al., 2023). Musculoskeletal complaints may interfere with nurses' ability to deliver caring behavior, reducing productivity and potentially affecting both staffing and institutional performance(Kang et al., 2025; NAOUM et al., 2022). Common nursing tasks, including lifting, pushing, or transferring patients, as well as prolonged standing or walking during 6–9-hour shifts, are key predisposing factors. Moreover, incorrect body posture while performing tasks further compromises health and occupational safety (Soylar & Ozer, 2018; Yanti et al., 2024)

MSDs are influenced by multiple determinants, including occupational, individual, environmental, and psychosocial factors. (Bezzina et al., 2023; Demissie et al., 2024) Occupational factors include posture, excessive muscle strain, repetitive activities, force or load, and prolonged work duration. Individual factors include age, gender, smoking habits, physical fitness, strength, length of service, work attitude, and environmental contributors include microclimate, lighting, and vibration, while psychosocial influences encompass job satisfaction, mental stress, and organizational conditions (Popova et al., 2025; Soares et al., 2019)

Work-related stress arises from internal (physical and emotional) as well as external (social and environmental) pressures. When these exceed adaptive capacity, stress can provoke adverse physiological responses that diminish work performance(Babapour et al., 2022; Dartey et al., 2023). High levels of occupational stress, coupled with low motivation, have been found to negatively impact hospital service quality. Stressed nurses may demonstrate unprofessional behaviors and provide suboptimal care, which ultimately harms both patients and healthcare institutions. Understanding the complex etiology of MSDs among nurses requires a comprehensive theoretical framework that accounts for the multifaceted nature of these disorders. This study adopts a Job Demands-Resources (JD-R) Model to provide a holistic understanding of WMSD development(Bakker & Demerouti, 2007). Indonesia lacks regulatory standards for safe patient handling equivalent to those in the United States (OSHA guidelines) or the European Union (Manual Handling Directive), and the absence of MSDs from the official list of compensable occupational diseases in Indonesian insurance healthcare systems

Given the substantial burden of MSDs, various factors among nurses in Indonesia (work stress and burden) and the multifactorial risks associated with nursing practice, research is urgently needed to better understand the occupational, individual, and psychosocial determinants of MSDs

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among nurses. Such insights will provide evidence-based foundations for preventive strategies and organizational policies aimed at improving nurse well-being and sustaining high-quality patient care. Based on the background described above, this research was to determine factors that contribute of Musculoskeletal Disorders Among Nurses in Indonesia.

2. METHODS

Research Design

This research is a cross-sectional study using an approach to examine factors that contribute to musculoskeletal disorders (MSDs) among nurses in Indonesia

Population and Sample

The population in this study is one of the largest hospitals in Indonesia. A convenience sampling method was used. Sample size estimation was performed a priori using G*Power 3.1 with a two-tailed t-test, assuming a medium effect size (Cohen's d = 0.50), significance level $\alpha = 0.05$, and statistical power of 80%. The calculation indicated a minimum required sample of 85 participants. By allowing for a 10% non-response rate, the adjusted sample size was 94. In this study, data were collected from 108 participants, exceeding the minimum requirement and thereby ensuring adequate statistical power.

Instrument

The instruments used in this study consisted of four instruments. First is Nordic Musculoskeletal Questionnaire (NMQ) to assess musculoskeletal complaints, and a structured questionnaire to evaluate workload, occupational stress, and ergonomic posture. (Kuorinka et al., 1987) The NMQ is a standardized and widely used instrument for assessing musculoskeletal complaints in nine body regions (neck, shoulders, elbows, wrists/hands, upper back, lower back, hips/thighs, knees, and ankles/feet) within the last 7 days and the last 12 months (Crawford, 2007) The NMQ has been translated and validated in various languages, including Indonesian, and has shown high reliability for identifying musculoskeletal disorders in occupational groups (Dewi, 2020). The 2nd questionnaire is the NASA Task Load Index (NASA-TLX) to measured workload. Each dimension is rated on a 20-point scale, and scores can be averaged to obtain an overall workload index. The NASA-TLX has demonstrated excellent sensitivity and reliability across occupational contexts, including nursing and healthcare settings (Hart & Staveland, 1988). The third is REBA (Rapid Entire Body Assessment) (McAtamney & Hignett, 2004) was used to evaluate ergonomic risk factors associated with work postures. REBA assesses body segments including the trunk, neck, legs, and upper limbs, as well as load, coupling, and activity characteristics. Each posture was observed, scored, and classified into a final risk level ranging from negligible (0) to very high (11-15), and the last is HSE (Health and Safety Executive), a 35-item questionnaire to assess an organization's performance in managing work-related stress and already translated into Bahasa Indonesia version with 0.5-0.9 Alpha Cronbach indicating good reliability. (Grasiaswaty et al., 2022)

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Research Procedure

This study was conducted in one month during September-October 2024. Respondents filled a self-measurement questionnaire to assess factors that determine of MSDs among nurses in Indonesia. Demographic characteristics were also obtained.

Data Analysis

A total of 108 respondents agreed to participate in this study. Data analysis was conducted using univariate analysis to describe participant characteristics and bivariate analysis with the Chi-square test to examine associations between variables. All analyses were performed using IBM SPSS (Statistical Package for the Social Sciences) version 25.

Ethical Clearance

This study was conducted in accordance with the principles of 7 (seven) WHO 2011 standards referring to2016 CIOMS Guideline Ethical approval was obtained from the Health Research Ethics Committee of STIKEP PPNI Jawa Barat (Approval No. III/103/KEPK-SLE/STIKEP/PPNI/JABAR/IX/2024). All participants received information about the study objectives and procedures, and written informed consent was obtained before participation. Confidentiality and anonymity of data were strictly maintained throughout the research process.

3. RESULT

Table 1. Demographic Characteristics of Nurses (n=108)

Variables Respondents	Mean ± SD/(min-max)	n(%)
Age (years old)	37.45 ± 8.25/ 22 - 48	
17-25		17 (15.7)
26-45		71 (65.7)
>46		20 (18.5)
Gender		
Male		51 (47.2)
Female		57 (52.8)
Education		
Diploma III Nursing		24 (22.2)
Bachelor of Nursing		84 (77.8)
Occupation		
Full-time Employment		17 (15.7)
Contract Employment		91 (84.3)
Work Duration (years)	8.88 ± 4.23 / 1-15	
<5		15 (13.9)
6-10		55 (50.9)
>11		38 (35.2)
MSDS Risk - NMQ	40.35 ± 7.67 / 25-54	
No Risk <28		10 (9.3)
Low Risk (28-49)		89 (82.4)
Moderate Risk (50-70)		9 (8.3)
Work Burden - NASA-TLX		
Moderate		74 (68.5)
Severe		34 (31.5)
Work Stress - HSE		
Moderate		61 (56.5)
Severe		47 (43.5)
Ergonomic Position (REBA)		
Low Risk		46 (42.6)
High Risk		62 (57.4)

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Table 2. Prevalence of MSDs pain in the back and the extremities in the past 7 days

Body Parts	n (%)	95%CI
Neck	50 (46.3)	1.37-1.56
Upper back	66 (61.1)	1,52-1.7
Lower back	55 (50.9)	1.58-1.81
Shoulder	74 (68.5)	1.35-1.65
Elbow	73 (67.6)	1.43-1.7
Hand/Wrist	75 (69.4)	1.48-1.73
Hip	61 (56.5)	1.11-1.43
Knees	68 (63)	1.29-1.6
Foot/Ankles	77 (71.3)	1.6-1.79

Table 3. Factors that determine MSDs cases among nurses in Indonesia

Variables	t-test/F-test	95%CI	p-value
Age	4.27	1.92 - 2.14	0.41
Gender	1.23	1.43 - 1.62	0.29
Education	2.08	1.7 - 1.86	1.3
Work Duration	1.56	8.07 - 9.69	0.22
Work Burden	3.93	30.02 - 32.11	0.02*
Work Stress	2.82	105.51 - 115.61	0.05*
Ergonomic Position	3.91	3.19 - 3.85	0.02*

*p-value is significant at <0.005

Based on Table 1, the average age is 37.45 (SD± 8.25), with the youngest being 22 years old and 48 is the oldest. The majority of respondents were in the age range of 26–45 years, totaling 73 people (67.6%). The total of female nurses is 57 (52.8%), and the majority had the latest education, Diploma III Nursing is 84 (77.8%), being contract remaining 91 (84.3%). The mean work duration is 8.88 ± 4.23 / 1-15, with 55 (50.9%) nurses working in the range 6-10 years.

Table 1 depicts information that a total of 89 nurses (82.4%) in low risk of MSDs, have moderate work burden 74 (68.5%), work stress is 61 (56.5%), and have a high-risk risk position of 62 (57.4%).

Table 2 explains that shoulder pain is the highest complaint from nurses, with 74 (68.5%; 1.37-1.56 95% CI), whilst neck pain is the lowest, with a total is 50 (46.3%; 1.37-1.56). In bivariate analysis from Table 3 showed that work burden (3.93; 30.02-32.11), work stress (2.82;105.51-115.61), and ergonomic position (3.91; 3.19-3.85) were significantly associated with MSDs cases among nurses (p<0.005).

4. DISCUSSION

The present findings demonstrate that the majority of nurses are within the productive age group. Previous evidence (Horn et al., 2024; Legault et al., 2014) highlighted that low back pain (LBP) is more prevalent among women of reproductive age, particularly between 28 and 40 years, which represents a critical period characterized by peak activity levels, dual responsibilities and multitasking demands. These problems are caused by multifaceted integrating factors from biological, social, and occupational. From biological mechanisms, as the majority of nurses are female, their musculoskeletal system is underdeveloped and their vertebral smaller compared to males thus making them at high risk of osteoporosis or other conditions that lead to MSDs (Sun et al., 2023). In social and occupational aspects, inevitably, nurses with high job demands, poor social support, low interpersonal relationships,

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and emotional stress interact to create heightened vulnerability in female nurses of productive age in developing musculoskeletal disorders. High physical workloads contribute to the emergence of musculoskeletal complaints. Moreover, in Indonesian nursing contexts. which women predominantly occupy, knowledge and practice related to workplace ergonomics are still low (Balaputra & Sutomo, 2017; Devi Azhari, 2024; Yanti et al., 2024).

A workplace is also contributed because evidence show that nursing home nurses with limited mechanical assistance experienced higher shoulder and lower back problems than nurses in hospital. The longer an individual is exposed to physical workloads, the greater the risk of experiencing muscle and joint complaints (Wang et al., 2024). A recognized framework of Job Demand-Resources (JD-R) model explains both the mechanisms (physiological stress pathways activated by demand-resource imbalance) and moderators (resources that buffer negative effects) of MSD development in female nurses.

Work Stress and Musculoskeletal Disorders

This proportion further highlights a sharp difference based on work stress levels, reinforcing the notion that psychological stress can trigger or exacerbate physical complaints, including muscle and joint pain. This study is supported by (Soylar & Ozer, 2018), who demonstrated that chronic stress has an impact on the occurrence of musculoskeletal disorders (MSDs). In their study, stress was triggered by various factors such as ineffective work management, lack of social support, psychological pressure, conflicting job demands, and imbalance between work and family life. If stress persists over a long period, it can lead to the development of MSDs.

Work stress and workload, as part of psychosocial factors, also contribute to physical conditions and the potential for musculoskeletal disorders (MSDs). Psychosocial factors are closely related to the risk of MSDs, particularly as a result of high stress and pressure at work.(Santosa & Porusia, 2025). A key physiological pathway linking psychosocial stress to musculoskeletal pathology involves activation of the nervous system, induced arteriolar constriction, which compromises the microcirculatory delivery of nutrients to musculotendinous structures. This vascular insufficiency impedes the regeneration of micro-traumatic lesions within tendon fibers, consequently manifesting as muscle fatigue and pain symptomatology (Ekpenyong et al., 2013; Yaribeygi et al., 2017). Even though, the finding is clear that a gap remains open among Indonesia nurses, regarding gender-specific vulnerabilities, organizational moderators, and culturally-adapted interventions.

Ergonomic Posture and Musculoskeletal Disorders

This indicates that non-ergonomic body postures during work activities—such as bending, lifting, or pushing patients—can increase the risk of musculoskeletal injuries The (Jacquier-Bret & Gorce, 2023; Laal et al., 2022) findings of this study are supported by who showed a relationship between working posture and the incidence of musculoskeletal disorders (MSDs). These findings reinforce that working postures that do not follow ergonomic principles contribute to the occurrence of musculoskeletal complaints among workers. Therefore, the application of ergonomic postures is crucial in preventing the risk of MSDs in the workplace.

Other studies also reinforce the finding that non-ergonomic working postures play a major

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role in causing musculoskeletal complaints. Incorrect body posture significantly affects the occurrence of musculoskeletal pain among office workers. Static body positions over long periods can cause muscle stress, restrict blood flow, and lead to fatigue, which ultimately triggers tissue damage and musculoskeletal complaints. Thus, non-ergonomic working postures clearly contribute to the occurrence of work-related musculoskeletal disorders (WMSDs).

The authors acknowledge limitation of this study in design constraints (self-report bias and cross-sectional design); therefore, a longitudinal measurement is needed to strengthen the findings for future research with a larger sample size in various health environment both in urban and rural areas in Indonesia, considering different work burden

5. CONCLUSION

Three important factors contributing to MSDs among nurses are work burden, work stress and work duration. The findings of this study are expected to provide input for the management of the nursing profession in Indonesia in developing policies that support occupational health among nurses. This can be achieved through regular evaluation and adjustment of workloads, as well as effective management of work shifts, to minimize the risk of musculoskeletal disorders (MSDs). The results emphasize the importance of increasing awareness regarding ergonomic working postures, maintaining physical health, and managing work-related stress effectively. These measures are crucial in preventing musculoskeletal disorders and promoting nurses' overall well-being.In addition, focus to female-specific ergonomic needs should be addressed to overcome this issues.

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7. CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this study.

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