The relationship between physiotherapists' compliance with ergonomics implementation and work-related musculoskeletal disorders in Yogyakarta

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Abstract
The application of ergonomic guidelines is essential for the prevention of Work-related Musculoskeletal Disorders (WMSDs) among physiotherapists and for enhancing the quality of healthcare services. This study evaluates the relationship between physiotherapist compliance with ergonomics implementation and the incidence of Work-related Musculoskeletal Disorders (WMSDs) in the Special Region of Yogyakarta. A total of 244 physiotherapists, members of the Indonesian Physiotherapists Association in the Special Region of Yogyakarta, were selected through a purposive sampling technique for data collection. This research employed a quantitative correlation design with a cross-sectional methodology, utilizing a questionnaire for data collection and a chi-square test to assess statistical significance. This study demonstrates that the demographic characteristics of physiotherapists play a crucial role in the level of knowledge regarding Work-related Musculoskeletal Disorders (WMSDs), where the most vulnerable group with low knowledge comprises physiotherapists aged 21-30 years, male gender, holding a diploma degree (D3), specializing in musculoskeletal practice, and possessing 6-10 years of work experience and the statistical analysis indicated a significant relationship between knowledge of ergonomics and the occurrence of Work-related Musculoskeletal Disorders (WMSDs) ($p < 0.05$), as well as between ergonomics practices and the incidence of Work-related Musculoskeletal Disorders (WMSDs) ($p < 0.05$). The findings assess the significance of ergonomics in physiotherapy practice and highlight the importance of educational interventions and ergonomics training to enhance physiotherapists' adherence to ergonomic principles aimed at preventing Work-related Musculoskeletal Disorders (WMSDs).

Keywords: ergonomic; physiotherapy; work-related musculoskeletal disorders

1. Introduction

Work-related Musculoskeletal Disorders (WMSDs) are disorders of the musculoskeletal system caused by work activities. This condition can affect various body structures, including muscles, tendons, ligaments, nerves, cartilage, and blood vessels in the areas of the hands, feet, neck, and back (Yosineba et al., 2020). These disorders can be triggered and exacerbated by various factors, including work characteristics, work environment conditions, and individual work capacity (Khofiyya et al., 2019). The clinical manifestations of Work-related Musculoskeletal Disorders (WMSDs) are very diverse, ranging from mild to severe complaints including pain, numbness, tingling, swelling, stiffness, sleep disturbances, and burning sensations in the affected areas (Azzahri et al., 2020). Work postures that do not comply with ergonomic principles become one of the main factors causing workers to easily experience fatigue (Aminullah, 2022), where exposure to static loads for extended periods can cause progressive damage to ligaments, joints, and tendons (Nino et al., 2019).

Work-related Musculoskeletal Disorders (WMSDs) cause worker health problems and reduce work productivity because effective working time is reduced (Jamro et al., 2018). Among health workers, particularly physiotherapists, there is a high risk of experiencing musculoskeletal disorders due to work characteristics that involve repetitive activities and high physical loads, therefore a deep understanding of ergonomic principles becomes very important to prevent the occurrence of Work-related Musculoskeletal Disorders (WMSDs) in the workplace, where implementation of ergonomic principles can begin by changing individual attitudes and behaviors through compliance processes, problem identification, and consistent application in daily activities (Wurarah et al., 2020).

The problem of Work-related Musculoskeletal Disorders (WMSDs) described above becomes increasingly complex when related to aspects of ergonomics implementation in the workplace. Although ergonomic principles have been widely recognized as one of the main prevention strategies, non-compliance in their application remains a major challenge in various workplaces. Implementation of ergonomic principles in work environments, especially in hospitals, still receives inadequate attention from workers (Wijayanti, 2018). This becomes a serious concern because musculoskeletal disorders not only affect workers' physical health, but also impact work quality, quality of life, and overall worker

welfare. Therefore, implementation of more standardized protocols becomes an urgent need to reduce the risk of Work-related Musculoskeletal Disorders (WMSDs) occurring (Obaseki & Erhabor, 2023).

The importance of this problem is reflected in the high prevalence rates of Work-related Musculoskeletal Disorders (WMSDs) reported globally. Global data shows that Work-related Musculoskeletal Disorders (WMSDs) are a very serious health problem worldwide, with Global Burden of Disease (GBD) estimates showing approximately 1.71 billion people worldwide experience musculoskeletal disorders (WHO, 2022). In the context of the physiotherapy profession, WMSD prevalence shows more concerning figures, where several studies show prevalence rates among physiotherapists worldwide exceeding 80% (Khairy et al., 2019; Kinaci, E., & Ataoğlu, 2020; Wilhelmus Johannes Andreas et al., 2011). Even in some countries such as Korea, Australia, and the United States, the prevalence of Work-related Musculoskeletal Disorders (WMSDs) among physiotherapists reaches 90%. Meanwhile, the prevalence of WMSDs in Indonesia overall is recorded at 36.6% (Susilo, 2022).

Despite data showing high prevalence of Work-related Musculoskeletal Disorders (WMSDs), there is an interesting phenomenon in the context of knowledge and implementation of ergonomics. Research on physiotherapists' knowledge about ergonomics has been extensively conducted and shows that most physiotherapists have a good understanding of ergonomic principles. However, implementation of ergonomics in practice is still relatively low, indicating a gap between theoretical knowledge and practical application. This gap becomes an important concern given its impact on the risk of Work-related Musculoskeletal Disorders (WMSDs). On the other hand, research on the occurrence of Work-related Musculoskeletal Disorders (WMSDs) among physiotherapists in Indonesia is still limited, including research discussing physiotherapists' compliance in implementing ergonomics regarding the occurrence of Work-related Musculoskeletal Disorders (WMSDs). This limitation of information encourages the author to conduct further studies related to physiotherapists' compliance in implementing ergonomics regarding the occurrence of Work-related Musculoskeletal Disorders (WMSDs).

2. Method

The main focus of this research is to analyze the level of physiotherapists' compliance with ergonomic principles that can cause work-related musculoskeletal disorders (WMSDs). This study uses a quantitative research design with a cross-sectional approach to identify the relationship between physiotherapists' compliance in implementing ergonomic principles and the occurrence of work-related musculoskeletal disorders (WMSDs). Data collection was conducted at one time with research locations covering three branches of the Indonesian Physiotherapy Association (IFI) Organization, namely Bantul Branch, Sleman and Jogja City branches under the auspices of the Regional Executive Board (PD) of the Indonesian Physiotherapy Association (IFI) Special Region of Yogyakarta (DIY). The research implementation began on March 6-May 20, 2025, with questionnaires temporarily suspended on March 24-April 8, 2025. The research sample was selected using purposive sampling method that complied with the predetermined inclusion criteria. The research sample consisted of 248 respondents with 4 respondents dropping out for not meeting the inclusion criteria. The research instrument consisted of two questionnaires. First, an ergonomics questionnaire that had been modified from previous researchers and had been tested for validity, reliability, and internal consistency with a Cronbach Alpha value of 0.77. This questionnaire consisted of 41 items categorized into three sections: section A contained 8 items to collect socio-demographic information, section B contained 17 items to explore ergonomic knowledge, and section C contained 16 items to assess ergonomic principle practices (Adje et al., 2019). Second, the Nordic Body Map (NBM) questionnaire consisting of 28 items to identify body parts experiencing pain. The NBM questionnaire had been tested for validity with results >0.2681 which was considered valid (Darmawan, 2019).

This study used Google Forms for questionnaire completion, with informed consent included in one Google Forms link, and only respondents who gave consent had access to fill out the questionnaire. To maintain anonymity, respondents' names were not included in the research results. As a reminder, the link was sent once per week for one week to participate in the questionnaire.

This research has obtained approval from the Health Research Ethics Committee (KEPK) Faculty of Health Sciences, Universitas 'Aisyiyah Yogyakarta with number 2058/KEP-UNISA/II/2025.

3. Results and Discussion

This study involved 244 physiotherapist respondents with diverse demographic characteristics. The age distribution of respondents was dominated by productive age groups, namely 21-30 years and 31-40 years, each accounting for 45.1% (110 respondents), followed by the 41-50 years age group at 9.4% (22 respondents), and the 51-60 years age group at 0.8% (2 respondents). Based on gender, respondents were dominated by females with 131 respondents (53.7%), while males numbered 113 people (46.3%). Educational characteristics showed distribution across various levels, with Diploma 3 (D3) as the largest group with 81 respondents (33.2%), followed by Professional education with 74 respondents (30.3%), Bachelor's degree (S1) with 63 respondents (25.8%), and Diploma 4 (D4) with 26 respondents (10.7%), while there were no respondents with Master's (S2) and Doctoral (S3) backgrounds. Specialization distribution showed dominance in the musculoskeletal field with 105 respondents (43.0%), followed by neurology with 34 respondents (13.9%), sports with 33 respondents (13.5%), geriatrics with 32 respondents (13.1%), orthopedics and pediatrics each with 31 respondents (12.7%), women's health with 5 respondents (2.0%), and cardiopulmonary with 4 respondents (1.6%), while there were no respondents with specializations in ergonomics and occupational health and safety (K3) as well as community physiotherapy. Work experience of respondents showed good variation with the majority having 6-10 years of experience totaling 95 respondents (38.9%), followed by 2-5 years with 66 respondents (27.0%), 11-15 years with 58 respondents (23.8%), 16-20 years with 17 respondents (7.0%), and more than 21 years with 8 respondents (3.3%).

Table 1. Relationship Between Demographic Characteristics and WMSDs Knowledge Level

Characteristic	Knowledge		Total
	Good	Poor	
Age (Year)			
21-30	104	6	110
31-40	106	4	110
41-50	22	0	22
51-60	2	0	2
Gender			
Male	107	6	113
Female	127	4	131
Educational Background			
D3	77	4	81
D4	25	1	26
S1	60	3	63
Professional	72	2	74
S2	0	0	0
S3	0	0	0
Specialization			
Muskuloskeletal	100	5	105
Cardiopulmonary	4	0	4
Ergonomics and Occupational Health	0	0	0
Geriatrics	32	0	32
Neurology	32	2	34
Orthopedics and Pediatrics	29	2	31
Sports	32	1	33
Women's Health	5	0	5
Community Physiotherapy	0	0	0
Work Experience (Years)			
2-5	65	1	66
6-10	87	8	95
11-15	57	1	58
16-20	17	0	17
>21	8	0	8

Based on Table 1, the distribution of respondents with poor knowledge levels shows that the 21-30 years age group has the highest proportion with 6 people. This research finding is consistent with studies

showing a significant relationship between age and prevalence of Work-related Musculoskeletal Disorders (WMSDs), where the 51-60 years age group has the highest prevalence (83.9%) compared to the 21-30 years age group (60.9%) with p value = 0.028 (Chinedu et al., 2020). The research results reinforce these findings by showing the highest proportion of poor knowledge in the young age group (21-30 years), indicating lack of work experience and exposure to ergonomic risks. This is in line with findings that young age groups remain vulnerable to impact because they are in their productive work period but do not yet have adequate ergonomic experience and awareness (WHO, 2022).

Based on gender, male respondents with poor knowledge numbered 6 people, while female respondents numbered 4 people. Studies find that men tend to be less active in accessing health information, understanding risks, and taking preventive measures, including in terms of ergonomics and WMSDs prevention. This is influenced by long-standing norms that encourage independent attitudes and rejection of health assistance, as well as lack of health programs specifically designed for men (Oliffe et al., 2020). This is reinforced by findings showing that men have limitations in understanding information and making decisions related to preventive measures. This condition explains why male respondents in this study show lower knowledge levels compared to women, with the root of the problem lying in social and cultural factors that influence their involvement in obtaining health information (Lee et al., 2019).

In terms of education level, respondents with D3 education level had the highest number with 4 people having low knowledge. This can be explained because D3 education focuses more on basic technical skills, while D4, S1, and professional levels develop more comprehensive scientific abilities, evidence-based analysis, and deeper conceptual understanding. This finding is consistent with the fact that increasing education levels is directly proportional to behavioral improvement, understanding, and openness to new information. However, low knowledge in certain groups such as D3 graduates cannot be concluded as merely a reflection of low competence. Systemic factors play a crucial role, including limited access to training, high workload, and absence of institutional policies for regular knowledge updates (Setianingsih, 2020). In line with this, there is research emphasizing that these structural factors require serious attention to improve knowledge quality at various education levels (Mu'minin, 2024).

Based on specialization, the musculoskeletal specialization has the most respondents with 5 people having low knowledge. This is consistent with previous research that 42.7% of musculoskeletal and orthopedic specialist physiotherapists have low ergonomic knowledge (Adje et al., 2019). This is caused by equipment limitations, high workload, absence of safe work guidelines, and minimal training outside the main field of expertise (Utami et al., 2018). Similar findings are confirmed by other research showing a significant relationship between specialization and Work-related Musculoskeletal Disorders (WMSDs) knowledge, showing a hierarchy from board-certified doctors (mean = 3.04) to diploma level. This variation occurs due to the absence of ergonomics curriculum in undergraduate education, variation in education duration, sociodemographic factors, and gaps between theoretical knowledge and practical application, so that implementation of ergonomic practices remains low in all groups (Alhazim et al., 2022).

The group with 6-10 years of work experience is the group with the highest number of respondents with poor knowledge, namely 8 respondents, showing a critical transition period in ergonomic mastery. Research confirms that this group has better knowledge than beginners but not as optimal as the >10 years group, where workers begin to realize the importance of ergonomics but have not yet mastered its application (Kumar et al., 2021). This finding is reinforced by other research showing that although knowledge increases after 6 years of work, WMSDs prevalence remains high because natural knowledge improvement is not always followed by correct work behavior changes. The 6-10 year work period becomes a critical period requiring special intervention because workers have high workloads but have not yet received adequate structural ergonomic education (Rafeemanesh et al., 2021).

Table 2. Spearman Rank Test of Knowledge with WMSDs

Spearman's rho			Knowledge	WMSDs
	Knowledge	Correlation Coefficient	1000	.025
		Sig.(2-tailed)	.	.696

			244	244
	Work-related musculoskeletal disorders	Correlation Coefficient	.025	1.000
		Sig.(2-tailed)	.696	.
			244	244

Correlation analysis using the Spearman rank test in this study shows a correlation coefficient r=0.025 which indicates a very weak positive correlation between physiotherapists' knowledge variables about ergonomics and the occurrence of Work-related Musculoskeletal Disorders (WMSDs). The significance value obtained was 0.696 ($p > 0.05$), it can be concluded that there is no significant relationship (Munika et al., 2023). The results of this study are in line with findings that there is no significant relationship between health workers' knowledge and the implementation of occupational safety and health ($r = -0.051$, $p = 0.725$), showing that high knowledge does not guarantee optimal implementation. This is supported by research that found inconsistencies between understanding of occupational health and safety policies and practical daily implementation, which is suspected to be caused by other factors such as attitudes, motivation, work habits, facility limitations, lack of supervision, and low organizational commitment (Purba & Dedy Syahyuni, 2023).

Table 3 Spearman Rank Test of Practice with WMSDs

			Practice	WMSDs
Spearman's rho	Practice	Correlation Coefficient	1000	-.276**
		Sig.(2-tailed)	.	.000
			244	244
	Work-related muskuloskeletal disorders	Correlation Coefficient	.025	1.000
		Sig.(2-tailed)	-.276**	1.000
			244	244

Based on the Spearman correlation test, it shows a significant negative relationship between ergonomic practice and WMSDs occurrence ($r = -0.276$; $p = 0.000$). This relationship indicates that the better the physiotherapists' ergonomic practice, the more the WMSDs occurrence tends to decrease. This relationship is classified as moderately strong and significant at the 99% confidence level ($p < 0.01$). The results of this study are supported by research showing a strong relationship between work posture and WMSDs occurrence in textile workers ($r=0.819$, $p=0.000$) (Sari et al., 2020). Although the context is different, ergonomic principles remain the same. Work practices that do not comply with ergonomic principles, such as bending when caring for patients, lifting heavy loads, and working in static positions can cause muscle tension and pain in the back, neck, and shoulders (Ribeiro et al., 2016). Health workers have a high risk of WMSDs due to heavy and repetitive physical activities. Therefore, training and implementation of ergonomic practices are very important to prevent injuries, increase productivity, and maintain the quality of health services (Kim & Jeong, 2024).

Table 4 Relationship Between Physiotherapists' Knowledge and WMSDs

Knowledge	**Injury**		**Pearson χ^2 Value**	**Assymp Sig.**
	Low	**Moderate**		
Good	216 (79.9%)	18 (20.1%)	6.067	0.045
Poor	7 (70.0%)	3 (30.0%)		

Based on the analysis results using chi-square test with Pearson value of 6.067 and significance value of 0.045 ($p<0.05$). This shows a relationship between knowledge and Work-related Musculoskeletal Disorders (WMSDs). This is in line with research showing that high knowledge levels correlate with better complaint prevention behaviors (Hendrasari et al., 2017). This is supported by research that found a significant relationship between ergonomic knowledge and WMSDs occurrence in nurses ($p = 0.014$), where nurses with poor ergonomic knowledge more frequently experienced WMSDs compared to those with good knowledge. This finding shows that ergonomic knowledge greatly influences health workers' ability to recognize and avoid risky work postures (Balaputra & Sutomo, 2017).

Table 5. Relationship Between Ergonomic Practice and WMSDs

Practice	Injury		Pearson χ^2 Value	Assymp Sig.
	Low	Moderate		
Compliant	223 (91.4%)	0	244.000	0.000
Adherent	0	21 (8.6%)		

Respondents with compliant practices mostly experienced low injury with 223 respondents (91.4%), while 21 respondents (8.6%) who were non-compliant experienced moderate injury. This is in line with research conducted on 30 polyclinic nurses at Hospital X confirming a correlation between ergonomic practice implementation and WMSDs occurrence, where most respondents experienced musculoskeletal disorders in the neck, shoulder, back, and waist areas triggered by non-ergonomic work attitudes such as repetitive bending and body rotation activities (Dewi, 2020). Similar findings also identified a relationship between low ergonomic implementation and increased WMSDs prevalence among medical personnel. Although understanding and perception regarding ergonomics are considered adequate, the majority of participants failed to apply ergonomic principles continuously in their work activities, resulting in adoption of inappropriate body postures and excessive physical pressure, thereby increasing the probability of occupational injury risks (Alhazim et al., 2022).

4. Conclusion

Based on the research results with the title "Relationship Between Physiotherapists' Compliance with Ergonomics Implementation and the Occurrence of Work-related Musculoskeletal Disorders (WMSDs) in the Special Region of Yogyakarta", it can be concluded that characteristics of age 21-30 years, male gender, D3 education, musculoskeletal specialization, and 6-10 years of work experience have low levels of WMSDs knowledge. The chi-square test results prove a significant relationship between physiotherapists' compliance with ergonomics implementation and the occurrence of Work-related Musculoskeletal Disorders (WMSDs) in the Special Region of Yogyakarta, with knowledge level significance value of 0.045 ($p < 0.05$) and practice level significance value of 0.000 ($p < 0.05$). This finding confirms the importance of improving physiotherapists' compliance in applying ergonomic principles to prevent WMSDs occurrence in the workplace.

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