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Patterns of musculoskeletal discomforts across sedentary and dynamic working activity types: An occupational health nursing approach

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ABSTRACT

Introduction: Musculoskeletal discomfort (MDs) is associated with prolonged sedentary behavior and awkward postures and remains a major burden in various occupations. This study investigated the pattern of musculoskeletal disorders (MDs), including their prevalence and determinants among sedentary and dynamic workers, and analyzed working posture across various job characteristics.

Methods: A total of 100 factory workers were recruited for this cross-sectional study. A self-reported Nordic Musculoskeletal Questionnaire was used to confirm the affected body parts, and observational analysis was performed using the Rapid Entire Body Assessment. Descriptive statistics and chi-square (χ^2) tests were used.

Results: Results showed that 89% of workers reported at least one musculoskeletal symptom in the past 12 months, with discomfort in the neck (52%), lower back (51%), and shoulder (48%) as the most affected regions. Office personnel exhibited higher proportions of discomfort in the wrist (38%), thighs (28%), and ankle and feet (32%) than dynamic workers ($p < 0.01$). Significant differences across occupational groups were identified in all body regions, with the largest effects in the wrist ($\chi^2 = 17.38$, $p < 0.001$), thigh ($\chi^2 = 26.53$, $p < 0.001$), and knee ($\chi^2 = 11.64$, $p < 0.01$). Female sex ($\chi^2 = 4.86$, $p < 0.05$), irregular exercise ($\chi^2 = 8.53$, $p < 0.01$), and shorter work duration ($\chi^2 = 5.10$, $p < 0.05$) were associated with a higher prevalence of MDs.

Conclusions: Dynamic workers exhibited higher ergonomic risk scores, particularly for trunk and leg postures compared to static workers. This study concludes that ergonomic redesign and occupational health nursing interventions based on occupational demands are essential to minimize musculoskeletal disorder risks and promote musculoskeletal well-being.

Keywords: ergonomic workplace, musculoskeletal discomforts, occupational health nurse, posture analysis, workers

Introduction

Musculoskeletal disorders (MSDs) are a predominant cause of lost-time injuries and work-related disability and continue to pose an escalating challenge in occupational health worldwide. Over the decades, MSD cases have increased; as of 2021, there were approximately 1.686 billion prevalent cases recorded, and in 2024, the global prevalence of MSDs is estimated to be approximately 1.69 billion cases worldwide (World Health Organization, 2022, Liu *et al.*, 2025). In Indonesia, the prevalence of work-related MDs was 36.2% in the past 7-day and 31.5% in the past 12-month (Kadir *et al.*, 2025). MSDs related to work impact 395 million non-fatal work-related injuries, contributing to an estimated loss of 4 percent of the annual GDP (International Labour Organization, 2024). Sustained heavy physical demands

resulting in MSDs in the workplace, particularly over eight to ten years, have been shown to significantly heighten the likelihood of ending a worker's career on a disability pension (Ervasti *et al.*, 2019, Center for Disease Control, 2025, Gammarano, 2025). Beyond limiting work ability, this prolonged strain has also been linked to an increased risk of premature death burden (Ervasti *et al.*, 2019, Gammarano, 2025).

The onset of MSDs is initiated by prolonged symptoms of musculoskeletal discomfort. MSDs manifest as early signs of musculoskeletal strain or fatigue (European Agency for Safety and Health, 2020, Canadian Center for Occupational Health and Safety, 2025). The patterns of body part discomfort frequently affect the lower back, shoulders, and neck. These complaints often correspond to sustained occupational exposure, such as twisting, bending, prolonged awkward posture, and task repetition (European Agency for Safety and Health, 2020, Prasetya *et al.*, 2024, Canadian Center for Occupational Health and Safety, 2025).

Distinct nature of job demands makes musculoskeletal discomforts vary in different type of occupations. The occupational exposure in office workers are prone to long hours of sedentary sitting, repetitive motions of mouse used and keyboard typing, and continuous screen exposure resulting to awkward postures (Wang *et al.*, 2019, Okezue *et al.*, 2020, Aulianingrum and Hendra, 2022, Prasetya *et al.*, 2024) where the manifestations often appear in neck, wrists, shoulder, and low back discomforts (Wang *et al.*, 2019, Okezue *et al.*, 2020, Aulianingrum and Hendra, 2022). This highlights that the office workers are highly vulnerable due to their sedentary work environments. In addition, sedentary workers experience fatigue due to routinely low physical activity and low muscular strength (Arini *et al.*, 2024). In contrast, dynamic workers are typically expose to heavy lifting tasks, repetitive manual handling, and adverse working posture that involve static bending or prolonged standing, and vibrations influencing either the whole body (Ding *et al.*, 2023, Nurhanisah *et al.*, 2024, Canadian Center for Occupational Health and Safety, 2025). Those physical exposures in static activities affect the development symptoms of wrist, hands, ankles, and feet. These symptoms that affected by occupational demands and physical exposure factors may progress to severe musculoskeletal disorders (Kadir *et al.*, 2025). In summary, occupational demands and physical exposure factors play a critical role in the development of musculoskeletal discomforts, where sedentary and dynamic workers are exposed to distinct patterns of occupational activities and risk. Accordingly, the present study addresses this gap by examining work postures and occupation-specific patterns of musculoskeletal discomforts, with the focus on contributing evidence to support occupational health nursing practice and inform evidence-based interventions.

Occupational health nurses contribute to early screening of MSDs cases related to work. A job analysis framework with the integration of environmental factors (Hulshof *et al.*, 2019) has been used to critically investigate the factors contributing to MSDs (Guzik, 2013). The deep approach to occupational characteristics enables the identification of occupational risk factors, such as sustained postures, repetitive movements, and ergonomic stressors, between office and dynamic workers (Indrayani *et al.*, 2022). An in-depth analysis of job characteristics enables nurses to develop strategies for preventing high prevalence in particular body parts based on working demands or job tasks through observational methods. Subsequently, the analysis can reduce the early detection of disorders and prevent the progression to severe musculoskeletal disorders in diverse workplace settings (Su *et al.*, 2023). Although existing studies highlight the high burden of musculoskeletal discomfort among dynamic and office workers (Wang *et al.*, 2019, Okezue *et al.*, 2020, Aulianingrum and Hendra, 2022, Prasetya *et al.*, 2024), the involvement of patterns across occupations through occupational health nursing analysis is limited. Hence, this study aimed to (1) compare the prevalence of musculoskeletal discomfort between office and dynamic workers with the associated characteristics and (2) examine working posture risk using an occupational health nursing approach.

Materials and Methods

Study design and participants

This cross-sectional study was conducted between 2019 and 2021 at a furniture manufacturing facility employing two occupational groups, including office and dynamic personnel, with subsequent data verification and analysis performed from 2022 to 2024. Participants were selected using a purposive sampling technique, and the eligibility criteria included full-time employment status, age between 18 and 60 years, and a minimum of one year of work experience. The selected candidates were subsequently informed by their supervisors to participate in the study. Workers with a history of musculoskeletal injuries or systemic diseases affecting mobility were excluded. A minimum required sample size of 80 respondents was determined using G*Power for a chi-square goodness-of-fit test (effect size = 0.5, $\alpha = 0.05$, power = 0.80, df = 5); hence, a total of 100 workers were recruited to compensate for potential attrition.

Measurements

MD's among the two types of occupations were measured using the self-reported Nordic Musculoskeletal Questionnaire (NMQ) Indonesian version (NMQ) (Ng *et al.*, 2013) Additionally, a minor modification was made to

fit the two occupational categories included in the study. This modification, which involved clarifying the description of discomforts, including numbness, pain, stiffness, and sickness, was reviewed through face validation by two bilingual experts, which contributed to strengthening the content validity of the instrument. This tool allowed the investigation of any self-reported pain or discomfort in body parts, including the neck, shoulders, upper back, elbows, lower back, wrists, thighs, knees, ankles, and feet. It was measured within the past seven days and 12 months among the two occupations. Office workers performed sedentary desk-based tasks or were in managerial positions, while dynamic workers engaged in physically demanding activities, such as production workers. The NMQ instrument has demonstrated good content validity, with an I-CVI of 0.83 (Kuorinka *et al.*, 1987) and has been widely used (Hortobagyi *et al.*, 2023). This instrument provides binary yes/no responses for the presence of discomfort in all body regions.

The Rapid Entire Body Assessment (REBA) tool was used to evaluate working posture. The REBA component includes the analysis of repetition, load, coupling quality, and posture distributed across different body regions, such as the neck, trunk, legs, and upper limbs (Hignett and McAtamney, 2000). Coupling is rated from ideal to poor according to handle fit, and the component of activity is categorized as repetitive, static, or combined. The scoring system for this instrument uses a range depending on the component with a maximum of 5, and an overall range of 1 to 15 from negligible risk to very high risk, indicating the need for ergonomic intervention. The process was based on representative records, and the procedure has shown a strong content validity (I-CVI = 0.88) and excellent reliability (ICC = 0.90), confirming its suitability for ergonomic assessment (Indrayani *et al.*, 2022).

Data collection procedure and statistical analysis

Data were collected through direct observation and self-administered questionnaires. The process was supervised by an occupational health professional. A job analysis adapted from Guzik (2013) was used to systematically examine the work goals, coupling design, pace, physical environment, and task characteristics. Prior to the analysis, the data were verified for completeness. Frequency and percentages were used to describe the characteristics of respondents and the prevalence of MDs, while the chi-square test was applied to evaluate the relationship among risk factors derived from REBA, job analysis, and occurrence of MDs, with statistical significance set at $p < 0.05$. The study protocol was reviewed and approved by the Institutional Review Board (IRB) of the Faculty of Nursing Ethics Committee, Sultan Agung Islamic University, Semarang, Indonesia. The IRB number is 343/A.1/FIK-SA/VII/2019.

Table 1. Characteristics of participants (n=100)

Variable	Mean (SD)/ Frequency (%)
Age	40.68±9.3
Gender	
Female	33 (33%)
Male	67 (67%)
Exercise	
Irregular	56 (56%)
Regular	44 (44%)
Tobacco smoking	
No	72 (72%)
Yes	28 (28%)
Working experience	
≤12 years	53 (53%)
>12 years	47 (47%)
Education	
<10 years	19 (19%)
≥10 years	81 (81%)
Job category	
Office (Sedentary)	52 (52%)
Dynamic	48 (48%)
MDs manifestations	
Yes	89 (89%)
No	11 (11%)

Results

One hundred participants completed the questionnaires. The participants were evenly distributed, with sedentary workers (52%) and dynamic workers (48%). The mean age of all participants was 40.68±9.3 years, and the majority were males (67%). Most participants did not smoke (72%) and were less likely to engage in regular exercise (44%). Most participants had ten or more years of formal education (81%), with the majority having less than equal to 12-year (53%). Table 1 summarizes the participants' characteristics. The prevalence of self-reported MDs among workers was 89%.

Table 2 presents the distribution of musculoskeletal discomfort among office and dynamic workers during the past 12-month. Overall, musculoskeletal symptoms were reported in multiple body regions, but the prevalence patterns differed across occupational groups. Office personnel exhibited higher proportions of discomfort in the wrist (38%), thighs (28%), and ankle and feet (32%) compared with 8%, 4%, and 10%, respectively, among dynamic workers. The differences were statistically significant ($p < 0.01$). Neck, shoulder, upper back, and lower back discomfort were also reported in both groups, but no significant differences were observed between office and dynamic workers ($p > 0.05$). This finding indicates an occupationally distinct distribution of musculoskeletal disorders across body parts, particularly a greater prevalence of distal limb symptoms in office workers.

Prevalence of musculoskeletal discomforts related to works

Table 3 outlines the 7-day and 12-month prevalence of musculoskeletal complaints among office and dynamic workers. More than half participants experiencing at

Table 2. Distribution of MDs office and dynamic workers in the past 12-month (n=100)

Body region	MDs	Office workers n (%)	Dynamic workers n (%)	χ^{22}	*p-value*
Neck	No	36 (72%)	40 (80%)	*0.87*	*0.34*
	Yes	14 (28%)	10 (20%)		
Shoulders	No	33 (74%)	41 (82%)	*3.32*	*0.06*
	Yes	17 (26%)	9 (18%)		
Upper back	No	37 (74%)	41 (82%)	*0.93*	*0.33*
	Yes	13 (26%)	9 (18%)		
Elbow	No	44 (88%)	46 (92%)	*0.44*	*0.50*
	Yes	6 (12%)	4 (8%)		
Low back	No	29 (58%)	35 (70%)	*1.56*	*0.21*
	Yes	21 (42%)	15 (30%)		
Wrist	No	31 (62%)	46 (92%)	*12.70*	*<0.01**
	Yes	19 (38%)	4 (8%)		
Thighs	No	36 (72%)	48 (96%)	*10.74*	*<0.01**
	Yes	14 (28%)	2 (4%)		
Knee	No	33 (74%)	41 (82%)	*3.32*	*0.06*
	Yes	17 (26%)	9 (18%)		
Ankle feet	No	34 (68%)	45 (90%)	*7.23*	*<0.01**
	Yes	16 (32%)	5 (10%)		

least one symptom in the past year and recent 7 d (54%). Neck area showed the highest body region (54%), followed by lower back (51%), and shoulders (48%), and and knee (34%). In addition, the data indicate statistically significant regional differences comparing two occupations. Dynamic workers demonstrated a higher prevalence of discomfort in the wrist (χ^2= 17.38, $p < 0.001$), arm fatigue (χ^2= 26.53, $p < 0.001$), and knees (χ^2= 11.64, $p < 0.01$). Meanwhile, neck (χ^2= 7.21, $p < 0.01$), shoulder (χ^2= 8.85, $p < 0.01$), upper back (χ^2= 8.09, $p < 0.01$), and thighs (χ^2= 10.71, $p < 0.01$) discomforts also showed significant occupational variation. According to the table, the past 7-day indicated lower frequency of musculoskeletal discomforts than 12-month. The finding suggests that musculoskeletal discomfort among participants were persistent.

The prevalence of musculoskeletal discomfort by body region and its association with individual characteristics are summarized in Table 4. Potential gender-related susceptibility was found, where female workers exhibited significantly more symptoms in the neck ($\chi^2 = 4.86$, $p < 0.05$), upper back ($\chi^2 = 6.50$, $p < 0.05$), and thighs ($\chi^2 = 4.60$, $p < 0.05$) than males. Participants who irregularly performed exercise experienced greater elbow discomfort ($\chi^2 = 8.53$, $p < 0.01$), highlighting the possible protective effect of frequent and consistent physical activity in combating discomfort. Furthermore, individuals with 12 or fewer years of experience reported significantly greater neck discomfort ($\chi^2 = 5.10$, $p < 0.05$), possibly linked to ergonomic adaptation over time. In addition, workers with less than 10 years of education experienced higher elbow discomfort ($\chi^2 = 4.89$, $p < 0.05$), implying that lower ergonomic educational exposure may contribute to a heightened risk of repetitive strain.

Job analysis: An occupational health nursing approach

Job analysis using a nursing approach was conducted to identify potential ergonomic and psychosocial hazards influencing musculoskeletal health among workers. The occupational health nursing approach in the current study focuses on a systematic assessment that distinguishes between two key aspects of job analysis, work tasks and physical work environment, in order to better understand the patterns and subsequent consequences of MDs. Job analysis involves several key components, including work objectives, work pace information that considers working tasks and the physical location of the job (Keyserling *et al.*, 1991, Guzik, 2013). The work objectives include office and dynamic workers in the furniture factory. The office personnel

Table 5. Analysis of working posture among office and dynamic personnel

	Office Personnel		Dynamic Personnel	
Posture (Range of level)	Non ergonomic posture score	Degree of average	Non ergonomic posture score	Degree of average
Neck	2 of 3	>20° downward flexion	2 of 3	>20° downward flexion
Trunk Posture	3 of 5	Flexion or bending 45°-60°	4 of 5	Flexion >60° and twisting or side flexion
Legs	1 of 4	Sitting position	3 of 4	Dangling
Upper Arm	3 of 6	Abducted position, unsupported nor leaning in degree of extension 45°-90°	3 of 6	Abducted position, unsupported nor leaning in degree of extension 45°-90°
Lower Arm	2 of 2	Downward, flexion movement in more than 100°	2 of 2	Downward, flexion movement in more than 100°
Wrist	3 of 3	The wrist position observed in upward, downward, abducted or adducted right flexion more than 45°	2 of 3	The wrist position observed in downward flexion more than 15°

involve a variety of administrative, clerical, and support tasks that help maintain the smooth operation of an office. Their role is critical to maintain the daily operation in the office of the factory and routinely in sitting position, using computer and telephone (Mohammadipour *et al.*, 2018). Meanwhile, the dynamic workers more in industrial work production are responsible for performing various tasks involved in the manufacturing or assembly of products within a production environment. Their duties typically include operating machinery, assembling parts or components, inspecting finished products for quality control, and ensuring that production processes run smoothly and efficiently, maintaining a clean and organized workspace such as assembling, packaging, labeling, and shipping finished goods (Thetkathuek and Meepradit, 2018). The factory has been established and located nearby the health center for health and emergency safety needs. The health promotion has been promoted although in the local area and all workers have registered for health insurance. All employees are registered for health insurance, ensuring that they have access to medical coverage and benefits, contributing to their overall well-being and security.

Table 5 presents the analysis of the working postures of office and dynamic workers. A high ergonomic risk was found in the neck, upper arm, and wrist regions for both types of occupations. A downward flexion greater than 20° was observed, suggesting a sustained head inclination during work. Dynamic workers demonstrated a higher risk of trunk posture compared to office workers, reflecting an increased trunk flexion greater than 60° along with twisting or lateral bending. A variation in leg posture was observed, with dynamic workers exhibiting a higher risk (3 of 4, dangling position) than office workers (1 of 4, sitting position). Upper and lower arm postures were comparable in both groups, typically demonstrating extended or abducted positions with insufficient support.

Discussions

The current study aimed to highlight the prevalence and determinant factors associated with MDs through pattern analysis of sedentary (office workers) and dynamic working activities (dynamic workers). This study identified a high prevalence of MDs among the two occupations, most commonly in the neck, low back, and shoulder. Based on a comparison of occupational categories, office personnel exhibited a higher proportion of discomfort in the wrist, thighs, and ankle feet than dynamic workers. Female sex, irregular exercise, and shorter working experience were associated with the presence of MDs across both occupations.

Task-specific exposure influences symptom patterns across these two distinct occupations. Office personnel reported higher discomfort in the wrist, thighs, and ankle/feet regions, which are typically exposed to repetitive manual tasks, awkward postures, and prolonged sitting. Discomfort in the wrist is explained by repetitive work on gripping or twisting wrist positions, which increases pressure on the tendon and carpal tunnel, contributing to tendon inflammation, soft-tissue irritation, or median nerve compression symptoms (Milaković, 2024, Prasetya *et al.*, 2024). Thigh discomfort is often associated with long hours of sitting, where the thighs bear passive pressure from the seat and the leg muscles remain minimally active. This can reduce blood flow, promote tissue compression, and cause fatigue or aching in the thigh region during long work periods. In short, the mechanism is mainly sustained compression plus poor circulation rather than a high force injury (Okezue *et al.*, 2020, Waongenngarm *et al.*, 2020). Ankle-foot problems are commonly associated with static postures, poor seating support, and inadequate foot support, especially when feet are dangling for long periods. Static loading can impair circulation, increase pressure in the lower limbs, and cause discomfort in the feet and ankles, resulting in cumulative muscle fatigue and localized pressure ischemia (National Research Council and Institute of Medicine, 2001, Silverman and Deuster, 2014, Brambilla *et al.*, 2023, De la Corte-Rodriguez *et al.*, 2024). Dynamic workers experience repetitive and compressive stress on the joints, plantar tissues, and supporting muscles during prolonged standing, stair climbing, and load carrying, leading to fatigue and ankle-foot pain (Ding *et al.*, 2023, Nurhanisah *et al.*, 2024, Canadian Center for Occupational Health and Safety, 2025).

The two occupations perceived MDs in all body regions, with the highest in the neck, shoulder, and lower back in the past 12-month and 7-day periods, indicating that the discomfort was persistent or chronic rather than transient, indicating no significant change in MDs among the workers. The persistent symptoms among these two occupations indicated that MDs related to work were chronic, and the data were consistent with persistent discomfort related to cumulative microtrauma and sustained biomechanical load (Waongenngarm *et al.*, 2020). Neck flexion exceeding 20° due to prolonged visual focus and static muscle loading is associated with head inclination to cervical strain (Hoogendoorn *et al.*, 2000, Mousavi-Khatir *et al.*, 2018, Munro *et al.*, 2021). Frequent screen use, visual display terminal use, and inadequate workstation alignment are potential contributors to neck (Lin and Chan, 2007, Waersted *et al.*, 2010). Previous studies have suggested that working activities that expose individuals to biomechanical stress from sedentary work result in upper limb and lumbar region (National Research Council and Institute of Medicine, 2001, Brambilla *et al.*, 2023). A repetitive and static seated posture physiologically contributes to cervical and shoulder discomfort in office workers

(Hoogendoorn *et al.*, 2000, Coenen *et al.*, 2013). The study is supported by previous research that manual workers tend to have a higher risk of dangling or prolonged standing (Thetkathuek and Meepradit, 2018). The data of MDs in dynamic workers were potentially linked to vibration exposure, force exertion, and poor handling repetition. Not using a hand rest while working and repetitive strain in office workers and poor grip position while lifting or crafting in dynamic workers are key contributors to wrist discomfort (Rodríguez-Pulido *et al.*, 2025). Whereas the condition of Inadequate lower limb support, including improper footwear, could heighten the possibility of ankle and foot discomfort (Tegegne Temesgen, 2023).

The current study is supported by observational data indicating that sedentary office work involves prolonged sitting and repetitive wrist flexion–extension exceeding 45°, corroborating the reported findings of increased mechanical strain on the distal upper extremities. Inadequate handle fit and acceptable grip design contribute to grip force and wrist deviation, resulting in hand and forearm discomfort (Seo and Armstrong, 2011, Revilla *et al.*, 2022). It was observed that the inclination of trunk posture (>60°) during lifting the product and dangling posture affected leg risk and reflected noticeable asymmetrical loading and manual handling demands.

Individual and behavioral characteristics are known to contribute to musculoskeletal discomfort. Consistent with earlier studies (Widanarko *et al.*, 2011, Okezue *et al.*, 2020), the current study revealed that female workers experienced neck and upper back discomfort. A possible explanation for this result is that women have lower muscle mass than men, hormonal impact on ligament elasticity, and workstation configuration that requires prolonged seated (Demissie *et al.*, 2024). Irregular exercise was found to be significantly correlated with elbow discomfort, a finding supported by prior research revealing that regular physical activity could be a musculoskeletal protection in enhancing the possibility of disorders (Kasaw Kibret *et al.*, 2020, Franklin *et al.*, 2022, Arini *et al.*, 2024, De la Corte-Rodriguez *et al.*, 2024). In addition, exercise engagement promotes blood circulation and tissue repair, which helps mitigate the accumulation of microtrauma (Silverman and Deuster, 2014). Workers with 12 or fewer years of working experience were significantly more likely to report neck discomfort, supporting the previous evidence that ergonomic adjustment and pacing tend to improve with longer tenure (National Research Council and Institute of Medicine, 2001, Mujiono *et al.*, 2023). In addition, a lower level of formal education was linked to elbow discomfort, implying a lack of ergonomic awareness or the ability to control their tasks (Ardalan Shariat, 2016, Kadir and Ergin, 2023, AzizAli and Sreedharan, 2024).

Given the findings, occupational health nurses are pivotal in detecting MDs and future potential MSDs from job analysis approach (Indrayani *et al.*, 2022). Evidence suggested the degree of posture based on job demands, handle or tool design, variation of rest break, and reduction of static or repetitive tasks affects the potential of muscle problem. Understanding the patterns of these MDs enables their use as a baseline for evaluating and implementing ergonomic interventions (Indrayani *et al.*, 2024). A key strength of this study lies in the systematic job analysis framework, which enables occupational health nurses to identify anatomical regions with a higher prevalence of MDs across two distinct occupational groups and to recognize potential occupational risk factors associated with future MD development. This framework facilitates the development of occupation-specific ergonomic interventions based on work characteristics and exposure patterns. Methodologically, the integration of self-reported musculoskeletal symptoms assessed over 12-month and 7-day periods with direct observational evaluation of work-related physical postures enhanced the identification of MD patterns and associated MSD's risks. In addition, the findings underscore the contribution of both individual and occupational determinants to the occurrence of MDs. Nevertheless, the external validity of the study may be limited, as the investigation was conducted primarily in manual work environments and may not adequately reflect ergonomic exposures in advanced machine-based or automated workstation settings.

Conclusion

The current study investigated distinct patterns of musculoskeletal disorders (MDs) among office and dynamic workers according to their work activity demands. The observational analysis confirmed that awkward and sustained static postures were aligned with self-reported discomfort, implying biomechanical demands on the work type. Individual and behavioral factors were linked to muscle discomfort, implying interactions between the behavioral job demands and individual characteristics. These findings suggest that occupational health nurses or related healthcare professionals should assess musculoskeletal risks based on working type characteristics and implement tailored ergonomic strategies to mitigate potential musculoskeletal disorders. Given that tailored management is required, occupational health nurses are encouraged to perform job-specific ergonomic assessments and plan targeted interventions. The strategy for the early detection of MD from the perspective of work demands addresses MDs for the two occupations and may further include workstation optimization awareness, ergonomic seating, and scheduled microbreaks to sedentary interrupt beneficial

to reduce further MSDs risk of MSDs among dynamic workers.

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Declaration Of Generative Artificial Intelligence (AI) Use

The authors used AI-assisted tools to improve clarity and quality of the writing. The AI-generated parts in the current sutdy was carefully validated by the authors to ensure scientific integrity and to preserve the original and accuracy of the data.

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Availability of data and materials

The data and materials are available from the corresponding authors upon reasonable request and under the authors' permission

Authors' contributions

Dr. NLDI served as the principal investigator and responsible for conceptualizing the study design, data collection, data analysis, and drafting the manuscript. Prof. CJW provided critical revision of the study design, supervised the analytical framework, and offered expert guidance in interpreting the findings. Dr. DS provided critical revision of the study design, supervised the analytical framework, and offered expert guidance in interpreting the findings. PPIO contributed to the literature review, and manuscript editing. Dr. AP contributed to the support literature review, feedback, and manuscript editing. Dr. NLPIB contributed to give feedback and manuscript editing

Declaration of Interest

The authors declare there are no financial or other interests involved in the current study that could affect the transparency, reproducibility or credibility of the research findings.

References

Ardalan Shariat, S. B. M. T., Manohar Arumugam, Mahmoud Danaee, Rajesh Ramasamy (2016). *Prevalence Rate of Musculoskeletal Discomforts Based on Severity Level Among Office Workers. Acta Medica Bulgarica,* 43.1.doi: 10.1515/amb-2016-0007

Arini, S. Y., *et al.* (2024). *Fatigue Assessment: Study Based on Physical Activity and Muscular Strength at Sedentary Workers. The Indonesian Journal of Occupational Safety and Health,* 13.3, 343–350.doi: 10.20473/ijosh.v13i3.2024.343-350

Aulianingrum, P. & Hendra, H. (2022). *Risk Factors of Musculoskeletal Disorders in Office Workers. The Indonesian Journal of Occupational Safety and Health,* 11.SI, 68–77.doi: 10.20473/ijosh.v11isi.2022.68-77

Azizali, N. & Sreedharan, J. (2024). *Ergonomic awareness and practices to prevent musculoskeletal disorder among healthcare workers in UAE: A cross-sectional study. Journal of Bodywork and Movement Therapies,* 40. 1973–1978.doi: https://doi.org/10.1016/j.jbmt.2024.10.022

Brambilla, C., *et al.* (2023). *Biomechanical Assessments of the Upper Limb for Determining Fatigue, Strain and Effort from the Laboratory to the Industrial Working Place: A Systematic Review. Bioengineering (Basel),* 10.4.doi: 10.3390/bioengineering10040445

Canadian Center for Occupational Health and Safety, C. 2025. Work-related Musculoskeletal Disorders (WMSDs). *CCOHS: Diseases, Disorders and Injuries*

Center for Disease Control, C. 2025. Disability and Health Related Conditions. *Disability and Health.*

Coenen, P., *et al.* (2013). *Cumulative low back load at work as a risk factor of low back pain: a prospective cohort study. J Occup Rehabil,* 23.1, 11–8.doi: 10.1007/s10926-012-9375-z

De La Corte-Rodriguez, H., *et al.* (2024). *The Role of Physical Exercise in Chronic Musculoskeletal Pain: Best Medicine-A Narrative Review. Healthcare (Basel),* 12.2.doi: 10.3390/healthcare12020242

Demissie, B., *et al.* (2024). *A systematic review of work-related musculoskeletal disorders and risk factors among computer users. Heliyon,* 10.3, e25075.doi: https://doi.org/10.1016/j.heliyon.2024.e25075

Ding, X., *et al.* (2023). *Prevalence and risk factors of work-related musculoskeletal disorders among emerging manufacturing workers in Beijing, China. Frontiers in Medicine,* 10.doi: 10.3389/fmed.2023.1289046

Ervasti, J., *et al.* (2019). *Long-term exposure to heavy physical work, disability pension due to musculoskeletal disorders and all-cause mortality: 20-year follow-up-introducing Helsinki Health Study job exposure matrix. Int Arch Occup Environ Health,* 92.3, 337–345.doi: 10.1007/s00420-018-1393-5

European Agency for Safety and Health. 2020. *Pathophysiological mechanisms of musculoskeletal disorders* [Online]. Available: https://oshwiki.osha.europa.eu/en [Accessed 29 October 2025 2025].

Franklin, B. A., *et al.* (2022). *Physical activity, cardiorespiratory fitness, and cardiovascular health: A clinical practice statement of the ASPC Part I: Bioenergetics, contemporary physical activity recommendations, benefits, risks, extreme exercise regimens, potential maladaptations. Am J Prev Cardiol,* 12. 100424.doi: 10.1016/j.ajpc.2022.100424

Gammarano, R. 2025. The right to occupational safety and health: Still unrealized.

Guzik, A. 2013. *Essentials for Occupational Health Nursing*, John Wiley & Sons, Inc.

Hignett, S. & Mcatamney, L. (2000). *Rapid entire body assessment (REBA). Appl Ergon,* 31.2, 201–5.doi: 10.1016/s0003-6870(99)00039-3

Hoogendoorn, W. E., *et al.* (2000). *Flexion and rotation of the trunk and lifting at work are risk factors for low back pain: results of a prospective cohort study. Spine (Phila Pa 1976),* 25.23, 3087–92.doi: 10.1097/00007632-200012010-00018

Hortobagyi, T., *et al.* (2023). *Effects of Exercise Training on Muscle Quality in Older Individuals: A Systematic Scoping Review with Meta-Analyses. Sports Med Open,* 9.1, 41.doi: 10.1186/s40798-023-00585-5

Hulshof, C. T. J., *et al.* (2019). *WHO/ILO work-related burden of disease and injury: Protocol for systematic reviews of exposure to occupational ergonomic risk factors and of the effect of exposure to occupational ergonomic risk factors on osteoarthritis of hip or knee and selected other musculoskeletal diseases. Environ Int,* 125. 554–566.doi: 10.1016/j.envint.2018.09.053

Indrayani, N. L. D., *et al.* (2024). *Effectiveness of exercise programs to reduce low back pain among nurses and nursing assistants: A systematic review and meta-analysis. J Safety Res,* 89. 312–321.doi: 10.1016/j.jsr.2024.01.001

Indrayani, N. L. D., *et al.* (2022). *Development of an educational protocol for ergonomic risk assessment of working postures to enhance the competence of occupational health nurses. Int J Nurs Pract,* 28.5, e13052.doi: 10.1111/ijn.13052

International Labour Organization, I. 2024. EU–ILO collaboration to promote the right to a safe and healthy working environment. *In:* Nunes, J. P. (ed.) *Safety + Health for All.* Brussels: ILO.

Kadir, A., *et al.* (2025). *Impact of Physical and Psychological Strain on Work-Related Musculoskeletal Disorders: A Cross-Sectional Study in the Construction Industry. Inquiry,* 62. 469580251315348.doi: 10.1177/00469580251315348

Kadir, E. & Ergin, A. (2023). *The Importance and Awareness Level of Ergonomics in Terms of Office Workers*. *Ergonomics International Journal*, 7.3, 1–6.doi: 10.23880/eoij-16000306

Kasaw Kibret, A., *et al.* (2020). *Work-Related Musculoskeletal Disorders and Associated Factors Among Bankers in Ethiopia, 2018*. *Pain Res Manag*, 2020. 8735169.doi: 10.1155/2020/8735169

Keyserling, W. M., *et al.* (1991). *Ergonomic Job Analysis: A Structured Approach for Identifying Risk Factors Associated with Overexertion Injuries and Disorders*. *Applied Occupational and Environmental Hygiene*, 6.5, 353–363.doi: 10.1080/1047322X.1991.10387896

Kuorinka, I., *et al.* (1987). *Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms*. *Applied Ergonnomics*, 18.3, 233–237.doi:

Lin, R.-T. & Chan, C.-C. (2007). *Effectiveness of workstation design on reducing musculoskeletal risk factors and symptoms among semiconductor fabrication room workers*. *International Journal of Industrial Ergonomics*, 37.1, 35–42.doi: https://doi.org/10.1016/j.ergon.2006.09.015

Liu, M., *et al.* (2025). *Global, regional, and national burden of musculoskeletal disorders, 1990–2021: an analysis of the global burden of disease study 2021 and forecast to 2035*. *Frontiers in Public Health*, 13.doi: 10.3389/fpubh.2025.1562701

Milaković, M., Koren, H., Zahariev Vukšinić, K., & Bubaš, M. (2024). *Work-related musculoskeletal disorders in Croatian nurses: A cross-sectional study*. . *UniCath Journal of Biomedicine and Bioethics*, 44–53.doi:

Mohammadipour, F., *et al.* (2018). *Work-related Musculoskeletal Disorders in Iranian Office Workers: Prevalence and Risk Factors*. *J Med Life*, 11.4, 328–333.doi: 10.25122/jml-2018-0054

Mousavi-Khatir, R., *et al.* (2018). *Disturbance of neck proprioception and feed-forward motor control following static neck flexion in healthy young adults*. *J Electromyogr Kinesiol*, 41. 160–167.doi: 10.1016/j.jelekin.2018.04.013

Mujiono, M., *et al.* (2023). *Description of Work-Related Neck Pain Among Employees in State Electricity Company (PLN Indonesia)*. *Journal of Public Health for Tropical and Coastal Region*, 6.1, 1–6.doi: 10.14710/jphtcr.v6i1.16819

Munro, D. M., *et al.* (2021). *Physical demands of overhead crane operation*. *International Journal of Industrial Ergonomics*, 86. 103200.doi: https://doi.org/10.1016/j.ergon.2021.103200

National Research Council and Institute of Medicine 2001. Musculoskeletal Disorders and the Workplace: Low Back and Upper Extremities. *In:* (Us), N. R. C. U. a. I. O. M. (ed.). Washington (DC): National Academies Press (US).

Ng, Y. G., *et al.* (2013). *The Prevalence of Musculoskeletal Disorder and Association with Productivity Loss: A Preliminary Study among Labour Intensive Manual Harvesting Activities in Oil Palm Plantation*. *Industrial Health* 52. 78–85.doi:

Nurhanisah, M. H., *et al.* (2024). *Risk factors of musculoskeletal symptoms among industrial workers in Peninsular Malaysia*. *Int J Occup Saf Ergon*, 30.4, 1105–1114.doi: 10.1080/10803548.2024.2373537

Okezue, O. C., *et al.* (2020). *Work-Related Musculoskeletal Disorders among Office Workers in Higher Education Institutions: A Cross-Sectional Study*. *Ethiop J Health Sci*, 30.5, 715–724.doi: 10.4314/ejhs.v30i5.10

Prasetya, T. A., *et al.* (2024). *Prevalence and associated risk factors of musculoskeletal disorders among information technology (IT) professionals: A systematic review*. *Narra J*, 4.3, e1100.doi: 10.52225/narra.v4i3.1100

Revilla, J. A., *et al.* (2022). *Effects of various handle shapes and surface profiles on the hand-arm responses and comfort during short-term exposure to handle vibration*. *Journal of Occupational and Environmental Hygiene*, 19.6, 353–369.doi: 10.1080/15459624.2022.2063877

Rodríguez-Pulido, A. G., *et al.* (2025). *Prevalence and correlation of workload and musculoskeletal disorders in industrial workers: a cross-sectional study*. *Frontiers in Rehabilitation Sciences*, 6.doi: 10.3389/fresc.2025.1677621

Seo, N. J. & Armstrong, T. J. (2011). *Effect of elliptic handle shape on grasping strategies, grip force distribution, and twisting ability*. *Ergonomics*, 54.10, 961–70.doi: 10.1080/00140139.2011.606923

Silverman, M. N. & Deuster, P. A. (2014). *Biological mechanisms underlying the role of physical fitness in health and resilience*. *Interface Focus*, 4.5, 20140040.doi: 10.1098/rsfs.2014.0040

Su, J. M., *et al.* (2023). *Machine learning approach to determine the decision rules in ergonomic assessment of working posture in sewing machine operators*. *J Safety Res*, 87. 15–26.doi: 10.1016/j.jsr.2023.08.008

Tegegne Temesgen, T. S., Abraham Teym, Getasew Yirdaw, Balew Adane, Eniyew Tegegne, Lake Kumlachew (2023). *Musculoskeletal Disorders: Prevalence and Its factors Among Computer User Bankers of Dessie City, Northeast Ethiopia, 2022*. *Research Square*, 1–20.doi:

Thetkathuek, A. & Meepradit, P. (2018). *Work-related musculoskeletal disorders among workers in an MDF furniture factory in eastern Thailand*. *International Journal of Occupational Safety and Ergonomics*, 24.2, 207–217.doi: https://doi.org/10.1080/10803548.2016.1257765

Waersted, M., *et al.* (2010). *Computer work and musculoskeletal disorders of the neck and upper extremity: a systematic review*. *BMC Musculoskelet Disord*, 11. 79.doi: 10.1186/1471-2474-11-79

Wang, T., *et al.* (2019). *Prevalence of musculoskeletal symptoms among industrial employees in a modern industrial region in Beijing, China*. *Chin Med J (Engl)*, 132.7, 789–797.doi: 10.1097/cm9.0000000000000165

Waongenngarm, P., *et al.* (2020). *Perceived musculoskeletal discomfort and its association with postural shifts during 4-h prolonged sitting in office workers*. *Appl Ergon*, 89. 103225.doi: 10.1016/j.apergo.2020.103225

Widanarko, B., *et al.* (2011). *Prevalence of musculoskeletal symptoms in relation to gender, age, and occupational/industrial group*. *International Journal of Industrial Ergonomics*, 41.5, 561–572.doi: https://doi.org/10.1016/j.ergon.2011.06.002

World Health Organization, W. 2022. *Musculoskeletal health*, 14 July 2022.

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Table 3. Twelve-month and 7-day prevalence of musculoskeletal discomfort among office and dynamic workers (n=100)

		Body regions																	
Period		**Neck**	**χ^2**	**Shoulder**	**χ^2**	**Upper Back**	**χ^2**	**Elbow**	**χ^2**	**Low-back**	**χ^2**	**Wrist**	**χ^2**	**Thighs**	**χ^2**	**Knee**	**χ^2**	**AF**	**χ^2**
12 months	No	46 (46%)	7.21**	52 (52%)	8.85**	63 (63%)	8.09**	80 (80%)	3.18	49 (49%)	5.68*	70 (70%)	17.38***	79 (79%)	10.71**	66 (66%)	11.64**	72 (72%)	26.53***
	Yes	54 (54%)		48 (48%)		37 (37%)		20 (20%)		51 (51%)		30 (30%)		21 (21%)		34 (34%)		28 (28%)	
7 days	No	46 (46%)		51 (51%)		62 (62%)		78 (78%)		48 (48%)		70 (70%)		79 (79%)		66 (66%)		70 (70%)	
	Yes	54 (54%)		49 (49%)		38 (38%)		22 (22%)		52 (52%)		30 (30%)		21 (21%)		34 (34%)		30 (30%)	

*p <0.05; **p <0.01; ***p<0.001

Table 4. Prevalence of work-related musculoskeletal discomforts and associated factors

Variable	**Neck**	**χ^2**	**Shoulder**	**χ^2**	**Upper Back**	**χ^2**	**Elbow**	**χ^2**	**Low-back**	**χ^2**	**Wrist**	**χ^2**	**Thighs**	**χ^2**	**Knee**	**χ^2**	**AF**	**χ^2**
Gender																		
Female	23 (42.6%)	4.86*	17 (35.4%)	0.24	18 (48.6%)	6.50*	7 (35.0%)	0.45	15 (29.4%)	0.60	10 (33.3%)	0.002	7 (33.3%)	0.001	16 (47.1%)	4.60*	9 (32.1%)	0.13
Male	31 (57.4%)		31 (64.6%)		19 (51.4%)		13 (65.0%)		36 (70.6%)		20 (66.7%)		14 (66.7%)		18 (52.9%)		19 (28.0%)	
Exercise																		
Irregular	34 (63.0%)	2.31	25 (52.1%)	0.57	24 (64.9%)	1.87	17 (85.0%)	8.53**	30 (58.8%)	0.33	21 (70.0%)	3.40	11 (52.4%)	0.14	23 (67.6%)	2.83	16 (57.1%)	0.21
Regular	20 (37.0%)		23 (47.9%)		13 (35.1%)		3 (15.0%)		21 (41.2%)		9 (30.0%)		10 (47.6%)		11 (32.4%)		12 (42.9%)	
Working Experience																		
≤12 years	23 (42.6%)	5.10*	22 (45.8%)	1.90	17 (45.9%)	1.17	10 (50%)	0.09	30 (58.8%)	0.23	16 (53.3%)	<0.001	9 (42.9%)	0.29	18 (52.9%)	<0.001	14 (50%)	0.14
>12 years	31 (57.4%)		26 (54.2%)		20 (54.1%)		10 (50%)		21 (41.2%)		14 (46.7%)		12 (57.1%)		16 (47.1%)		14 (50%)	
Education																		
<10 years	12 (22.2%)	1.41	11 (22.9%)	1.51	8 (21.6%)	0.52	7 (35.0%)	4.89*	12 (23.5%)	2.15	8 (26.7%)	2.18	6 (28.6%)	2.01	7 (20.6%)	0.23	8 (28.6%)	2.94
≥10 years	42 (77.8%)		37 (77.1%)		29 (78.4%)		13 (65.0%)		39 (76.5%)		22 (73.3%)		15 (71.4%)		27 (79.4%)		20 (71.4%)	

*p <0.05; **p <0.01; ***p<0.001