



Body Segment Distribution of Musculoskeletal Disorders Among Hospitalized Patients: The Role of Sociodemographic Characteristics

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Abstract

Musculoskeletal disorders are among the leading causes of disability and frequently require hospital care. This study aimed to analyze the sociodemographic characteristics of hospitalized patients with musculoskeletal disorders and to examine the distribution of diagnoses across different anatomical body regions and their associated sociodemographic factors. A quantitative observational study was conducted using secondary data from the medical records of 421 hospitalized patients diagnosed with musculoskeletal disorders at Gunung Jati Regional Hospital in Cirebon City, Indonesia, between December 2023 and December 2024. Diagnoses were classified into nine anatomical body regions based on the Nordic Musculoskeletal Questionnaire framework. Descriptive statistics, chi-square tests, and binary logistic regression were performed. Lower back disorders were the most common diagnosis (41.1%), followed by wrist/hand (22.1%) and knee disorders (11.9%). Sex, age, marital status, educational attainment, and occupation were significantly associated with specific anatomical regions, whereas place of residence was not. Female sex independently predicted wrist/hand disorders, while marital status and occupation independently predicted lower back disorders. These findings indicated that sociodemographic characteristics influenced musculoskeletal disorders differently across anatomical regions, highlighting the importance of region-specific and patient-centered strategies for prevention, early detection, and clinical management.

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Introduction

Musculoskeletal disorders (MSDs) are among the most prevalent health problems worldwide and represent a leading cause of disability across all age groups. The World Health Organization

(2022) estimates that approximately 1.71 billion people globally are affected by musculoskeletal conditions, with low back pain being the leading cause of disability in more than 160 countries. These conditions not only impair physical functioning and reduce quality of life by approximately 17%, but also increase the demand for healthcare services and rehabilitation among adult populations (Blyth, 2023; World Health Organization, 2022). Furthermore, global trends indicate that the burden of MSDs continues to rise due to increasing life expectancy and changes in modern lifestyle and activity patterns (Bouziri et al., 2023).

The burden of MSDs is expected to continue increasing as populations age, lifestyles change, the prevalence of chronic diseases rises, and exposure to biomechanical and ergonomic risk factors remains high. Findings from the Global Burden of Disease (GBD) study indicate that the prevalence of various musculoskeletal disorders has steadily increased over the past three decades and is projected to rise substantially by 2050, particularly in low- and middle-income countries undergoing demographic and epidemiological transitions (Blyth, 2023).

Numerous studies have identified sociodemographic factors as important determinants associated with both the occurrence and distribution of musculoskeletal disorders (MSDs) (Briggs et al., 2023; Gregg et al., 2024). Factors such as age, sex, educational attainment, occupation, and socioeconomic status are known to influence an individual's susceptibility to musculoskeletal disorders through biological, behavioral, and occupational or environmental exposure pathways (Gregg et al., 2024; World Health Organization, 2022).

In Indonesia, musculoskeletal disorders also represent a significant public health concern. The 2018 Indonesian Basic Health Research (Riskesdas) reported a prevalence of physician-diagnosed joint diseases of 7.3%, with higher rates among women and older adults (Badan Penelitian dan Pengembangan Kesehatan, 2019). National studies have further shown that musculoskeletal complaints may reach 24.7% in specific population groups, reflecting the influence of population aging, chronic diseases, physical inactivity, and lifestyle changes (Anggraini & Harahap, 2025).

Hospital reports have consistently shown that diseases classified under the ICD-10 codes M00–M99 are among the major chronic conditions requiring both outpatient and inpatient care, particularly among adult and older patients. Inpatients diagnosed with these conditions generally require multidisciplinary management, medical rehabilitation services, and more intensive clinical monitoring than patients admitted for acute illnesses (World Health Organization, 2022).

The Nordic Musculoskeletal Questionnaire (NMQ) is one of the most widely used instruments for assessing musculoskeletal complaints across nine anatomical body regions (Kuorinka et al., 1987). However, previous studies have predominantly focused on workers, healthcare professionals, students, or community populations. Evidence regarding hospitalized patients remains limited, particularly concerning the relationship between sociodemographic characteristics and body region-specific musculoskeletal disorders. Most existing studies have reported the overall prevalence of MSDs without examining variations across anatomical regions or identifying patient characteristics associated with these patterns.

Based on these considerations, this study aimed to analyze the sociodemographic characteristics of hospitalized patients with musculoskeletal disorders and to describe the distribution of musculoskeletal disorders across anatomical body regions using the Nordic Musculoskeletal Questionnaire (NMQ) framework. Unlike previous studies that primarily reported the overall prevalence of MSDs in occupational or community settings, this study explicitly integrates sociodemographic characteristics with body region-specific musculoskeletal mapping among hospitalized patients. To the best of our knowledge, this is one of the few studies in Indonesia to investigate these relationships in an inpatient population. The findings are expected to provide evidence to inform the development of more targeted clinical management, rehabilitation programs, and preventive strategies based on patient characteristics and the anatomical distribution of musculoskeletal disorders.

Materials and Methods

This study employed a quantitative research design with an analytical observational approach based on secondary data. The study data were obtained from the medical records of hospitalized patients admitted between December 23, 2023, and December 31, 2024.

The study population consisted of all inpatient medical records with diagnoses classified under ICD-10 codes M00–M99 at Gunung Jati Regional Hospital, Cirebon City, totaling 781 records. Following the screening process, 421 complete medical records met the eligibility criteria and were included as the final study sample.

The independent variables included sex, age, marital status, educational attainment, occupation, and place of residence. The dependent variable was the physician-confirmed diagnosis of musculoskeletal disorders, as documented in patients' medical records. These diagnoses were subsequently classified into nine anatomical body regions based on the Nordic Musculoskeletal Questionnaire (NMQ) framework: neck, shoulders, upper back, elbows, wrists/hands, lower back, hips/thighs, knees, and ankles/feet (Kuorinka et al., 1987).

Data were collected through a structured review of medical records using a standardized data extraction form aligned with the study variables. Age was categorized into five groups: toddlers, children, adolescents, adults, and older adults, following the classification established by the Indonesian Ministry of Health (Kementerian Kesehatan Republik Indonesia, 2026). Educational attainment was classified into four categories: no formal education; primary education (elementary and junior high school graduates); secondary education (senior high school or equivalent); and higher education (diploma, bachelor's degree, or above).

Univariate analysis was performed to describe the distribution of participants' sociodemographic characteristics and musculoskeletal diagnoses using frequencies and percentages. Bivariate analysis was conducted using the chi-square test to examine the associations between sociodemographic characteristics and categories of musculoskeletal diagnoses. Statistical significance was established at a p-value of < 0.05 . Multivariable analysis was subsequently performed using binary logistic regression.

Results and Discussions

Sociodemographic Characteristics of Hospitalized Patients with Musculoskeletal Disorders

Table 1. Sociodemographic Characteristics of Hospitalized Patients with Musculoskeletal Disorders (n = 421)

Variable	Category	n	%
Sex	Male	192	45.6
	Female	229	54.4
Age	<5 years	7	1.7
	5–9 years	9	2.1
	10–17 years	25	5.9
	18–59 years	290	68.9
	≥60 years	90	21.4
Marital status	Unmarried	84	20.0
	Married	292	69.4
	Divorced	16	3.8
	Widowed	29	6.9
Education	No formal education	18	4.3

Occupation	Primary education	268	63.7
	Secondary education	110	26.1
	Higher education	25	5.9
	Unemployed	84	20.0
	Homemaker	145	34.4
	Laborer	52	12.4
	Fisherman	3	0.7
	Self-employed	52	12.4
	Trader	33	7.8
	Farmer	9	2.1
	Civil servant	12	2.9
	Others	6	1.4
Residence	Private employee	23	5.5
	Urban	86	20.4
	Rural	335	79.6

Among the 421 hospitalized patients diagnosed with musculoskeletal disorders (MSDs), females accounted for a slightly higher proportion than males (54.4% vs. 45.6%). Most patients were adults aged 18–59 years (68.9%), followed by older adults aged ≥60 years (21.4%). The majority were married (69.4%), had completed primary education (63.7%), worked as homemakers (34.4%), and resided in rural areas (79.6%) (Table 1). These findings indicate that hospitalized patients with MSDs in this setting were predominantly middle-aged adults with relatively low educational attainment and substantial domestic or occupational responsibilities.

The predominance of female patients is consistent with previous epidemiological studies reporting that women generally experience a higher burden of musculoskeletal disorders and utilize healthcare services more frequently than men. Several biological mechanisms may explain this pattern, including lower muscle mass, differences in body composition, hormonal fluctuations, and accelerated bone loss following menopause, all of which increase susceptibility to musculoskeletal conditions (Hart, 2023; World Health Organization, 2022). In addition, women are often exposed to dual workloads consisting of domestic responsibilities and paid employment, resulting in repetitive upper-limb movements, prolonged standing, awkward postures, and cumulative biomechanical stress that further elevate the risk of MSDs (Greggi et al., 2024; Jacquier-Bret & Gorce, 2023).

Adults of working age represented nearly seven out of ten hospitalized patients, highlighting that MSDs are not solely diseases of older adults but also substantially affect economically productive populations. Continuous exposure to occupational and household physical demands may lead to cumulative biomechanical loading, repetitive microtrauma, and progressive degeneration of muscles, tendons, ligaments, and intervertebral discs. Consequently, musculoskeletal pain and functional impairment frequently develop before old age, reducing work productivity and quality of life (Gill et al., 2023; World Health Organization, 2022). Although aging remains an important determinant of musculoskeletal degeneration, the present findings emphasize that preventive interventions should begin in adulthood rather than be delayed until later life.

Most participants were married, suggesting that family-related responsibilities may contribute indirectly to musculoskeletal health. Married individuals generally experience greater domestic and economic obligations, which can increase their exposure to lifting, prolonged standing, repetitive movements, and physically demanding daily activities. However, marital status itself should not be interpreted as a direct biological risk factor. Instead, it likely serves as a social determinant reflecting differences in lifestyle, psychosocial stress, and accumulated physical workload that collectively influence musculoskeletal health (Briggs et al., 2023).

Educational attainment was predominantly limited to primary education, reflecting relatively low educational levels among hospitalized patients with MSDs. Lower educational attainment has consistently been associated with reduced health literacy, limited awareness of ergonomic principles, and greater employment in physically demanding occupations. Individuals with lower levels of education may therefore be less likely to adopt preventive behaviors, recognize early musculoskeletal symptoms, or implement appropriate workplace ergonomics, thereby increasing their vulnerability to MSDs (European Agency for Safety & Health at Work, 2021; World Health Organization, 2022).

Homemakers constituted the largest occupational group in this study. Although household work is frequently overlooked as a non-occupational activity, it involves numerous biomechanically demanding tasks, including repetitive lifting, bending, carrying, cleaning, cooking, and prolonged standing. Systematic evidence indicates that these repetitive domestic activities substantially increase the risk of low back pain, shoulder disorders, and upper-limb musculoskeletal symptoms, suggesting that homemakers should be recognized as an important at-risk population rather than being considered physically inactive (Palacios-Ceña et al., 2021).

Finally, nearly 80% of participants resided in rural areas, which most likely reflects the hospital's service coverage rather than indicating residence as an independent risk factor for MSDs. Previous studies have shown that musculoskeletal disorders are primarily influenced by individual characteristics, occupational exposure, lifestyle, ergonomic conditions, and comorbidities rather than geographic location alone (World Health Organization, 2022). Therefore, the observed residential distribution should be interpreted as describing the patient population served by the hospital rather than implying a causal relationship between rural residence and musculoskeletal disorders.

Overall, the sociodemographic profile identified in this study suggests that hospitalized patients with MSDs were predominantly female, working-age adults, married, had lower educational attainment, were frequently homemakers, and mainly lived in rural communities. These findings reinforce the biopsychosocial perspective that musculoskeletal disorders arise from the complex interaction of biological susceptibility, occupational and domestic physical demands, and broader social determinants. Consequently, preventive strategies should extend beyond clinical management to include ergonomic education, workplace and household risk-reduction measures, and health-promotion programs tailored to vulnerable population groups.

Distribution of Musculoskeletal Disorders Across Nine Body Regions

Table 2. Distribution of Musculoskeletal Disorders by Body Region (n = 421)

Body Region	n	%
Neck	27	6.4
Shoulders	4	1.0
Upper back	31	7.4
Elbow	0	0.0
Wrists/Hands	93	22.1
Lower back	173	41.1
Hips/Thighs	14	3.3
Knees	50	11.9
Ankles/Feet	29	6.9

As shown in Table 2, lower back disorders represented the most common musculoskeletal diagnosis among hospitalized patients, accounting for 41.1% of all cases. Disorders affecting the wrists and hands were the second most frequent (22.1%), followed by the knees (11.9%). Diagnoses involving the upper back (7.4%), ankles and feet (6.9%), neck (6.4%), hips/thighs (3.3%), and shoulders (1.0%) occurred less frequently, while no cases involving the elbow were identified in the study population. These findings demonstrate that musculoskeletal disorders requiring

hospitalization predominantly affected weight-bearing structures and body regions subjected to repetitive biomechanical loading.

The predominance of lower back disorders is consistent with global epidemiological evidence identifying low back pain as the leading cause of disability worldwide. According to the World Health Organization, more than 600 million people currently experience low back pain, and this number is expected to increase substantially as the population ages and lifestyles change (World Health Organization, 2022). Similarly, the Global Burden of Disease study reported that low back pain remains the largest contributor to years lived with disability (YLDs) across nearly all countries, including low- and middle-income nations such as Indonesia (Gill et al., 2023). The present findings therefore reinforce the substantial clinical burden of lumbar disorders in hospital settings.

Several biomechanical mechanisms may explain the high prevalence of lower back involvement. The lumbar spine serves as the primary load-bearing region during standing, walking, lifting, and prolonged sitting, making it particularly susceptible to cumulative mechanical stress. Repetitive loading, awkward postures, and manual handling tasks can produce microtrauma to the intervertebral discs, facet joints, paraspinal muscles, and supporting ligaments, thereby accelerating degenerative changes and contributing to chronic pain and functional limitations (Hartvigsen et al., 2018; Jahn et al., 2023). In addition, increasing age, obesity, and chronic comorbidities have been recognized as important factors that further increase the risk of low back disorders and their long-term disability burden (GBD 2021 Low Back Pain Collaborators, 2023).

The wrists and hands constituted the second most affected body region. This finding suggests that repetitive hand-intensive activities remain an important contributor to musculoskeletal morbidity among hospitalized patients. Repetitive gripping, forceful hand exertion, manual material handling, and prolonged repetitive movements increase mechanical loading on the flexor tendons, ligaments, and the median nerve, thereby predisposing individuals to tendinopathies, osteoarthritis, and carpal tunnel syndrome (Descatha et al., 2021; European Agency for Safety & at work, 2021). Considering that women and homemakers represented the largest demographic groups in this study, the relatively high frequency of wrist and hand disorders may reflect cumulative exposure to repetitive domestic and occupational activities, including cooking, cleaning, lifting, and other household tasks that require sustained hand use (Lu et al., 2023; Osinuga et al., 2021).

Knee disorders ranked third in prevalence, accounting for approximately one in eight musculoskeletal diagnoses. As one of the principal weight-bearing joints, the knee is continuously subjected to substantial compressive and shear forces during standing, walking, stair climbing, and lifting. Degenerative conditions, particularly knee osteoarthritis, become increasingly common with advancing age and are further exacerbated by obesity, previous injuries, and prolonged occupational loading (Hunter et al., 2020). The observed prevalence of knee disorders therefore likely reflects the combined effects of biomechanical overload and age-related joint degeneration within the hospitalized population.

Although disorders involving the neck, upper back, and ankles/feet occurred less frequently, they remain clinically important because of their impact on mobility and daily functioning. Neck and upper back symptoms are commonly associated with prolonged static postures, repetitive upper-body movements, and sustained cervical flexion during occupational or domestic activities. Meanwhile, ankle and foot disorders are often related to prolonged standing, walking, balance impairment, trauma, and degenerative changes affecting the lower extremities (World Health Organization, 2022). Even when less prevalent than lumbar disorders, these conditions can substantially reduce functional independence and quality of life.

Interestingly, no elbow disorders were identified among hospitalized patients. This finding may reflect the clinical characteristics of the study population rather than the true absence of elbow musculoskeletal conditions. Disorders such as lateral and medial epicondylitis are generally managed in outpatient settings because they rarely require hospitalization. Moreover, these conditions are

typically associated with highly repetitive occupational or sports-related activities and therefore occur less frequently among general inpatient populations (Descatha et al., 2021). Consequently, the absence of elbow diagnoses should be interpreted cautiously and may primarily reflect hospital admission patterns rather than disease epidemiology.

Overall, the distribution of musculoskeletal disorders observed in this study indicates that body regions subjected to repetitive biomechanical loading and weight-bearing functions, particularly the lower back, wrists/hands, and knees, accounted for the majority of inpatient diagnoses. These findings support the multifactorial nature of MSDs, in which mechanical loading, degenerative processes, occupational exposure, and daily functional activities interact to determine disease occurrence. From a clinical perspective, the results emphasize the need for hospital-based prevention strategies that extend beyond medical treatment to include ergonomic education, early rehabilitation, and targeted risk assessment for high-risk anatomical regions. Such interventions may reduce functional disability, improve recovery, and decrease the long-term burden of musculoskeletal disorders among hospitalized patients.

Associations Between Sociodemographic Characteristics and Body Region-Specific Musculoskeletal Disorders

Table 3. Associations Between Sociodemographic Characteristics and Body Region-Specific Musculoskeletal Disorders (Chi-square Analysis)

Variable	Neck	Shoulders	Upper Back	Wrists/ Hands	Lower Back	Hips/ Thighs	Knees	Ankles/ Feet
n (%)	27 (6.4)	4 (1.0)	31 (7.4)	93 (22.1)	173 (41.1)	14 (3.3)	50 (11.9)	29 (6.9)
Sex								
Male	16 (8.3)	3 (1.6)	13 (6.8)	27 (14.1)	69 (35.9)	7 (3.6)	34 (17.7)	23 (12.0)
Female	11 (4.8)	1 (0.4)	18 (7.9)	66 (28.8)	104 (54.4)	7 (3.1)	16 (7.0)	6 (2.6)
χ^2	2.168	1.407	0.182	13.217	3.875	0.113	11.470	14.263
p-value	.203	.335	.811	<.001	.062	.950	.001	<.001
Age								
<5 years (Toddlers)	NS	NS	2 (28.6)	4 (57.1)	1 (14.3)	NS	NS	NS
5–9 years (Children)	NS	NS	1 (11.1)	2 (22.2)	2 (22.2)	1 (11.1)	3 (33.3)	NS
10–17 years (Adolescents)	NS	NS	1 (4.0)	17 (68.0)	4 (16.0)	NS	3 (12.0)	NS
18–59 years (Adults)	22 (7.6)	2 (0.7)	22 (7.6)	60 (20.7)	121 (41.7)	9 (3.1)	34 (11.7)	20 (6.9)
≥60 years (Older adults)	5 (5.6)	2 (2.2)	5 (5.6)	10 (11.1)	45 (50.0)	4 (4.4)	10 (11.1)	9 (10.0)
χ^2	3.585	2.150	5.668	42.248	12.902	3.193	4.960	4.392
p-value	.465	.708	.225	<.001	.012	.526	.291	.356
Marital Status								
Unmarried	1 (1.2)	1 (1.2)	8 (9.5)	37 (44.0)	16 (19.0)	4 (4.8)	13 (15.5)	4 (4.8)

Married	22 (7.5)	3 (1.0)	21 (7.2)	52 (17.8)	134 (45.9)	9 (3.1)	30 (10.3)	21 (7.2)
Divorced	2 (12.5)	NS	NS	NS	10 (62.5)	NS	2 (12.5)	2 (12.5)
Widowed	2 (6.9)	NS	2 (6.9)	4 (13.8)	13 (44.8)	1 (3.4)	5 (17.2)	2 (6.9)
χ^2	5.428	0.502	1.868	32.339	22.837	1.145	2.560	1.420
p-value	.143	.919	.600	<.001	<.001	.766	.465	.701
Educational Attainment								
No formal education	1 (5.6)	NS	2 (11.1)	6 (33.3)	7 (38.9)	2 (11.1)	NS	NS
Primary education	17 (6.3)	1 (0.4)	22 (8.2)	46 (17.2)	118 (44.0)	8 (3.0)	38 (14.2)	18 (6.7)
Secondary education	5 (4.5)	3 (2.7)	5 (4.5)	37 (33.6)	35 (31.8)	4 (3.6)	11 (10.0)	10 (9.1)
Higher education	4 (16.0)	NS	2 (8.0)	4 (16.0)	13 (52.0)	NS	1 (4.0)	1 (4.0)
χ^2	4.492	5.052	1.947	14.160	6.129	4.384	5.636	2.501
p-value	.213	.168	.583	.003	.106	.223	.131	.475
Occupation								
Unemployed	3 (3.5)	NS	7 (8.1)	35 (40.7)	25 (29.1)	3 (3.5)	9 (10.5)	4 (4.7)
Homemaker	8 (5.5)	1 (0.7)	11 (7.6)	33 (22.8)	73 (50.3)	6 (4.1)	10 (6.9)	3 (2.1)
Laborer	3 (5.8)	1 (1.9)	3 (5.8)	4 (7.7)	23 (44.2)	2 (3.8)	8 (15.4)	8 (15.4)
Fisherman	NS	NS	NS	NS	2 (66.7)	NS	1 (33.3)	NS
Self-employed	8 (15.4)	2 (3.8)	4 (7.7)	9 (17.3)	17 (32.7)	2 (3.8)	8 (15.4)	2 (3.8)
Trader	NS	NS	3 (9.1)	2 (6.1)	14 (42.4)	NS	8 (24.2)	6 (18.2)
Farmer	NS	NS	1 (11.1)	1 (11.1)	4 (44.4)	NS	3 (33.3)	NS
Civil servant	2 (16.7)	NS	NS	1 (8.3)	8 (66.7)	NS	NS	1 (8.3)
Others	NS	NS	NS	2 (33.3)	2 (33.3)	NS	1 (16.7)	1 (16.7)
Private employee	3 (13.0)	NS	2 (8.7)	6 (26.1)	5 (21.7)	1 (4.3)	2 (8.7)	4 (17.4)
χ^2	15.710	6.912	2.347	32.675	19.817	2.634	16.894	24.864
p-value	.073	.646	.985	<.001	.019	.977	.050	.003
Place of Residence								
Urban	3 (3.5)	2 (2.3)	6 (7.0)	16 (18.6)	35 (40.7)	2 (2.3)	14 (16.3)	8 (9.3)
Rural	24 (7.2)	2 (0.6)	25 (7.5)	77 (23.0)	138 (41.2)	12 (3.6)	36 (10.7)	21 (6.3)
χ^2	1.541	2.173	0.042	0.763	0.007	0.336	2.002	0.982
p-value	.320	.187	1.000	.467	1.000	.744	.219	.452

The chi-square analysis demonstrated that the associations between sociodemographic characteristics and musculoskeletal disorders (MSDs) varied by affected anatomical region. Sex, age, marital status, education, and occupation showed significant associations with specific body regions, whereas place of residence was not significantly associated with MSDs in any anatomical location (Table 3).

Sex

Sex was significantly associated with MSDs affecting the wrists/hands ($p < 0.001$), knees ($p = 0.001$), and ankles/feet ($p < 0.001$). Female patients experienced a substantially higher proportion of wrist and hand disorders, whereas knee and ankle disorders were more frequently observed among males. These findings indicate that the influence of sex on musculoskeletal disorders is site-specific rather than uniformly distributed across the musculoskeletal system.

The higher frequency of wrist and hand disorders among women is biologically plausible. Women generally have lower muscle mass, reduced grip strength, and anatomical characteristics of the wrist that may increase susceptibility to upper-extremity musculoskeletal disorders. In addition, sex-related hormonal fluctuations can influence collagen metabolism, ligament laxity, and tendon integrity, further contributing to musculoskeletal conditions affecting the wrists and hands (Napper et al., 2023; Overstreet et al., 2023). Women also frequently perform repetitive domestic activities, including cooking, cleaning, washing, and childcare, which expose the wrists and hands to sustained repetitive movements and cumulative mechanical loading. Previous studies have demonstrated that these activities are associated with an increased risk of upper-limb musculoskeletal disorders among women (Lu et al., 2023). Conversely, the higher prevalence of knee and ankle disorders among male patients may reflect greater participation in physically demanding occupational and recreational activities involving prolonged standing, heavy lifting, walking on uneven surfaces, and repetitive lower-limb loading. Occupational studies have consistently shown that workers exposed to high physical workloads are at increased risk of lower-extremity musculoskeletal disorders because of cumulative biomechanical stress (Mekonnen et al., 2022). Together, these findings suggest that both biological differences and activity-related exposures contribute to the sex-specific distribution of musculoskeletal disorders observed in this study.

Age

Age was significantly associated with wrist/hand disorders ($p < 0.001$) and lower back disorders ($p = 0.012$), indicating that musculoskeletal diagnoses vary across different age groups. Aging is accompanied by progressive reductions in muscle mass, bone mineral density, tendon elasticity, and regenerative capacity, all of which increase susceptibility to musculoskeletal degeneration and chronic pain (GBD 2021 Low Back Pain Collaborators, 2023).

The association between age and lower back disorders is consistent with global evidence showing that lumbar degeneration increases progressively throughout adulthood and reaches its highest prevalence among older populations (GBD 2021 Low Back Pain Collaborators, 2023). Likewise, age-related changes affecting cartilage, tendons, and hand joints may explain the significant association observed for wrist and hand disorders. Previous global epidemiological studies have consistently demonstrated that the burden of musculoskeletal disorders rises markedly with advancing age across almost all populations (Briggs et al., 2023; Safiri et al., 2021). These findings underscore the importance of implementing preventive interventions in adulthood to minimize cumulative biomechanical damage before advanced age.

Marital Status

Marital status showed significant associations with wrist/hand disorders ($p < 0.001$) and lower back disorders ($p < 0.001$). Although marital status itself is unlikely to exert a direct biological effect on musculoskeletal health, it may reflect differences in social roles, domestic responsibilities, and psychosocial stress.

Married individuals generally take on greater household and occupational responsibilities, increasing their exposure to repetitive lifting, bending, prolonged standing, and other physically demanding daily activities. Furthermore, psychosocial stress associated with family and economic responsibilities has been linked to increased pain perception through neuroendocrine and inflammatory pathways, thereby contributing to chronic musculoskeletal pain (Hartvigsen et al., 2018). A previous study conducted in China similarly reported that marital status was associated with musculoskeletal disorders, suggesting that social circumstances may influence musculoskeletal health through multiple indirect mechanisms (Yang et al., 2019).

Educational Attainment

Educational attainment was significantly associated only with wrist/hand disorders ($p = 0.003$), whereas no significant associations were observed for other anatomical regions. Individuals with lower educational attainment often have limited access to health information, reduced awareness of ergonomic practices, and are more likely to engage in manual occupations involving repetitive upper-limb movements.

Previous studies have consistently demonstrated that lower education is associated with increased musculoskeletal risk because individuals are more frequently employed in physically demanding occupations and may have fewer opportunities to implement preventive ergonomic practices (Greggi et al., 2024; Krishnan et al., 2021). Conversely, higher educational attainment is generally associated with better health literacy, healthier behaviors, and improved access to preventive healthcare services (World Health Organization, 2022). Therefore, educational interventions focused on ergonomic awareness may help reduce upper-extremity musculoskeletal disorders among vulnerable populations.

Occupation

Occupation emerged as the sociodemographic factor associated with the greatest number of anatomical regions, demonstrating significant relationships with wrist/hand disorders ($p < 0.001$), lower back disorders ($p = 0.019$), knee disorders ($p = 0.050$), and ankle/foot disorders ($p = 0.003$). This finding highlights the important contribution of occupational biomechanical exposure to the development of musculoskeletal disorders.

Different occupations involve varying levels of repetitive movement, heavy lifting, prolonged standing, awkward postures, and static loading, all of which contribute to cumulative microtrauma affecting muscles, tendons, ligaments, and joints. Previous studies have consistently reported elevated musculoskeletal risks among manual laborers, agricultural workers, healthcare professionals, and construction workers because of continuous exposure to biomechanical hazards (Greggi et al., 2024). Previous evidence has consistently demonstrated that physically demanding work and exposure to ergonomic hazards substantially increase the risk of lower back, knee, and upper-limb musculoskeletal disorders. In contrast, prolonged sedentary work is more frequently associated with neck and shoulder complaints. These findings reinforce the importance of implementing comprehensive workplace ergonomic interventions and occupational health promotion programs that address both biomechanical and psychosocial risk factors to reduce the overall burden of musculoskeletal disorders (Hulshof et al., 2021; Macdonald & Oakman, 2024).

Place of Residence

Unlike the other sociodemographic variables, place of residence was not significantly associated with musculoskeletal disorders in any body region ($p > 0.05$). This finding suggests that

geographical location alone is unlikely to determine the anatomical distribution of MSDs among hospitalized patients.

Rather than residential setting, musculoskeletal disorders are primarily influenced by individual characteristics, occupational exposure, lifestyle behaviors, obesity, comorbidities, and ergonomic conditions (Briggs et al., 2023; World Health Organization, 2022). Environmental influences may also operate indirectly through psychosocial pathways, including occupational stress, job dissatisfaction, anxiety, and other workplace-related factors that contribute to musculoskeletal symptoms (Aeni et al., 2025). Consequently, the absence of significant associations with residence supports the biopsychosocial model, which holds that musculoskeletal disorders result from complex interactions among biological, behavioral, occupational, psychological, and social determinants rather than from geographic location alone.

Independent Sociodemographic Predictors of Body Region–Specific Musculoskeletal Disorders

Table 4. Multivariable Binary Logistic Regression Analysis of Sociodemographic Factors Associated with Body Region–Specific Musculoskeletal Disorders

Diagnosis	B	Adjusted OR	95% CI of OR	p-value
Wrists/Hands				
Constant	-1.260	0.284	,	< .001
Sex				
Male	Reference			
Female	1.025	2.778	1.332–5.836	.007
Age				
<5 years (Toddlers)	Reference			
5–9 years (Children)	-0.586	0.556	0.048–6.507	.640
10–17 years (Adolescents)	0.801	2.227	0.307–16.180	.429
18–59 years (Adults)	-1.261	0.283	0.047–1.699	.168
≥60 years (Older adults)	-2.005	0.135	0.020–0.923	.041
Marital Status				
Unmarried	Reference			
Married	-0.508	0.602	0.256–1.418	.245
Divorced	-20.217	0.000	0.000	.998
Widowed	-1.059	0.347	0.087–1.379	.133
Educational Attainment				
No formal education	Reference			
Primary education	-0.104	0.901	0.238–3.406	.878
Secondary education	0.764	2.148	0.548–8.421	.273
Higher education	0.042	1.043	0.155–7.027	.966
Occupation				
Unemployed	Reference			

Homemaker	-0.632	0.532	0.202–1.402	.201
Laborer	-1.109	0.330	0.079–1.383	.129
Fisherman	-19.385	0.000	0.000	.999
Self-employed	-0.326	0.722	0.238–2.190	.565
Trader	-1.465	0.231	0.039–1.367	.106
Farmer	-0.662	0.516	0.047–5.603	.586
Civil servant	-0.985	0.374	0.029–4.800	.450
Others	-0.914	2.494	0.365–17.028	.351
Private employee	-0.023	0.977	0.269–3.545	.972
Lower Back				
Constant	-0.360	0.698	,	< .001
Age				
<5 years (Toddlers)	Reference			
5–9 years (Children)	-0.117	0.890	0.055–14.381	.934
10–17 years (Adolescents)	-0.156	0.856	0.075–9.697	.900
18–59 years (Adults)	0.961	2.615	0.293–23.340	.389
≥60 years (Older adults)	1.322	3.749	0.407–34.578	.244
Marital Status				
Unmarried	Reference			
Married	1.244	3.469	1.512–7.957	.003
Divorced	1.974	7.199	1.914–27.076	.003
Widowed	1.057	2.877	0.982–8.431	.054
Occupation				
Unemployed	Reference			
Homemaker	-0.004	0.996	0.449–2.208	.992
Laborer	-0.286	0.751	0.301–1.876	.540
Fisherman	0.627	1.871	0.150–23.308	.626
Self-employed	-0.795	0.452	0.180–1.134	.091
Trader	-0.368	0.692	0.249–1.921	.480
Farmer	-0.305	0.737	0.159–3.415	.697
Civil servant	0.611	1.843	0.411–8.255	.424
Others	-0.760	0.468	0.072–3.032	.426
Private employee	-1.350	0.259	0.076–0.886	.031
Knees				
Constant	-2.004	0.135	,	< .001
Sex				
Male	Reference			
Female	-0.975	0.377	0.141–1.010	.052
Occupation				
Unemployed	Reference			
Homemaker	0.136	1.146	0.374–3.510	.812
Laborer	0.123	1.131	0.367–3.480	.831
Fisherman	0.973	2.647	0.207–33.858	.454

Self-employed	-0.105	0.900	0.276–2.932	.861
Trader	0.841	2.319	0.752–7.151	.143
Farmer	1.316	3.728	0.744–18.688	.110
Civil servant	-18.784	0.000	0.000	.999
Others	0.179	1.196	0.119–12.041	.879
Private employee	-0.394	0.675	0.128–3.549	.642
Ankles/Feet				
Constant	-2.604	0.074	,	< .001
Sex				
Male	Reference			
Female	-1.332	0.264	0.070–0.999	.050
Occupation				
Unemployed	Reference			
Homemaker	-0.044	0.957	0.170–5.397	.961
Laborer	0.953	2.594	0.660–10.197	.172
Fisherman	-18.594	0.000	0.000	.999
Self-employed	-0.711	0.491	0.079–3.060	.446
Trader	1.171	3.226	0.762–13.656	.112
Farmer	-18.390	0.000	0.000	.999
Civil servant	0.925	2.522	0.243–26.147	.438
Others	1.149	3.155	0.275–36.125	.356
Private employee	1.143	3.136	0.641–15.353	.158

Notes: OR = odds ratio; CI = confidence interval; Reference = reference category used in the regression model. Statistically significant associations were defined as $p < 0.05$

Multivariable binary logistic regression was performed to identify independent sociodemographic predictors of musculoskeletal disorders (MSDs) after adjusting for potential confounders. Separate regression models were developed for anatomical regions that showed significant associations in the bivariate analysis: wrists/hands, lower back, knees, and ankles/feet. Overall, sex, marital status, and occupation remained significant predictors for specific body regions, whereas no independent sociodemographic predictor was identified for knee disorders (Table 4).

Wrists and Hands

In the wrists/hands model, female sex remained an independent predictor after adjustment for age, marital status, educational attainment, and occupation. Female patients had 2.78 times greater odds of receiving a wrist/hand MSD diagnosis than male patients (AOR = 2.78, 95% CI: 1.33–5.84, $p = 0.007$). In contrast, patients aged ≥ 60 years had significantly lower odds than the reference group (AOR = 0.14; 95% CI, 0.02–0.92; $p = 0.041$).

The elevated risk observed among women is consistent with previous studies demonstrating that females are more susceptible to upper-extremity musculoskeletal disorders, including tendinopathies, hand osteoarthritis, and carpal tunnel syndrome. Biological factors such as lower grip strength, smaller carpal tunnel dimensions, and hormonal influences on connective tissue metabolism contribute to this increased vulnerability (Genova et al., 2020; Padua et al., 2016). In addition, repetitive domestic activities, including cooking, cleaning, washing, and childcare, place considerable cumulative mechanical stress on the wrists and hands, particularly among women who frequently undertake household responsibilities.

Interestingly, older adults exhibited lower odds of wrist and hand disorders than the reference category. This finding should be interpreted with caution because children younger than 5 years served as the reference group, despite representing only a very small proportion of the sample. Such

an imbalanced reference category may have produced unstable parameter estimates, as reflected by the relatively wide confidence interval. Consequently, this result likely reflects the statistical structure of the dataset rather than a true protective effect of older age. Future studies should consider selecting a more epidemiologically appropriate reference category, such as younger or middle-aged adults, to facilitate more meaningful interpretation.

Lower Back

For lower back disorders, marital status and occupation remained significant independent predictors. Married individuals were approximately 3.47 times more likely to receive a lower back diagnosis than unmarried individuals (AOR = 3.47, 95% CI: 1.51–7.96, $p = 0.003$), while divorced participants had an even greater likelihood (AOR = 7.20, 95% CI: 1.91–27.08, $p = 0.003$). Conversely, private-sector employees demonstrated significantly lower odds of lower back disorders than unemployed participants (AOR = 0.26, 95% CI: 0.08–0.89, $p = 0.031$).

Although marital status is unlikely to exert a direct biological influence on lumbar disorders, it may reflect broader psychosocial and behavioral determinants. Married and divorced individuals often experience greater family responsibilities, financial obligations, and psychological stress, all of which may increase exposure to prolonged lifting, repetitive bending, awkward postures, and chronic stress-related pain sensitization. Contemporary evidence indicates that psychosocial stress contributes to chronic low back pain through neuroendocrine dysregulation, inflammatory pathways, and altered pain processing mechanisms (Oliveira et al., 2026).

The lower odds observed among private-sector employees may be explained by the healthy worker effect, whereby individuals who remain actively employed generally have better functional health than those who are unemployed or unable to work due to illness or disability. Moreover, many private companies have increasingly implemented workplace ergonomics and occupational health promotion programs that may reduce exposure to biomechanical risk factors and consequently decrease the incidence of work-related musculoskeletal disorders (Macdonald & Oakman, 2024).

Knees

No sociodemographic variable remained independently associated with knee disorders after adjustment for potential confounders, despite the significant association observed during the bivariate analysis. Although women tended to have lower odds of knee disorders than men, the association narrowly failed to reach statistical significance ($p = 0.052$).

The absence of significant predictors suggests that knee disorders may be more strongly influenced by clinical and biomechanical factors that were not available in the present study. Variables such as body mass index, previous knee trauma, osteoarthritis severity, occupational loading, physical activity, obesity, and metabolic diseases have consistently been identified as major determinants of knee pathology (Hunter et al., 2020). Therefore, incorporating these clinical variables into future predictive models may substantially improve the ability to explain knee-related musculoskeletal disorders.

Ankles and Feet

In the ankle/foot model, sex was the only independent predictor. Female patients had significantly lower odds of ankle and foot disorders than male patients (AOR = 0.26; 95% CI, 0.07–0.99; $p = 0.050$).

This finding suggests that male patients may experience greater biomechanical loading of the lower extremities due to physically demanding occupations, prolonged standing, walking, or occupational injuries. Ankle disorders commonly result from repetitive mechanical loading, ligament sprains, chronic instability, and overuse injuries, all of which are frequently associated with physically demanding activities and manual labor (Martin et al., 2021). Nevertheless, because the association was observed at the threshold of statistical significance and the confidence interval approached unity,

this finding should be interpreted with caution. Larger multicenter studies are warranted to determine whether sex independently influences ankle and foot musculoskeletal disorders among hospitalized patients.

Overall, the multivariable analysis demonstrates that the influence of sociodemographic characteristics varies across anatomical regions rather than uniformly affecting musculoskeletal disorders. Female sex emerged as the principal predictor of upper-extremity disorders, whereas marital status and employment characteristics were more strongly associated with lower back disorders. These findings highlight the heterogeneous etiology of MSDs and emphasize that preventive strategies should consider both patient characteristics and the specific anatomical region affected. Such region-specific risk stratification may improve early identification of vulnerable patients and support the development of targeted prevention and rehabilitation programs in hospital settings.

Clinical Implications, Strengths, and Limitations

The present study provides novel evidence regarding the anatomical distribution of musculoskeletal disorders (MSDs) and their associations with sociodemographic characteristics among hospitalized patients in Indonesia. Unlike many previous studies that have examined MSDs as a single clinical entity, this study evaluated body region-specific diagnoses using the Nordic Musculoskeletal Questionnaire (NMQ) framework in combination with physician-confirmed diagnoses recorded in hospital medical records. This approach enabled a more detailed understanding of how sociodemographic characteristics influence different anatomical regions rather than assuming that all musculoskeletal disorders share identical risk profiles.

The findings have several important clinical implications. First, lower back disorders accounted for more than two-fifths of all musculoskeletal diagnoses, followed by wrist/hand and knee disorders, indicating that preventive strategies in hospital settings should prioritize these anatomical regions. Second, the identification of sex, marital status, and occupation as independent predictors of specific body regions suggests that musculoskeletal prevention programs should be tailored to patient characteristics rather than applying a uniform intervention to all individuals. Risk-based screening at hospital admission, ergonomic education, early rehabilitation, and targeted follow-up for high-risk populations may improve functional outcomes while reducing long-term disability associated with musculoskeletal disorders.

From a public health perspective, the predominance of female patients, working-age adults, individuals with lower educational attainment, and homemakers highlights the importance of extending musculoskeletal prevention beyond occupational settings. Domestic activities, informal work, and cumulative biomechanical exposure should receive greater attention in health promotion programs because these factors may substantially contribute to the burden of MSDs within the community. Consequently, multidisciplinary interventions involving clinicians, rehabilitation specialists, occupational health professionals, and public health practitioners are essential to reduce the growing burden of musculoskeletal disorders.

This study has several strengths. First, it analyzed physician-confirmed diagnoses derived from hospital medical records rather than relying solely on self-reported symptoms, thereby improving diagnostic validity. Second, musculoskeletal disorders were classified into nine anatomical body regions, enabling region-specific analyses that yield more clinically meaningful information than studies evaluating MSDs as a single outcome. Third, the relatively large sample of hospitalized patients enhanced the precision of the statistical analyses. At the same time, multivariable logistic regression identified independent sociodemographic predictors after adjustment for potential confounders.

Nevertheless, several limitations should be acknowledged. The cross-sectional design precludes causal inference regarding the relationship between sociodemographic characteristics and

musculoskeletal disorders. Because secondary medical-record data were used, several important clinical and lifestyle variables, including body mass index, physical activity, smoking status, occupational ergonomic exposure, duration of symptoms, previous injuries, obesity, and comorbid chronic diseases, could not be evaluated. These unmeasured factors may have influenced both the occurrence and anatomical distribution of MSDs. Furthermore, the study was conducted at a single referral hospital, which may limit the generalizability of the findings to other healthcare settings or populations with different demographic characteristics.

Future research should employ multicenter prospective or longitudinal designs to clarify causal pathways linking sociodemographic characteristics with body region-specific musculoskeletal disorders. Incorporating clinical, ergonomic, occupational, and lifestyle variables into predictive models may improve their explanatory power and support the development of more accurate risk prediction tools. Such evidence will facilitate the implementation of personalized prevention strategies and strengthen hospital- and community-based programs to reduce the burden of musculoskeletal disorders across diverse populations.

Conclusion

This study showed that lower back disorders were the most prevalent musculoskeletal disorders (MSDs) among hospitalized patients, followed by wrist/hand and knee disorders. Sociodemographic characteristics influenced MSDs differently across anatomical regions, with sex, marital status, and occupation emerging as the key independent predictors of specific body region-related disorders. These findings emphasize that musculoskeletal disorders should not be managed with a one-size-fits-all approach but rather require region-specific, patient-centered strategies for prevention, early detection, rehabilitation, and clinical management. By integrating sociodemographic characteristics with the anatomical distribution of MSDs, this study provides evidence to support risk stratification and more targeted healthcare planning for hospitalized patients. Future multicenter prospective studies incorporating occupational, ergonomic, and lifestyle factors are warranted to strengthen risk prediction and inform more effective prevention and rehabilitation strategies.

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Ethics Approval

This study was approved by the Health Research and Development Ethics Committee of Gunung Jati Regional Hospital, Cirebon City, under Ethical Approval No. 062/LAIKETIK/KEPPKRSGJ/XII/2025.

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