Workplace Conditions and their Association with Musculoskeletal Disorders among Nurses and Orderlies at a Hospital in Nicaragua

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Direct Research Journal of Public Health and Environmental Technology

Direct RESEARCH JOURNALS

Vol. 11(2), Pp. 27-34, May 2026

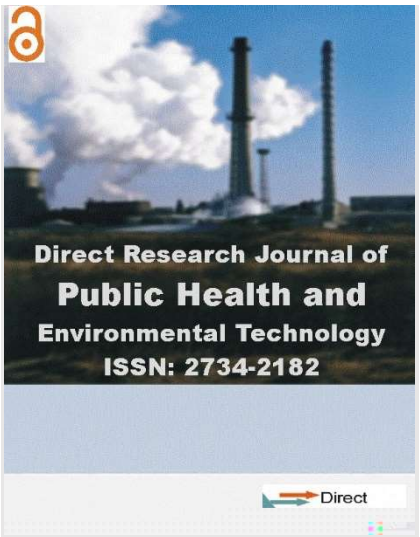
Research Article
ISSN: 2734-2182
https://journals.directresearchpublisher.org/index.php/drjphet; https://www.ajol.info/index.php/drjphet

Received 27 February 2026, Accepted 1 April 2026, Published 7 May 2026

ABSTRACT

Due to the high frequency of exposure to awkward postures, repetitive movements, and manual handling of loads in the hospital setting, the association between workplace conditions and musculoskeletal disorders among nurses and orderlies at a hospital in Nicaragua was studied during 2024. The objective was to characterize the staff's sociodemographic profile, evaluate workplace ergonomic conditions, identify musculoskeletal complaints, and analyze their association with high ergonomic risk. A quantitative, observational, descriptive, and analytical cross-sectional study was conducted on 148 workers, of whom 123 were nurses and 25 were orderlies. The REBA matrix, an ergonomic checklist, and the Nordic Questionnaire were used. The analysis included descriptive statistics and simple and multiple binary logistic regression. Predominance was found among nursing staff, female employees, those in the inpatient ward, and those with more than five years of service. In the ergonomic assessment, the most common factors were mixed postures, neck flexion or extension greater than 20°, pronounced knee flexion, repetitive movements, and handling loads greater than 10 kg. The lumbar region had the highest frequency of discomfort, followed by the wrist or hands. In the bivariate analysis, handling loads greater than 10 kg and poor grip quality were associated with high ergonomic risk; however, in the adjusted model, only loads greater than 10 kg maintained a significant association. It was concluded that load handling constitutes the main factor associated with high ergonomic risk and that its reduction represents a priority for hospital occupational health.

Keywords: *Musculoskeletal Disorders; Nursing Staff; Ergonomics; Hospitals; Occupational Health*



Citation: Rivera, G. M. P. & Segovia, E. A. J. C. (2026). Workplace Conditions and their Association with Musculoskeletal Disorders among Nurses and Orderlies at a Hospital in Nicaragua. *Direct Research Journal of Public Health and Environmental.* Vol. 11(2), Pp. 27-34.
https://doi.org/10.26765/DRJPHET051751227

INTRODUCTION

Work-related musculoskeletal disorders reduce work performance. Systematic reviews have reported a high annual prevalence among hospital nursing staff, ranging from 71.8% to 84.0%. On the other hand, clinical nursing staff showed an overall prevalence of 79%, with a higher incidence in the neck, lower back, and shoulders (Sousa

et al., 2023; Wang et al., 2024). The most vulnerable anatomical regions are typically the lumbar region, the neck, and the shoulders, and according to healthcare workers, mechanical movements and forced postures are identified as predictors (Portilla Pantoja & Juna Juca, 2024). Additionally, other studies revealed a high prevalence of musculoskeletal pain, with an adjusted prevalence of cervical and dorsal pain of 45.9% for Nicaragua, with women and manual workers being the most affected (Rojas et al., 2015).

This problem has multiple causes, stemming from the biomechanical and organizational demands inherent to the job. It has been highlighted that being over 35 years of age, length of service, workdays exceeding 8 hours, workweeks exceeding 40 hours, perceived fatigue, and night shifts are predictors of developing more severe musculoskeletal disorders and of workers taking a greater number of sick days, as well as reduced work performance (Schultz et al., 2022). In hospitals, the ergonomic risk factors most closely associated with musculoskeletal disorders are: manual patient handling, forced or sustained postures, repetitive movements, excessive exertion, and physical overload due to work pace. Furthermore, physical and mental overload, staff shortages, and limited availability of assistive devices exacerbate ergonomic exposure in hospital settings (Chandralekha et al., 2022; Liu et al., 2025; Wåhlin et al., 2025) Although equipment designed to lift, transfer, and reposition patients is recommended to ensure the safety of both staff and patients, its practical application has been limited. According to studies, only 40% of staff use such equipment in half of all lifting or transfer tasks (Khairallah et al., 2024; Schoenfisch et al., 2019; Serranheira et al., 2015).

In Nicaragua, the literature on musculoskeletal disorders among hospital staff is more limited and does not specifically focus on joint research involving nurses and orderlies. The studies identified in this analysis are predominantly directed toward medical staff, laboratory personnel, or more general approaches to occupational health, highlighting a relevant research gap for the present study. Similarly, the group of orderlies has been excluded from numerous studies and classified within larger hospital groups, despite their contribution to the manual handling of patients and the transfer of patients from beds to chairs and to other areas of the hospital (Johnson et al., 2023; Kim et al., 2012; Vaughan et al., 2021). Within the Latin American hospital setting, a study conducted on workers including nursing staff and orderlies revealed that the back region was the most affected among orderlies and paramedics, while among nursing staff, the feet and legs were the most affected (Jacquier-Bret & Gorce, 2023; Rivera Guillén et al., 2015).

The primary objective of this study was to characterize the sociodemographic and occupational profile of nurses and orderlies at a hospital in Nicaragua in 2024, to assess their working conditions based on an ergonomic risk assessment checklist, to identify musculoskeletal disorders among these staff members, and to analyze the correlation between these working conditions and the incidence of such disorders.

METHODOLOGY

A quantitative, observational, descriptive, and analytical cross-sectional study was conducted at a hospital in Nicaragua in 2024. The ergonomic assessment by sector covered nine hospital areas: Shock Room, Observation, Intensive Care Unit, Medical-Surgical, Inpatient, Emergency, Outpatient, Recovery, and Labor and Delivery.

The study population consisted of the hospital's nursing staff and orderlies. Non-probability sampling was used, as all available records in the hospital's data matrices that met the selection criteria were included. The sample consisted of 148 workers, of whom 123 were nurses and 25 were orderlies. Nine hospital departments were included for the assessment by area. Duplicate records, inconsistent records, or those with insufficient information for the specific analysis of each instrument were excluded, as were personnel outside the occupational categories of interest and areas not included in the ergonomic assessment.

The unit of analysis was multiple. In the REBA matrix and the Nordic Questionnaire, the unit of analysis consisted of each evaluated worker; in the ergonomic checklist, the unit of analysis consisted of each evaluated hospital area and each aspect observed within that area. For the first objective, the socio-occupational variables of occupation, hospital department, sex, and length of service were considered. For the second objective, the following were included: work area, section of the checklist, affirmative and negative responses by evaluated aspect, type of load or posture, neck position, leg position, activity, load handled, grip quality, and ergonomic risk level according to REBA. For the third objective, musculoskeletal complaints were incorporated by anatomical region, complaints at some point, in the last 6 months, and in the last 7 days, treatment received, pain intensity, time of onset of complaints, and activity attributed to the origin of the complaint. For the fourth objective, an analytical approach based on REBA was used, considering high ergonomic risk as the dependent variable, defined as the category "urgent changes to the task are required"; the independent variables included occupation, department, sex, length of service, load handled, and grip quality.

Data collection was conducted through structured ergonomic observation of the workstation and by administering a standardized questionnaire to the study participants. Fieldwork was conducted over a six-week period dedicated to the systematic collection of information. For the environmental and organizational component, the ergonomic checklist was implemented in nine hospital areas, and data collection took place

according to a schedule from 8 a.m. to 4 p.m. Data analysis was performed using a single consolidated matrix processed in the Statistical Package for the Social Sciences (SPSS), version 25. For the first objective, absolute and relative frequencies of the sociolaboral variables available in the REBA matrix were calculated. For the second objective, affirmative and negative responses from the ergonomic checklist were summarized by area and by section, in addition to obtaining descriptive statistics by section and describing the main postural findings from the REBA. For the third objective, frequencies and percentages of musculoskeletal complaints were calculated by anatomical region, across different time periods, as well as treatment received, pain intensity, time of onset, and attributed activity. For the analysis corresponding to the fourth objective, high ergonomic risk according to REBA, operationalized dichotomously, was taken as the dependent variable. The category "urgent changes to the task are required" was considered an event of interest, and the remaining categories were grouped as absence of high risk. For the bivariate analysis, simple binary logistic regression models were used to estimate crude odds ratios (OR), 95% confidence intervals, and p-values. Subsequently, a multivariate analysis was performed using multiple binary logistic regression to estimate the adjusted association between the independent variables and high ergonomic risk according to REBA. Adjusted odds ratios (aOR) were calculated along with their 95% confidence intervals and p-values, maintaining a significance level of $\alpha = 0.05$.

Regarding ethical considerations, the study was categorized as low-risk because it focused on the assessment of working conditions, job positions, and musculoskeletal symptoms among hospital staff, without involving therapeutic or experimental intervention. By using the data solely for academic purposes and presenting the results in aggregate form, without participants being individually identifiable, the confidentiality of the information was ensured. The study was conducted in accordance with the principles of privacy, confidentiality, voluntariness, and responsible use of information, in line with ethical standards relevant to health and occupational health research and in compliance with the guidelines established by the CIES Ethics Committee.

RESULTS

The study included 148 workers, of whom 123 (83.1%) were nursing staff and 25 (16.9%) were orderlies. Most worked in inpatient care, with 116 participants (78.4%), followed by the emergency department with 17 (11.5%) and outpatient care with 15 (10.1%). By gender, 80 (54.1%) were women and 68 (45.9%) were men (Table 1). Regarding length of service, the group with more than 5 years of service predominated, with 124 workers (83.8%), while 24 (16.2%) had between 3 and 5 years.

In the ergonomic assessment, the mixed load or posture type predominated in 141 cases (95.3%). Neck flexion or extension greater than 20° was observed in 142 cases (95.9%), and flexion of one or both knees greater than 60° in 143 (96.6%). Repetitive movements exceeding four times per minute were identified in 107 workers (72.3%), handling of loads greater than 10 kg in 128 (86.5%), and grip quality was classified as good in 136 cases (91.9%). According to the ergonomic risk level by REBA, 102 workers (68.9%) were classified in the "task redesign required" category, 45 (30.4%) in "urgent task changes required," and 1 (0.7%) in the acceptable risk category. Regarding musculoskeletal complaints, the lumbar region was the most common across the three evaluated periods, with 29 cases (19.6%) at some point, 29 (19.6%) in the past 6 months, and 19 (12.8%) in the past 7 days. This was followed by the wrist or hands, with 22 cases (14.9%) at some point, 21 (14.2%) in the past 6 months, and 18 (12.2%) in the past 7 days (Table 1). When evaluated using crude odds ratios in a bivariate analysis, the occupation variable did not show a statistically significant association with high ergonomic risk according to the REBA (Table 2). Nursing staff presented high risk in 30.9% of cases, while among orderlies, 28.0% of cases were recorded, with an OR = 1.15 (95% CI: 0.44–2.98; p = 0.774). Similarly, gender did not show a significant association, with men exhibiting a high-risk frequency of 30.9% compared to 28.6% in women, OR=1.12 (95% CI: 0.55–2.28; p=0.761). Length of service also showed no significant association, with a lower probability among those with more than 5 years of service (OR=0.68; 95% CI: 0.27–1.70; p=0.411).

Regarding hospital services, a trend toward higher risk was observed in the emergency department and inpatient care compared to outpatient care, although this was not statistically significant. In the emergency department, 35.3% had a high REBA risk, OR=7.64 (95% CI: 0.80–73.14; p=0.078), while during hospitalization, 32.8% were at high risk, OR=6.82 (95% CI: 0.86–53.81; p=0.068). These results suggest a possible higher ergonomic exposure in care areas with greater physical demands, although no conclusive evidence was observed in the crude analysis.

The variables that showed a statistically significant association with high ergonomic risk were load handling and grip quality (Table 2). Workers who handled loads greater than 10 kg had a high-risk frequency of 33.6%, compared to 10.0% among those who handled loads of 10 kg or less, with an OR = 4.55 (95% CI: 1.01–20.53; p = 0.049). Similarly, among those with poor grip strength, 58.3% were at high risk, compared with 27.9% of those with good grip strength, OR=3.61 (95% CI: 1.08–12.07; p=0.037). In the crude analysis, handling loads greater than 10 kg (OR=4.55; 95% CI: 1.01–20.53; p=0.049) and poor grip strength (OR=3.61; 95% CI: 1.08–12.07; p=0.037) were associated with high REBA risk. In the binary multivariate logistic regression model, the variable that remained statistically and significantly associated

Table 1: Socio-occupational characteristics, ergonomic conditions, and profile of musculoskeletal complaints among nurses and orderlies at the Hospital

Domain	Variable	Category	Results
Sociolaboral profile	Profile	Nursing	123 (83.1%)
		Orderlies	25 (16.9%)
	Area	Inpatient	116 (78.4%)
		Emergency	17 (11.5%)
		Outpatient	15 (10.1%)
	Gender	Female	80 (54.1%)
		Male	68 (45.9%)
	Length of service	More than 5 years	124 (83.8%)
		3 to 5 years	24 (16.2%)
Key ergonomic findings according to REBA	Type of load or posture	Mixed	141 (95.3%)
	Neck position	flexion/extension >20°	142 (95.9%)
	Legs	flexion of one or both knees >60°	143 (96.6%)
	Activity	Repetitive movement >4 times/min	107 (72.3%)
	Handled Load	>10 kg	128 (86.5%)
	Grip quality	Good	136 (91.0%)
REBA ergonomic risk level	REBA factor	Requires task redesign	102 (68.9%)
		Urgent changes to the task are required	45 (30.4%)
		Acceptable risk	1 (0.7%)
Musculoskeletal complaints by anatomical region	Nordic Questionnaire	Neck: ever / last 6 months / last 7 days	18 (12.2%) / 18 (12.2%) / 17 (11.5%)
		Back: ever / last 6 months / last 7 days	14 (9.5%) / 12 (8.1%) / 13 (8.8%)
		Lower back: ever / last 6 months / last 7 days	29 (19.6%) / 29 (19.6%) / 19 (12.8%)
		Shoulders: ever / last 6 months / last 7 days	5 (3.4%) / 4 (2.7%) / 1 (0.7%)
		Wrist or hands: ever / last 6 months / last 7 days	22 (14.9%) / 21 (14.2%) / 18 (12.2%)

Table 2: Bivariate analysis of factors associated with high ergonomic risk according to REBA

Variable	Category	High REBA risk n/N (%)	Crude OR	95% CI	P
Occupation	Orderlies	7/25 (28.0)	1.00	Reference	
Department	Nursing	38/123 (30.9)	1.15	0.44–2.98	0.774
	Outpatient	1/15 (6.7)	1.00	Referral	
	Emergency	6/17 (35.3)	7.64	0.80–73.14	0.078
	Hospitalization	38/116 (32.8)	6.82	0.86–53.81	0.068
Gender	Female	22/77 (28.6)	1.00	Reference	
	Male	21/68 (30.9)	1.12	0.55–2.28	0.761
Length of employment	3 to 5 years	9/24 (37.5)	1.00	Reference	
	More than 5 years	36/124 (29.0)	0.68	0.27–1.70	0.411
Handled load	≤10 kg	2/20 (10.0)	1.00	Reference	
	>10 kg	43/128 (33.6)	4.55	1.01–20.53	0.049
Grip strength	Good	38/136 (27.9)	1.00	Reference	
	Not good	7/12 (58.3)	3.61	1.08–12.07	0.037

with high ergonomic risk according to REBA was handling loads exceeding 10 kg, which increased the probability of high risk by approximately 11 times compared to handling loads of 10 kg or less (ORa = 11.08; 95% CI: 1.80–68.31; p = 0.010). This finding indicates that the magnitude of the physical load handled was the most significant factor within the adjusted model (Table 3).

The other variables included were not statistically significant. No significant association was observed based on occupation, as nursing staff had an adjusted OR of 1.33 compared to orderlies (95% CI: 0.41–4.35; p = 0.639). Similarly, males did not show a higher probability of high risk compared to females (aOR = 0.94; 95% CI: 0.38–2.33; p = 0.887). Regarding hospital department, both the emergency department and inpatient units had elevated adjusted ORs compared to outpatient clinics, but without statistical significance (p = 0.099 in both cases), suggesting a trend that could not be confirmed in the final model (Table 3).

Regarding length of service, the group with more than 5 years had a lower probability of high ergonomic risk compared to those with 3 to 5 years of service (ORa = 0.26; 95% CI: 0.07–1.01; p = 0.052), resulting in a trend approaching statistical significance. Finally, poor grip strength increased the probability of high ergonomic risk (ORa = 3.39; 95% CI: 0.95–12.04), although this finding did not reach statistical significance (p = 0.059).

Table 3: Multivariate binary logistic regression model of factors associated with high ergonomic risk according to REBA.

Variables	Category	High REBA risk n/N (%)	Adjusted OR	95% CI	p
Occupation	Orderlies	7/25 (28.0)	1.00	Reference	
	Nursing	36/120 (30.0)	1.33	0.41–4.35	0.639
Department	Outpatient	1/14 (7.1)	1.00	Referral	
	Emergency	6/17 (35.3)	6.81	0.70–66.47	0.099
	Hospitalization	36/114 (31.6)	5.97	0.72–49.81	0.099
Gender	Female	22/77 (28.6)	1.00	Reference	
	Male	21/68 (30.9)	0.94	0.38–2.33	0.887
Length of employment	3 to 5 years	8/23 (34.8)	1.00	Reference	
	More than 5 years	35/122 (28.7)	0.26	0.07–1.01	0.052
Handled load	≤10 kg	2/20 (10.0)	1.00	Reference	
	>10 kg	41/125 (32.8)	11.08	1.80–68.31	0.010
Grip strength	Good	36/133 (27.1)	1.00	Reference	
	Not good	7/12 (58.3)	3.39	0.95–12.04	0.059

Overall, the adjusted model identified the handling of loads greater than 10 kg as the main factor associated with high ergonomic risk among the evaluated staff.

DISCUSSION

From a socio-occupational perspective, the predominance of nursing staff and female employees, as well as the concentration in inpatient care and the long tenure of staff, characterize a workforce that mirrors the typical composition of many hospital departments. This structure influences ergonomic exposures and the workload. International evidence shows that the prevalence of musculoskeletal disorders tends to be particularly high in teams with long workdays, frequent shifts, and continuous care demands (Barragan et al., 2025; Wang et al., 2024). On the other hand, the fact that no statistically significant association was found between high REBA risk and occupation, and seniority in both bivariate and multivariate analyses should not be interpreted as an absence of substantive differences between groups, but rather as an exposure within the hospital setting, especially since nurses and orderlies share tasks involving patient mobilization, care support, and demanding postures. One should also consider the possibility of low statistical power due to the small size of the orderlies subgroup and the high concentration of the sample in inpatient care. In addition, those who have been in the position longer may have developed adaptive strategies, redistributed tasks, or developed occupational tolerance, which could explain the protective trend observed among those with greater seniority, although it did not reach formal significance elements that have been described by other authors (Rivera Guillén et al., 2015; Schultz et al., 2022).

It is important to note that although areas such as the emergency department and inpatient care do not reach statistical significance in the adjusted model, both areas present high odds ratios compared to outpatient care, which is epidemiologically consistent with the nature of their tasks. The literature indicates that services with a higher number of patients and clinical complications involve greater exposure to rushed maneuvers, trunk flexion, twisting, and unplanned exertion. In this same study, the authors noted that the complexity of the service modifies the pattern of exposure and the location of pain. Therefore, it is likely that the fact that this study did not reach statistical significance reflects limitations in sample size rather than a lack of ergonomic plausibility (Jacquier-Bret & Gorce, 2023; Nemera et al., 2024).

The assessment of working conditions shows that mental load, repetitive movements, and physical exertion are the primary concerns, a finding supported by current evidence (Portilla Pantoja & Juna Juca, 2024; Wang et al., 2024). In addition to this, marked flexion and extension of the neck, pronounced knee flexion, repetitive movements, and handling of loads exceeding 10 kg constitute a high biomechanical exposure profile. This pattern is consistent with studies that identify trunk flexion, torsion, sustained postures, and manual patient handling as critical components in the development of musculoskeletal injuries. Nemera et al. and Sun et al. described the association between musculoskeletal disorders and poor postures, which place significant physical demands on the lumbar spine and upper extremities (Johnson et al., 2023; Nemera et al., 2024; Sun et al., 2023).

The prevalence of discomfort in the lumbar region receives the most therapeutic attention. On the other hand, the fact that the wrist or hands exhibit the highest intensity of pain suggests that these discomforts could have a greater immediate functional impact on fine motor tasks, equipment handling, gripping, and daily caregiving activities. According to Koyuncu et al., pain in the neck, back, wrist, and hand increases disability in daily tasks, which aligns with the hypothesis that the symptomatic burden should not be measured solely by frequency, but also by intensity and functional consequences (Koyuncu

et al., 2025). The most analytically consistent finding of the study is the association between handling loads greater than 10 kg and high ergonomic risk according to REBA, which persists after multivariate adjustment and increases the probability of the outcome. From a biomechanical and occupational perspective, this result is highly plausible. The transfer of patients and heavy loads increases the demand for strength, promotes compensatory postures, reduces fine motor control, and increases the need for sudden exertions, especially in time-limited situations (Johnson et al., 2023; Kim et al., 2012); likewise, the crude association observed with poor grip quality loses significance upon adjustment, which is also consistent with other studies reporting that poor grip strength is associated with a greater number of postural compensations, reduced movement stability, and may transfer greater load to the wrists, shoulders, and back (Nemera et al., 2024; Wang et al., 2024).

The main limitations lie in the use of self-reporting for symptoms, which may be subject to memory and perception bias, and the reliance on the observer for the application of the REBA and the checklist. Likewise, the sample size and composition—with the disproportion between nurses and orderlies and the heavy concentration on inpatient care—limits the precision of some comparisons and may explain the wide confidence intervals observed in the multivariate analysis. Finally, potentially relevant variables such as weight, height, comorbidities, exact frequency of patient mobilization, availability and actual use of mechanical aids, absenteeism, or productivity were not included.

Future research should focus on longitudinal or cohort designs that allow for the establishment of temporality and the examination of the evolution of musculoskeletal symptoms in relation to repeated ergonomic exposures. Furthermore, it is necessary to build integrated databases that link, at the individual level, ergonomic assessment, symptoms, treatment, absenteeism, and the use of mechanical aids. It is also advisable to delve deeper into the qualitative determinants of the problem, particularly those associated with the experience lived in the work environment.

CONCLUSION

The study indicates that the evaluated staff, primarily nurses with more than five years of service, endure adverse ergonomic conditions that entail a high biomechanical risk. It is observed that the main factor associated with this risk is the handling of loads exceeding 10 kg, primarily affecting the lumbar region and the wrists. Although some non-significant correlations were found between other variables, such as gender and grip strength, the need to intervene in reducing manual load and reorganizing tasks is highlighted as an essential aspect for improving occupational health. The study's limitations, such as the use of self-reports and the concentration of the sample, suggest the need for future research examining the relationship between exposure and ergonomic injuries, as well as a better assessment of work experience in these contexts. It is essential to understand the physical demands of the hospital environment to make the workplace safer.

Ethical Clearance

Ethics Committee Approval: Institutional Ethics Committee of UNAN-Managua/CIES

Conflict of interes

The authors declare no conflict of interest

Funding

The authors declare that they have not received any funding

Author responsibility statement

Geling Pineda: Conceptualization, development of results, initial draft. Methodology, formal analysis, visualization,
Erick Chamorro Segovia: Drafting, revision, and editing. Supervision, validation, and review of the final document.

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