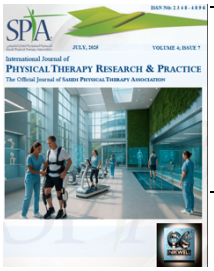

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Original Article

Association Between Patient Lifting Systems and Musculoskeletal Disorders Among Nurses in Saudi Arabia: A Cross-Sectional Study

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Abstract

Background: This cross-sectional study investigated the association between the use of patient lifting systems and the prevalence of musculoskeletal disorders (MSDs) among nurses in Saudi Arabia. It also examined the influence of lifting frequency, ergonomic knowledge, and sociodemographic factors. **Methods:** An electronic survey was distributed to 51 nurses between January and June 2023. The survey collected data on sociodemographic, patient lifting system usage frequency, and MSDs using the Nordic Musculoskeletal Questionnaire (NMQ) and the Visual Analogue Scale (VAS). Chi-square tests assessed associations, and logistic regression identified significant MSD risk factors. **Results:** Among the 51 nurses (mean age = 35.64 years), 35.3% used lifting systems sometimes, 37.3% rarely, and 15.7% never. A total of 25.5% reported insufficient ergonomic training. Frequent use of hoists was significantly associated with lower MSD prevalence ($p < 0.001$). Logistic regression showed that younger age (OR = 1.628, $p = 0.020$) and female gender were predictors of higher MSD risk. Lower back pain was the most reported issue (63%), but its severity was lower among nurses who regularly used lifting devices. **Conclusion:** Frequent use of patient lifting systems was associated with a lower prevalence and severity of MSDs, particularly lower back pain. However, inconsistent use and inadequate ergonomic training may limit their protective benefits. Healthcare facilities should prioritize training and encourage routine use of lifting systems to mitigate MSD risk among nursing staff.

Keywords: Nurses, Musculoskeletal Disorders (MSDs), Patient Lifting Systems, Manual Handling, Saudi Arabia, Ergonomics, Pain Assessment.

Introduction

Musculoskeletal disorders (MSDs) are a critical occupational health issue among healthcare workers, particularly nurses, due to the physical demands of their job. These disorders encompass a variety of conditions affecting muscles, tendons, ligaments, joints, and spinal structures, primarily caused by repetitive physical strain rather than sudden injuries (Shieh et al., 2016). Common symptoms include back pain, shoulder strain, and carpal tunnel syndrome, all of which can

significantly hinder a nurse's ability to perform daily tasks (Alruwaili et al., 2023). Lower back pain (LBP) is especially common, leading to decreased work performance and diminished quality of life (Tinubu et al., 2010, Luan et al., 2018).

Globally, the prevalence of MSDs among nurse's ranges from 40% to 95% (Luan et al., 2018). In Saudi Arabia, the statistics are similarly concerning, with 63% of nurses reporting lower back pain, 50% reporting shoulder pain, and 48% experiencing upper back discomfort (Alruwaili et al., 2023). This high prevalence is largely due to the physically demanding nature of nursing, particularly tasks such as lifting, transferring, and repositioning patients (da Costa and Vieira 2010). These activities place significant strain on the lower back, cervical spine, and shoulders, areas that are prone to injury due to repetitive movements, awkward postures, and heavy lifting (Nelson et al., 2003, Dawson et al., 2007).

Research consistently highlights manual patient handling as a major cause of MSDs in nurses. Regular lifting and transferring of patients exert considerable biomechanical stress on the spine and joints, leading to conditions like lumbar disc herniation and degenerative spinal disorders (Carlson 2008). Studies have shown that these lumbar issues, caused by manual lifting, pose greater long-term risks than low back pain alone, as they contribute to cumulative structural damage over time (Hoy et al., 2014). Nurses who are regularly involved in patient handling are twice as likely to develop MSDs compared to those who are not (da Costa and Vieira 2010). Extended work periods without adequate recovery time further increase the risk (Sikiru and Hanifa 2010). Other risk factors include being female, older age, longer years of service, and insufficient ergonomic training (Smith and Leggat 2004, Harcombe et al., 2009).

The effects of MSDs on healthcare workers are substantial. Nurses with MSDs often experience chronic pain, reduced ability to perform essential duties, and higher rates of absenteeism, all of which negatively impact patient care (Leijon, Hensing and Alexanderson 2004, Dawson et al., 2007). Additionally, MSDs contribute to high healthcare costs, as injured workers require medical treatments and sometimes surgery (Lagerström et al., 1995). A study by Smith and Leggat (2004) confirmed that the costs associated with MSD treatments, combined with productivity losses due to absenteeism, create a significant economic burden on healthcare systems.

To reduce the physical strain on nurses and decrease MSD prevalence, patient lifting systems (PLS) are widely advocated in healthcare settings. Assistive devices such as mechanical hoists, sliding sheets, and transfer belts are designed to reduce manual handling and lessen the biomechanical load on nurses (Nelson et al., 2003). Research supports that these tools can significantly lower the risk of MSDs by reducing the physical demands on nurses (Carlson 2008). For example, a study by Trinkoff et al., (2007) found that the use of assistive devices led to a significant reduction in back injuries among nurses engaged in patient handling tasks.

Despite the known benefits of patient lifting systems, their actual utilization in clinical settings remains inconsistent, particularly in Saudi Arabia, where research on their effectiveness and usage patterns is limited (Kugler, Taylor and Brusco 2024). While international studies have explored the relationship between assistive lifting devices and the reduction of musculoskeletal disorders among nurses, there is a lack of context-specific data that considers local practices, training adequacy, and equipment accessibility (Dawson et al., 2007; Nelson et al., 2003). Moreover, few studies have examined how factors such as ergonomic knowledge, frequency of lifting system use, and sociodemographic characteristics collectively influence MSD risk (Verbeek et al., 2012; Harcombe et al., 2009; da Costa and Vieira 2010). Addressing this gap is essential to inform evidence-based interventions and policy changes aimed at protecting the health and productivity of Saudi nursing staff.

Therefore, the primary objective of this study is to evaluate the association between the use of patient

lifting systems and the prevalence of musculoskeletal disorders among nurses in Saudi Arabia. Additionally, the study aims to examine how factors such as ergonomic training, knowledge of assistive devices, usage frequency, and sociodemographic characteristics contribute to MSD risk. By identifying key predictors and barriers, the findings will support the development of targeted strategies to enhance safe patient handling practices and reduce the occupational burden on nursing professionals.

Methodology

Participants and Study Design

This cross-sectional study was designed to include nurses employed in hospitals across Saudi Arabia that are equipped with patient lifting systems. The participants comprised male and female nursing staff aged between 21 and 50 years who had been performing patient handling tasks for a minimum of one year. Importantly, participants were required to have no history of trauma or surgery. Certain groups were excluded from the study, including nurses working across multiple hospital units, those on sabbatical leave, nursing interns or students, pregnant nurses, and individuals with a history of trauma or surgery.

Sampling and Sample Size Estimation

A cluster sampling technique was employed to select participants, with nurses grouped based on their geographic location. From each hospital in various administrative regions of Saudi Arabia, one nurse was selected to complete the survey. This method helped ensure a geographically diverse sample that was representative of the nursing workforce across the country.

The sample size was calculated based on the number of accredited hospitals in Saudi Arabia. Using a 95% confidence interval, a 5% margin of error, and an assumed population proportion of 50%, the required sample size was calculated to be 50 nurses.

Study Setting

Data collection took place over a period of six months, from January 1, 2023, to June 30, 2023. Questionnaires were distributed to the selected nurses through social media platforms such as WhatsApp, X (formerly Twitter), and Instagram, allowing for widespread dissemination. After responses were received, they were carefully reviewed, and any false or irrelevant responses were excluded from the dataset. The remaining valid responses were compiled into a Microsoft Excel spreadsheet in preparation for statistical analysis.

Study Procedure

The questionnaire was developed using Google Forms and was structured into three main sections. The first section collected sociodemographic data, including age, gender, height, weight, job position, education, years of experience, and body mass index (BMI). The second section focused on the nurses' knowledge and use of the patient lifting system, including the frequency of use, perceived effectiveness, and the impact of the system on both nurses and patients. The third section measured health outcomes using the Nordic Musculoskeletal Questionnaire (NMQ) and the Visual Analogue Scale (VAS), providing a comprehensive picture of the participants' musculoskeletal health and pain levels.

Outcomes' assessments

The Nordic Musculoskeletal Questionnaire (NMQ) is a widely recognized tool used to assess the prevalence and severity of musculoskeletal symptoms. It evaluates the frequency and intensity of symptoms experienced over the past year and the past week, as well as any impact on daily activities and work performance.

The Visual Analogue Scale (VAS) was used to quantify pain intensity, with participants marking their pain level on a 100 mm scale where 0 represents "no pain" and 100 represents "worst imaginable pain." These tools were chosen for their

effectiveness in capturing detailed data on musculoskeletal discomfort and pain intensity.

Ethical Considerations

This study was reviewed and approved by the Institutional Review Board (IRB) at King Abdullah International Medical Research Center (KAIMRC), Saudi Arabia (Approval Number: NRJ25/024/6). All procedures were conducted in accordance with the ethical standards outlined in the Declaration of Helsinki.

Prior to participation, informed consent was obtained electronically through Google Forms from all respondents. The online questionnaire included a detailed introduction explaining the study's purpose, voluntary nature, confidentiality of responses, and participants' right to withdraw at any time. No personal identifiers were collected, and all data were anonymized and securely stored.

Statistical Analysis

For the statistical analysis, the collected data were organized and analyzed using the Statistical Package for Social Sciences (SPSS) version 24. Descriptive statistics, including frequencies, proportions, means, and standard deviations (SD), were calculated to summarize both categorical and continuous variables. Prior to inferential testing, the normality of continuous variables (e.g., age, BMI, VAS scores) was assessed using the Shapiro–Wilk test and visual inspection of histograms.

As the data were not normally distributed, nonparametric tests were applied. To explore bivariate associations between continuous or ordinal variables (e.g., age, BMI, frequency of hoist use) and musculoskeletal discomfort scores (from the NMQ and VAS), Spearman's rank correlation coefficient was used. For associations between categorical variables, such as gender, lifting system usage categories, and the presence of MSDs, Chi-square tests were conducted. Assumptions for the Chi-square test, particularly regarding expected cell counts, were checked.

To identify predictors of musculoskeletal disorders, binary logistic regression analysis was performed. Independent variables included age, gender, BMI, years of experience, and frequency of lifting system use. Multicollinearity among predictors was assessed using the Variance Inflation Factor (VIF), and model fit was evaluated using the Hosmer–Lemeshow goodness-of-fit test. Results from the logistic regression were reported as odds ratios (ORs) with corresponding 95% confidence intervals (CIs) to indicate the strength and direction of associations. All statistical tests were two-tailed, and a p-value < 0.05 was considered statistically significant. Given the multiple comparisons performed in the bivariate analyses, findings should be interpreted as exploratory, and no formal adjustment for Type I error was applied for these specific tests.

Results

Cronbach's Alpha is 0.804, indicating good internal consistency. This suggests that the 32 items included in the analysis reliably measure the same underlying construct.

Table 1 demonstrate the intensity levels of usage across different categories with corresponding counts and percentages. The most frequent response is "Rarely," with 19 participants (37.3%), followed by "Sometimes," with 18 participants (35.3%). A smaller portion of the participants reported using the item "Often" (5 participants, 9.8%) and "Never" (8 participants, 15.7%). Only one participant (2.0%) reported using the item "Always," indicating it is the least common frequency of usage.

Table 1. Intensity level of usage (N=51).

Categories	N (%)
Sometimes	18 (35.3%)
Rarely	19 (37.3%)
Often	5 (9.8%)
Never	8 (15.7%)
Always	1 (2.0%)

Table 2: Perceptions of the Impact of Patient Lifting Systems (Hoist) on Musculoskeletal Disorders, Nurse Performance, and Patient Satisfaction.

Question	Strongly Disagree N (%)	Disagree N (%)	Neither agree nor disagree N (%)	Agree N (%)	Strongly Agree N (%)
Do you believe that using patient lifting system (Hoist) minimize musculoskeletal disorders?	8 (15.7)	19 (37.3)	13 (25.5)	7 (13.7)	4 (7.8)
Do you think that using patient lifting system machine (Hoist) increases the level of performance among nurses?	7 (13.7)	19 (37.3)	7 (13.7)	12 (23.5)	6 (11.8)
Do you think that using patient lifting system machine (Hoist) increases the level of patient satisfaction?	10 (19.6)	14 (27.5)	13 (25.5)	8 (15.7)	6 (11.8)

Table 3: Demographic and Professional Characteristics of Participants.

Variables' Parameters		N (%)
Age	20 - 25	9 (17.6)
	31 - 35	14 (27.5)
	36 - 40	5 (9.8)
	26 - 30	9 (17.6)
	46 - 50	7 (13.7)
	41 - 45	7 (13.7)
Gender	Female	25 (49.0)
	Male	26 (51.0)
Position	Nurse Assistant	13 (25.5)
	Charge Nurse	8 (15.7)
	Nurse Specialist	21 (41.2)
	Head Nurse	8 (15.7)
	Nursing coordinator	1 (2.0)
Education (Academic degrees)	Diploma	32 (62.7)
	Bachelor	14 (27.5)
	Master	4 (7.8)
	PhD	1 (2.0)
Experience	> 10 years	22 (43.1)
	> 5 to 10 years	17 (33.3)
	1 to 5 years	9 (17.6)
	< 1 years	3 (5.9)
Do you good knowledge of patient lifting system machine (Hoist)?	No	4 (7.8)
	Yes	39 (76.5)
	Not sure	8 (15.7)
Have you used patient lifting system machine before (Hoist)?	No	10 (19.6)
	Yes	41 (80.4)
	Not sure	0 (0)
BMI Categories	Underweight	4 (7.8)
	Normal	18 (35.3)
	Overweight	18 (35.3)
	Obese	7 (13.7)
	Severely Obese	4 (7.8)

Table 2 presents responses to three questions regarding the perceived impact of using a patient lifting system (Hoist) on musculoskeletal disorders, nurse performance, and patient satisfaction, measured on a Likert scale. For the first question, most respondents either disagreed (37.3%) or strongly disagreed (15.7%) with the belief that using the Hoist minimizes musculoskeletal disorders, while 25.5% were neutral, and only 13.7% agreed. Regarding the second question on nurse performance, 37.3% of participants disagreed, but a notable 23.5% agreed that the Hoist improves performance, with 13.7% neutral and 11.8% strongly agreeing. For the third question about patient satisfaction, most respondents either disagreed (27.5%) or strongly disagreed (19.6%), while 25.5% remained neutral, and 15.7% agreed that the Hoist improves satisfaction, with 11.8% strongly agreeing.

In table 3, the most represented age group is 31-35 years (27.5%), followed by 20-25 years and 26-30 years (both at 17.6%). Gender is almost evenly split, with 51.0% male and 49.0% female. In terms of job position, most participants are Nurse Specialists (41.2%), followed by Nurse Assistants (25.5%), while a few are Nursing Coordinators (2.0%). The majority of participants hold a Bachelor's Degree (62.7%), with 27.5% having a Diploma and 7.8% having a Master's. Regarding experience, 43.1% have more than 10 years of experience, while 33.3% have 5 to 10 years of experience. Most participants (76.5%) reported having good knowledge about the

patient lifting system (Hoist), and 80.4% had used it before. In terms of BMI, 35.3% were categorized as normal and overweight, while 7.8% were underweight or severely obese, with 13.7% obese.

Table 4. Prevalence and Severity of Musculoskeletal Discomfort.

Categories		N (%)	Mean ± SD
Have you at any time during the last 12 months had trouble (ache, pain, discomfort, numbness)	No discomfort	2 (3.9)	1.7059±2.3777
	Mild discomfort	0 (0.0)	
	Moderate discomfort	33 (64.7)	
	Severe discomfort	16 (31.4)	
Have you at any time during the last 12 months been prevented from doing your normal work(at home or away from home) because of the trouble?	No discomfort	27 (52.9)	2.0784±2.6218
	Mild discomfort	8 (15.7)	
	Moderate discomfort	13 (25.5)	
	Severe discomfort:	3 (5.9)	
Have you had trouble at any time during the last 7 days?	No discomfort	20 (39.2)	4.6078±1.7097
	Mild discomfort	15 (29.4)	
	Moderate discomfort	9 (17.6)	
	Severe discomfort:	7 (13.7)	

Table 5: Age-Based Distribution of VAS Scores and Musculoskeletal Discomfort.

Variables score and distributions		Age					
		20 - 25 N (%)	31 - 35 N (%)	36 - 40 N (%)	26 - 30 N (%)	46 - 50 N (%)	41 - 45 N (%)
VAS Score	Mild	0 (0.0)	4 (28.6)	2 (40.0)	2 (22.2)	2 (28.6)	4 (57.1)
	Moderate	3 (33.3)	6 (42.9)	2 (40.0)	6 (66.7)	3 (42.9)	3 (42.9)
	Severe	2 (22.2)	3 (21.4)	1 (20.0)	1 (11.1)	1 (14.3)	0 (0.0)
	Worst	4 (44.4)	1 (7.1)	0 (0.0)	0 (0.0)	1 (14.3)	0 (0.0)
Have you at any time during the last 12 months had trouble (ache, pain, discomfort, numbness)	No discomfort	2 (22.2)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Mild discomfort	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
	Moderate discomfort	4 (44.4)	8 (57.1)	3 (60.0)	6 (66.7)	5 (71.4)	7 (100.0)
	Severe discomfort:	3 (33.3)	6 (42.9)	2 (40.0)	3 (33.3)	2 (28.6)	0 (0.0)
Have you at any time during the last 12 months been prevented from doing your normal work(at home or away from home) because of the trouble?	No discomfort	3 (33.3)	6 (42.9)	3 (60.0)	6 (66.7)	3 (42.9)	6 (85.7)
	Mild discomfort	1 (11.1)	1 (7.1)	1 (20.0)	2 (22.2)	2 (28.6)	1 (14.3)
	Moderate discomfort	4 (44.4)	6 (42.9)	1 (20.0)	1 (11.1)	1 (14.3)	0 (0.0)
	Severe discomfort:	1 (11.1)	1 (7.1)	0 (0.0)	0 (0.0)	1 (14.3)	0 (0.0)
Have you had trouble at any time during the last 7 days?	No discomfort	2 (22.2)	4 (28.6)	3 (60.0)	3 (33.3)	3 (42.9)	5 (71.4)
	Mild discomfort	1 (11.1)	4 (28.6)	1 (20.0)	5 (55.6)	2 (28.6)	2 (28.6)
	Moderate discomfort	5 (55.6)	3 (21.4)	0 (0.0)	1 (11.1)	0 (0.0)	0 (0.0)
	Severe discomfort:	1 (11.1)	3 (21.4)	1 (20.0)	0 (0.0)	2 (28.6)	0 (0.0)

The scores for the questionnaire were likely computed by categorizing the participants' responses into different levels of discomfort (No discomfort, Mild discomfort, Moderate discomfort,

and Severe discomfort) based on their self-reported experiences during the specified time frames (the last 12 months and the last 7 days).

Table 4 results show that musculoskeletal discomfort was highly prevalent among participants, with the majority, 64.7%, reporting moderate discomfort over the past 12 months, and 31.4% experiencing severe discomfort. Only a small portion, 3.9%, reported no discomfort, and none reported mild discomfort, indicating that discomfort levels were generally higher. When asked if this discomfort affected their ability to work, 52.9% reported no interference, though 25.5% indicated moderate discomfort, and 5.9% severe discomfort, suggesting a lower impact for most but still significant effects for others.

In the past 7 days, there was an increase in participants reporting no discomfort (39.2%), while 29.4% experienced mild discomfort, and fewer participants (17.6%) had moderate discomfort. Severe discomfort remained for 13.7%, showing a slight improvement but with persistent higher-level discomfort for some.

The Visual Analogue Scale (VAS) scores were calculated to categorize participants' discomfort levels, helping to quantify the intensity of their musculoskeletal issues. The VAS is a well-established tool that allows individuals to rate their discomfort on a scale from 0 to 10, where 0 represents no discomfort and 10 represents the worst possible pain. In this particular analysis, the scores were grouped into four categories: Mild (0-2), Moderate (3-5), Severe (6-8), and Worst (9-10). Based on these categories, the majority of participants fell into the moderate category, with 23 individuals (45.1%) rating their discomfort between 3 and 5.

Additionally, 27.5% of participants (14 individuals) reported mild discomfort, indicating that a smaller group experiences relatively low levels of discomfort. On the more severe end, 15.7% of participants (8 individuals) reported severe discomfort, with VAS scores between 6 and 8, reflecting significant pain that likely interferes with daily tasks and quality of life. The smallest group, 11.8% (6 participants), rated their discomfort as the worst possible, with scores between 9 and 10, suggesting a high level of suffering or chronic pain.

Table 5 presents the distribution of participants' discomfort levels on the VAS (Visual Analogue Scale) across different age groups, as well as their experiences with discomfort over the past 12 months and the past 7 days. The data highlights significant variation in discomfort based on age, with younger participants (20-25 years) reporting a higher incidence of extreme discomfort. In the 20-25 age group, 44.4% of participants reported worst discomfort on the VAS scale, while none reported mild discomfort. Conversely, in the 41-45 age group, the majority (57.1%) experienced only mild discomfort, with none reporting severe or worst discomfort. Similarly, in the 31-35 age group, the majority experienced moderate discomfort (42.9%), but a smaller proportion (7.1%) reported the worst discomfort. This suggests that discomfort intensity tends to vary across different age brackets, with older participants generally reporting milder discomfort than their younger counterparts.

In terms of participants' experiences over the past 12 months, the majority reported moderate discomfort, especially in the 41-45 age group, where 100% of participants reported moderate discomfort. Across other age groups, a notable portion reported severe discomfort, especially in the 26-30 and 31-35 age groups, where approximately 33.3% and 42.9%, respectively, experienced severe discomfort. However, a smaller proportion of participants, particularly in the Younger 20-25 age group, were prevented from doing their normal work due to this discomfort, with 33.3% reporting no impact on their work, compared to 85.7% in the 41-45 group who reported no discomfort-related work limitations. Over the past 7 days, the majority of participants in the 41-45 group reported no discomfort (71.4%), while the 20-25 age group was more likely to report moderate discomfort (55.6%), further emphasizing how age may influence the intensity and impact of

musculoskeletal discomfort.

Table 6. Chi-Square Test Results for Demographic and Usage Variables Related to Musculoskeletal Discomfort and Hoist Usage.

Variables	Chai-Square	Asymp. Sig.
Age	5.588	0.3480
Gender	.020	0.8890
BMI	20.471	0.0001
Intensity level of usage [How often do you use patient lifting system (Hoist) machine?]	24.980	0.0001
Visual Analogue Scale	17.039	0.0480
Have you at any time during the last 12 months had trouble (ache, pain, discomfort, numbness?	15.569	0.0160
Have you at any time during the last 12 months been prevented from doing your normal work(at home or away from home) because of the trouble?	63.608	0.0001
Have you had trouble at any time during the last 7 days?)	55.059	0.0001

The chi-square test results reveal several key relationships between the variables (Table 6). Both age and gender show no significant associations with musculoskeletal discomfort, as their p-values are relatively high at 0.348 and 0.889, respectively. On the other hand, BMI shows a strong link to discomfort, with a high chi-square value of 20.471 and a very low p-value of 0.0001, indicating that higher BMI categories are associated with increased musculoskeletal issues. The frequency of using the Hoist is also significantly related to discomfort, as evidenced by a chi-square value of 24.980 and a p-value of 0.0001, indicating a strong correlation. Additionally, the Visual Analogue Scale (VAS), which measures pain intensity, shows a significant association with discomfort, with a chi-square value of 17.039 and a p-value of 0.048. The Nordic Musculoskeletal Questionnaire (NMQ) variables show very strong associations with discomfort and work limitations, as reflected by chi-square values of 15.569, 63.608, and 55.059, and extremely low p-values, further showing the strong connection between these factors and musculoskeletal outcomes.

Table 8. Correlation of Nordic Musculoskeletal Questionnaire (NMQ) Scores with Hoist Usage, Age, Gender, and BMI

		Intensity level of usage [How often do you use patient lifting system (Hoist) machine?]	Age	Gender	BMI
Nordic Musculoskeletal Questionnaire (NMQ):	Correlation Coefficient	0.01	-.336*	-.314*	0.091
	Sig. (2-tailed)	0.946	0.016	0.025	0.527

The correlation analysis of Nordic Musculoskeletal Questionnaire (NMQ) scores with factors like Hoist usage, age, gender, and BMI reveals several important findings. For this analysis, age and BMI were treated as continuous variables, and gender as a dichotomous variable. First, the intensity of Hoist usage shows a very weak, non-significant correlation with NMQ scores (r = 0.01, p = 0.946), indicating that how frequently participants use the Hoist does not significantly impact their musculoskeletal symptoms. This suggests other factors may be more influential. In contrast, both age and gender show significant negative correlations with NMQ scores. Age has a moderate negative correlation (r = -0.336, p = 0.016), implying that as age increases, musculoskeletal discomfort decreases, with younger participants more likely to experience discomfort. Gender also shows a moderate negative correlation (r = -0.314, p = 0.025), suggesting that males (or the reference

gender) are less likely to report musculoskeletal issues compared to females. Lastly, BMI exhibits a weak, non-significant positive correlation (r = 0.091, p = 0.527), indicating no strong link between BMI and musculoskeletal discomfort in this group (Table 7).

Table 8: Logistic Regression Model Summary: Predicting VAS Scores Using NMQ Variables.

Category	Value
Variables in the Equation (Step 0)	
Constant (B)	0.357
S.E.	0.285
Wald	1.572
df	1
Sig.	0.21
Exp(B)	1.429
Model Summary	
-2 Log likelihood	7.042
Cox & Snell R Square	0.704
Nagelkerke R Square	0.949
Hosmer and Lemeshow Test	
Chi-square	1.417
df	8
Sig.	0.994

The logistic regression analysis explores the relationship between dichotomized Visual Analogue Scale (VAS) scores (specifically, where 'No discomfort' and 'Mild discomfort' were coded as 0, and 'Moderate,' 'Severe,' and 'Worst' discomfort were coded as 1) and variables from the Nordic Musculoskeletal Questionnaire (NMQ). The constant (B = 0.357), with a standard error of 0.285 and a Wald statistic of 1.572, indicates a baseline odds ratio (Exp(B)) of 1.429. However, with a p-value of 0.21, this constant is not statistically significant, meaning the intercept alone does not strongly predict VAS scores. The model's -2 Log likelihood value of 7.042 suggests a reasonable fit, with lower values indicating better model performance. The Cox & Snell R Square (0.704) and Nagelkerke R Square (0.949) demonstrate that the model accounts for a substantial portion of the variance in VAS scores, with Nagelkerke R Square showing 94.9% of the variability explained. The Hosmer and Lemeshow Test yields a Chi-square value of 1.417 and a p-value of 0.994, indicating a very close match between observed and predicted values, confirming the model fits the data well.

Table 10. Predictors of Musculoskeletal Issues with 95% Confidence Intervals.

		95% Confidence Interval						95% Confidence Interval	
Predictor	**Estimate**	**Lower**	**Upper**	**SE**	**Z**	**p**	**Odds ratio**	**Lower**	**Upper**
Intercept	0.4018	-2.2685	3.0721	1.3624	0.295	0.768	1.495	0.103	21.59
Age	0.4875	0.0771	0.8978	0.2094	2.328	0.020	1.628	1.080	2.45
Gender	1.2737	-0.0467	2.5940	0.6737	1.891	0.059	3.574	0.954	13.38
BMI	-0.0657	-0.1647	0.0332	0.0505	-1.303	0.193	0.936	0.848	1.03

The logistic regression model aimed to assess the relationship between age (as a continuous variable), gender (as a dichotomous variable), and BMI (as a continuous variable) as predictors of musculoskeletal issues, using the Nordic Musculoskeletal Questionnaire (NMQ) as the outcome (Table 8). For the NMQ outcome, 'No musculoskeletal issues' was coded as 0, and 'Musculoskeletal issues present' (indicating any reported trouble/discomfort according to the NMQ) was coded as 1. The results showed that age was a significant predictor (p = 0.020), with the odds ratio of 1.628 suggesting that older individuals are more likely to report no musculoskeletal issues (NMQ = No) (Table 9). This indicates that with each increase in age, the likelihood of not having musculoskeletal

problems increases. Gender approached significance (p = 0.059), with an odds ratio of 3.574, indicating that males (or whichever gender is referenced in your data, e.g., if male=1, then males) might be more likely to avoid musculoskeletal issues, though the result is not fully conclusive due to its p-value. BMI, however, was not a significant predictor, with a slight but non-significant negative effect on musculoskeletal outcomes (odds ratio = 0.936, p = 0.193), suggesting that BMI does not strongly influence whether an individual reports musculoskeletal issues.

In Figure 1, The predictive ability of the model was moderate, with an accuracy of 66.7%, meaning it correctly predicted whether an individual had musculoskeletal issues two-thirds of the time. The model showed good discriminatory power, as indicated by the AUC of 0.790, meaning it can distinguish well between those with and without musculoskeletal issues. However, its sensitivity (72.4%) and specificity (59.1%) suggest that while it performs moderately well at identifying individuals without musculoskeletal issues, its ability to detect those with such issues is somewhat weaker.

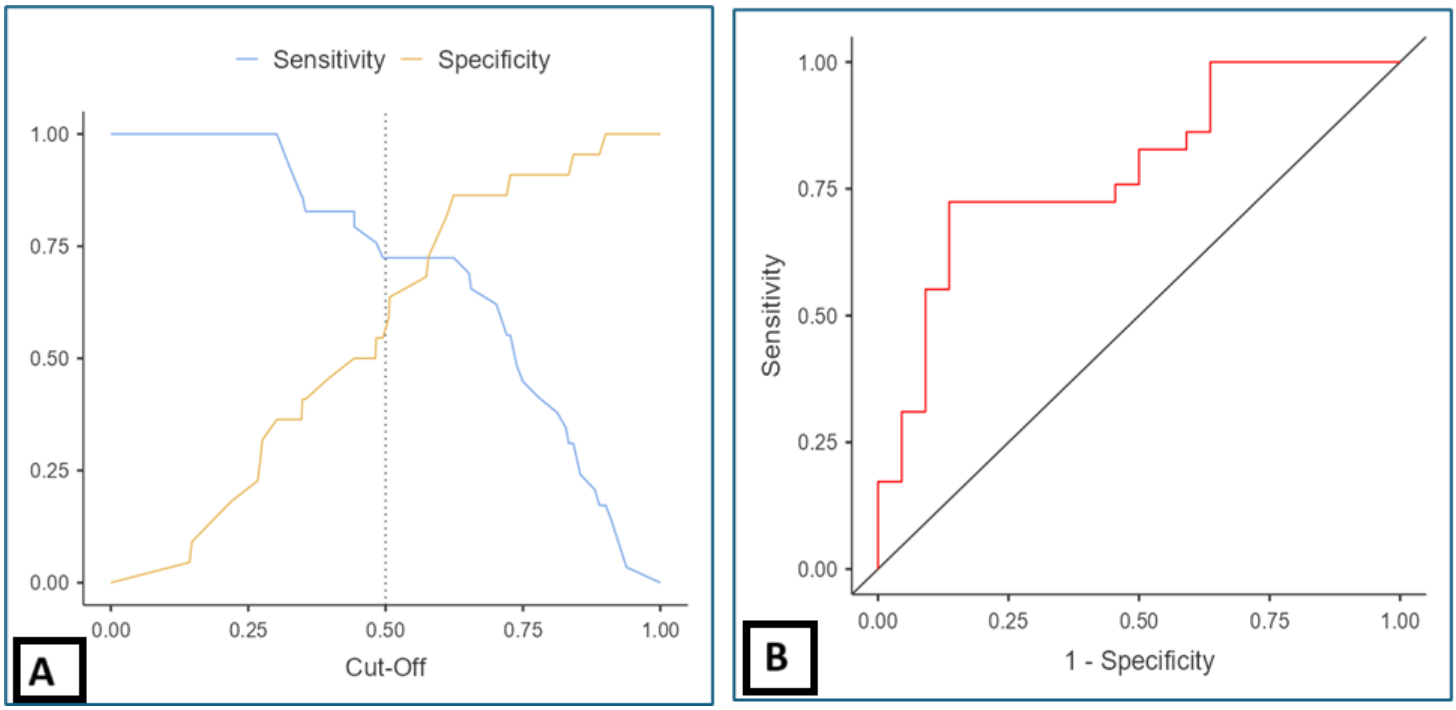

Figure 1 A: Cut-Off Plot shows the trade-off between sensitivity (true positive rate) and specificity (true negative rate) at different threshold values, B: ROC Curve illustrates the model's ability to distinguish between positive and negative cases.

Discussion

This study aimed to investigate the prevalence of musculoskeletal disorders (MSDs) among nurses in Saudi Arabia, assess their perceptions and usage patterns of patient lifting systems (hoists), and identify factors associated with MSDs. Our findings reveal a high prevalence of MSDs among the participating nurses, with nearly two-thirds reporting moderate to severe discomfort, predominantly affecting the lower back, shoulders, and neck. While the majority of nurses demonstrated good knowledge of patient lifting systems, actual utilization rates were notably low. Significant associations were found between BMI, hoist usage frequency, and MSD prevalence. Furthermore, our analysis indicated that age was a significant predictor of MSDs, with younger nurses experiencing higher levels of discomfort, and a trend suggesting gender also plays a role in susceptibility to MSDs.

Musculoskeletal disorders (MSDs) are highly prevalent among nurses due to the physical

demands of patient care. Numerous studies confirm the global incidence of MSDs in nurses. For instance, Tinubu et al., (2010) found that over 78% of Nigerian nurses experienced work-related musculoskeletal pain, with the lower back being the most commonly affected area. Luan et al., (2018) also reported global MSD prevalence rates ranging from 40% to 95%, with the lower back, shoulders, and neck being the most frequently impacted regions.

Our study aligns with these findings, with 64.7% of nurses in Saudi Arabia reporting moderate to severe discomfort, primarily in the lower back, shoulders, and neck. Additionally, 31.4% of participants experienced severe discomfort, mirroring the findings of Alruwaili et al., (2023), where 63% of Saudi nurses reported lower back pain. The literature identifies key risk factors for MSDs, including manual patient handling, prolonged standing, awkward postures, and repetitive movements (Choi and Brings 2015). Our study confirmed that younger nurses (aged 20-25) reported higher levels of discomfort, which is consistent with Smith and Leggat (2004), who noted that younger nurses and those with higher BMIs were more prone to MSDs.

Gender is another significant factor, with female nurses being more susceptible to MSDs than males, as found by Soylar and Ozer (2018). Our study showed similar results, revealing a moderate negative correlation between age, gender, and musculoskeletal discomfort, indicating that younger and female nurses were more affected by MSDs.

Patient lifting systems, such as mechanical hoists, are promoted as a means to reduce the physical strain on nurses. Carlson (2008) demonstrated that these systems reduce the incidence of MSDs by lowering biomechanical stress. However, despite their proven benefits, lifting systems are often underutilized due to insufficient training, time constraints, and the perception that manual lifting is faster. Our findings reflected these challenges, with 76.5% of nurses being familiar with hoists but only 15.7% reporting "always" or "often" using them, and 37.3% using them "rarely." This is consistent with Nelson et al., (2003), who found that many nurses still opt for manual handling despite the availability of lifting aids.

MSDs are known to negatively impact both nurse performance and patient care. Leijon, Hensing and Alexanderson (2004) found that nurses with MSDs report higher levels of job dissatisfaction, fatigue, and a reduced ability to care for patients. Similarly, our study revealed that 37.3% of participants felt that using hoists did not improve their performance, and 27.5% believed it did not enhance patient satisfaction. Kugler, Taylor and Brusco (2024) identified similar barriers to hoist usage, particularly in fast-paced environments where time and convenience are critical factors.

Logistic regression in our study indicated that age was a significant predictor of MSDs, with older nurses reporting fewer severe MSDs (OR = 1.628, $p = 0.020$). This is consistent with Harcombe et al., (2009), who found that younger nurses are more susceptible to musculoskeletal injuries. Although BMI was strongly correlated with MSDs ($\chi^2 = 20.471$, $p < 0.001$), logistic regression did not show BMI to be a significant predictor of MSD severity ($p = 0.193$), suggesting that other factors, such as work experience, may play a larger role.

Chi-square analysis revealed a significant relationship between hoist usage and MSD prevalence ($\chi^2 = 24.980$, $p < 0.001$), which aligns with Nelson et al., (2003), who found that frequent use of lifting aids reduced MSD-related injuries. However, our logistic regression did not show a strong correlation between hoist usage intensity and discomfort ($p = 0.946$), indicating that access to lifting devices alone is not sufficient without adequate training and ergonomic education (Verbeek et al., 2012).

Finally, both the VAS and NMQ provided valuable insights into the severity of MSDs. Most nurses reported moderate discomfort (45.1%), while a smaller portion experienced severe discomfort (15.7%). These findings are consistent with Luan et al., (2018), where most nurses reported moderate

pain that interfered with work but could be managed with rest. The NMQ results also revealed a negative correlation between age and discomfort ($r = -0.336$, $p = 0.016$), supporting Harcombe et al., (2009), who showed that younger nurses report higher discomfort levels, likely due to engaging in more physically demanding tasks.

Limitation

This study has several limitations that should be acknowledged. First, the use of a cluster sampling method with only one nurse selected per hospital may have introduced selection bias and limited the representativeness of the sample across different hospital departments. Second, data collection through online platforms such as WhatsApp and Instagram may have led to self-selection bias, as only nurses who were active on these platforms and willing to participate responded. Third, the reliance on self-reported questionnaires (NMQ and VAS) introduces the possibility of recall bias, particularly when participants were asked to recall musculoskeletal symptoms experienced over the past year. Additionally, while the NMQ and VAS are validated tools, the study did not formally validate the Arabic version of the survey instruments in this population, which may affect measurement reliability. These limitations should be considered when interpreting the findings, and future studies are encouraged to use larger, more diverse samples and incorporate observational or longitudinal designs for improved validity.

Conclusion

This study draws attention to the high prevalence of musculoskeletal disorders (MSDs) among nurses in Saudi Arabia, emphasizing the vital role patient lifting systems play in reducing physical strain. Despite the proven effectiveness of devices like hoists in alleviating MSDs, inconsistent usage remains a significant challenge, largely due to inadequate training and perceptions of inefficiency. Our findings show that younger nurses and female nurses are at greater risk of developing MSDs, with lower usage of patient lifting systems contributing to these risks. To minimize the impact of MSDs, healthcare organizations must prioritize both the accessibility of lifting equipment and comprehensive ergonomic training. Ensuring frequent and proper use of these systems is essential for enhancing nurse safety and improving patient care.

Future Research

Future research should primarily focus on thoroughly investigating the specific barriers and facilitators to consistent patient lifting system (hoist) utilization in various clinical settings. While our study found that knowledge of hoists is high, their actual usage remains low, suggesting that access alone is insufficient. Qualitative methodologies, such as in-depth interviews or focus groups with nurses and nurse managers, would be invaluable here. This approach could uncover nuanced issues related to time constraints, workflow integration, the effectiveness of current training programs, and the influence of organizational culture, providing critical insights that quantitative surveys may not capture. Understanding these intricate factors is essential for designing targeted interventions aimed at improving adherence to safe patient handling practices and, consequently, reducing musculoskeletal disorders among nurses.

Author Contributions

All authors significantly contributed to the work reported, including conception, study design, execution, data acquisition, analysis, and interpretation. They actively participated in drafting, revising, or critically reviewing the manuscript, provided final approval of the version to be published, agreed on the journal submission, and accepted accountability for all aspects of the work.

Data Availability Statement

The authors will transparently provide the primary data underpinning the findings or conclusions of this article, without any unjustified reluctance. If need from editorial team.

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Conflicts of Interest

The authors declare no potential conflicts of interest related to the research, writing, or publication of this work.

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