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Evaluation of musculoskeletal disorders risk in various wards of Imam Ali Hospital, Chabahar, using the MAPO Index

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ABSTRACT

Background: Work-related musculoskeletal disorders (WMSDs) are among the most prevalent occupational health issues in hospital settings, imposing substantial financial burdens on healthcare organizations. Nursing staff and other personnel involved in patient handling and transfer are especially vulnerable to the development of musculoskeletal disorders.

Materials and Methods: This descriptive-analytical study was conducted in 12 departments of Imam Ali Hospital in Chabahar, Iran, during the fall of 2024 on all nursing staff and other personnel responsible for patient transfer. The MAPO method was used to assess the risk of developing musculoskeletal disorders.

Results: This study was conducted on 54 healthcare staff members from various departments of Imam Ali Hospital in Chabahar, including 36 men and 18 women. The average age of men and women was 35.6 ± 9.4 years and 35.5 ± 6.5 years, respectively. The MAPO index in five departments was classified in the red zone.

Conclusion: Based on the results, the risk of developing musculoskeletal disorders is high in all departments, especially in the Men's Surgery, Emergency, CCU, and Maternity departments of Imam Ali Hospital in Chabahar.

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Introduction

Musculoskeletal disorders (MSDs) are among the most prevalent occupational health issues across diverse work environments, particularly in healthcare settings (1, 2). These disorders affect various body regions, including the neck, shoulders, lower back, hands, and lower limbs, leading to detrimental conditions in muscles, tendons, ligaments, joints, and peripheral nerves (3, 4). MSDs primarily result from repetitive force exertion, improper movements, non-ergonomic postures, and frequent lifting or transferring of patients. These factors contribute significantly to decreased productivity, increased absenteeism, reduced healthcare quality, and work-related illnesses. Moreover, MSDs are multifactorial, arising from a range of contributing factors (3, 5). Broadly, four key risk factors contribute to the development of MSDs: genetic factors, morphological traits, biomechanical factors, and psychosocial influences. While intervention in genetic and morphological factors for MSD prevention is limited, biomechanical and psychosocial risk factors can be addressed (3, 6). Among biomechanical risk factors, elements such as poor or sustained postures, excessive force exertion,

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manual load handling, and repetitive tasks are primary contributors to musculoskeletal injuries. Various methods are available to assess occupational exposure to these risk factors, including observational techniques, direct instrumental methods, self-reported assessments, and psychophysiological approaches. The MAPO index and the Nordic Musculoskeletal Questionnaire are two widely utilized tools, representing observational and self-reported approaches, respectively (3, 7).

Manual handling of mobility-impaired patients is a primary contributor to acute lower back pain among nursing staff (8). Preventing musculoskeletal disorders (MSDs) resulting from patient handling requires precise assessment tools to effectively identify occupational risks (9, 10). Several methods are currently available to evaluate the risks associated with manual patient handling, based on various perspectives and analyses of working conditions in healthcare settings (8, 11, 12). Given the emphasis on patient transfer techniques and the need for nurse training to be seamlessly integrated into daily routines without disrupting workflow, observational methods are considered more practical in healthcare environments. These methods include MAPO (Movement and Assistance of Hospital Patient), REBA (Rapid Entire Body Assessment), DINO (Direct Instrument Nurse Observation), PTAI (Patient Transfer Assessment Instrument), and OWAS (Ovako Working Analysis System) (3, 7, 11, 13).

The MAPO index is a widely utilized tool for assessing the risk associated with manual patient handling, characterized by a rapid evaluation process. This method assesses key factors related to occupational exposure to MSD risk, including the physical strain of caring for disabled patients, the type and severity of patient disability, the structural characteristics of the workspace, the availability of patient transfer equipment, and staff training. The MAPO index operates similarly to a traffic light system, categorizing risk levels as follows: Green (0 – 1.5): Negligible risk, Yellow (1.5 – 5): Moderate risk, and Red (>5): High risk. Additionally, this index serves as a valuable tool for planning targeted preventive interventions aimed at mitigating the risk of work-related musculoskeletal disorders among healthcare professionals responsible for caring for disabled patients (11).

An additional important tool for data collection and predicting musculoskeletal disorders (MSDs) is the Nordic Musculoskeletal Questionnaire (NMQ). The Extended Nordic Questionnaire, developed by Dawson in 2009, is an adaptation of the original Nordic Questionnaire. This revised version includes both general and specific sections, broadening the scope beyond musculoskeletal pain in the lower back, shoulders, and neck to encompass additional screening questions for other musculoskeletal pains. The questionnaire aims to distinguish between pain, discomfort, and vague pain sensations, as well as differentiate between acute and chronic conditions. The Nordic Questionnaire is a simple yet comprehensive tool that provides valuable insights into musculoskeletal disorders across nine body regions. Its response format follows a binary (Yes/No) system, facilitating ease of administration and analysis (14). Hospital employees, particularly nurses, nurse assistants, physiotherapists, hospital computer operators, and service staff, are at high risk of developing musculoskeletal injuries (15-17). Studies show that the prevalence of MSDs among hospital personnel is notably high, often resulting in chronic pain, physical disabilities, decreased professional efficiency, and even job turnover (13, 16). Given the demanding nature of their work, identifying and assessing risk factors is crucial to minimizing injuries and enhancing working conditions. Considering the high workload of nurses in the only hospital in Chabahar County, the present study seeks to assess the risk of musculoskeletal disorders among nurses, nurse assistants, and, in some cases, service staff at Imam Ali Hospital in Chabahar using the MAPO index and the Nordic Musculoskeletal Questionnaire.

Materials and Methods

This cross-sectional descriptive-analytical study aimed to assess the risk of musculoskeletal disorders (MSDs) among nurses and other personnel responsible for patient handling in different departments of Imam Ali Hospital, Chabahar, affiliated with Iranshahr University of Medical Sciences, using the MAPO index. The participants were selected through census sampling. The study

was conducted in four main phases:

1. Screening of Study Participants: Initially, the hospital departments and the number of nurses involved in manual patient handling were identified, including the intensive care unit (ICU), cardiac care unit (CCU), and male and female surgery wards. Informed consent was obtained from nurses who met the inclusion criteria: a work experience of over one year, involvement in patient lifting and transfer tasks, and no prior history of musculoskeletal disorders or injuries.

2. Assessment of Musculoskeletal Disorders Using the Nordic Questionnaire: To determine the prevalence of musculoskeletal disorders (MSDs), the Nordic Musculoskeletal Questionnaire (NMQ) was employed. This questionnaire was initially developed in 1987 by L. R. Rock and colleagues at the Nordic Institute of Occupational Health in Scandinavian countries. The NMQ comprises 37 questions, divided into four sections: 9 questions (1–9) on demographic and personal information, eight questions (10–17) addressing pain, burning sensations, and discomfort in various body regions, 12 questions (18–29) on physical job demands, and eight questions (30–37) related to psychological job demands. The validity of the NMQ was established in a study by Yazdan Panah (2015), with a Cronbach's alpha reliability coefficient of 0.70. The selected hospital personnel completed the NMQ during this phase (14, 18).

3. Data Collection on Medical Equipment and Calculation of the MAPO Index: In the third phase, hospital departments were assessed for musculoskeletal disorder (MSD) risks using the MAPO index. The MAPO method consists of two sections: Section 1 involves data collection through interviews with head nurses to gather information on organizational and training aspects. Section 2 consists of the assessment of environmental and equipment-related factors through on-site observations and the evaluation of specialized patient-handling maneuvers. The MAPO index factors were collected separately for each hospital ward and calculated using Equation (1):

$$MAPO = [NC/OP \times LF + PC/OP \times AF] \times WF \times EF \times TF$$

"Where: NC (Non-cooperative patient), PC (Partially cooperative patient), OP (Operators/Nurses), LF (Lifting factor), AF (Minor aids factor), WF (Wheelchair factor), EF (Environmental factor), and TF (Training factor). Each factor was determined using standard reference tables, and the final MAPO score was calculated by inserting these values into Equation (1). The ergonomic risk level was classified based on the obtained MAPO score (19). Notably, the MAPO index is not designed to assess individual risk but serves as a complementary tool alongside individual risk assessment indices.

4. Statistical Analysis: Statistical analysis was performed using SPSS software (version 21). The Chi-square test (χ^2) was applied to examine the relationship between MAPO scores and the study variables.

Results

This study was conducted on 54 nursing staff and healthcare employees from various departments of Imam Ali Hospital, Chabahar, in 2024. Among the participants, 36 were male (66%), and 18 were female (33%). The majority of participants were in the 30–35 age group. The mean age for male and female participants was 35.6 and 35.5 years, respectively (Table 2). Additionally, 61% of the participants were married. Regarding equipment availability, each hospital ward had two wheelchairs, meeting the minimum requirement (at least 50% of the number of disabled patients). The highest MAPO index values (above 5) were found in the Emergency, Maternity, ICU, and Male Surgery wards, while the lowest MAPO index was observed in the Operating Room. The MAPO index values for different hospital wards are presented in Table 1. In terms of departmental distribution, the highest number of participants was from Dialysis (9 participants), Maternity (6 participants), Emergency (6 participants), and Operating Room (6 participants). Additionally, two participants (both male) were left-handed, and four participants (11.1%) reported having a second job.

Table 1. MAPO index values for different hospital wards

Hospital sections	Index MAPO	Area
CCU	7.392	3
ICU	3.192	2
Internal Medicine (Female)	3.08	2
Internal Medicine (Male)	2.66	2
Emergency	6.9825	3
Female Surgery	1.995	2
Male Surgery	12.66	3
Maternity	10.125	3
Operating Room	1.99	3

Table 2. Demographic information of participants

Hospital sections	Gender(n)	Age (years)	Work Experience (years)	Married(n)	Weight (kg)
Dialysis	Female (4)	33.25±5.75	6.5±2.5	2	**62.5±7.5**
	Male (5)	33.6±2.4	9.4±1.6	2	**67.6±9.4**
Maternity	Female (6)	36±6	6.7±2.3	4	**63.3±6.7**
	Male (0)	-	-	-	-
ICU&CCU	Female (1)	50	26	1	**74**
	Male (5)	38.2±2.8	7±5	4	**65.2±6.8**
Radiology	Female (0)	-	-	-	-
	Male (6)	34.6±4.4	7.3±2.7	2	**70±5**
Male Surgery	Female (0)	-	-	-	-
	Male (3)	37±3	7±3	1	**75±2**
Female Surgery	Female (3)	37.3±1.7	6.7±2.3	2	**63.7±6.3**
	Male (0)	-	-	-	-
Emergency	Female (0)	-	-	-	-
	Male (6)	33.8±2.2	7.8±2.2	3	**71±6**
Operating Room	Female (0)	-	-	-	-
	Male (6)	33.8±3.2	7.5±3.5	4	**72.5±7.5**
Internal Medicine (Male)	Female (0)	-	-	-	-
	Male (3)	36.6±3.4	8±2	2	**71.6±5.4**
Internal Medicine (Female)	Female (3)	33.7±1.3	7.3±1.7	2	**69.3±1.7**
	Male (0)	-	-	-	-
Thalassemia	Female (1)	27	3	1	**60**
	Male (2)	41±4	12±1	1	**71±1**

Discussion

The multifactorial nature of musculoskeletal disorders (MSDs) related to work could be one of the primary reasons for the high prevalence of these disorders in various work environments. Job characteristics, individual traits, and morphology are key factors influencing the development of MSDs (7). Therefore, the research objective was to evaluate these disorders by investigating individual characteristics and job parameters in a hospital using the MAPO method. Based on the demographic data provided in Table 2, the majority of the study participants were male, particularly in the emergency, CCU, and radiology departments, where most of the staff were male. This study was unable to analyze the significance of work experience, age, and weight separately for male and female groups because some departments, including maternity, male surgery, female surgery, male internal medicine, and female internal medicine, were represented by only one gender. The results showed that the average age of participants in all departments, except for the

thalassemia department, ranged from 33 to 38 years, while the average work experience of 93% of participants was between 7 and 9 years.

An assessment of the MAPO index across various hospital departments revealed that none of the departments fell within the green zone (0 to 1.5). Forty-four point four percent (44.4%) of the departments were classified as level two (0 to 5), while fifty-five point six percent (55.6%) were classified as level three (above 5). The departments of CCU, emergency, male surgery, and maternity all had MAPO scores exceeding 7, placing them in the red zone. The highest MAPO score was found in the male surgery department, with a score of 12.66. In a study by Berazandeh et al. (2012), which evaluated the risk of MSDs in hospital workers across two hospitals in Ilam, the average MAPO score in both hospitals was significantly higher than the normal range (0 to 1.5), aligning with the findings of the present study (20). In the study by Habibi et al. (2014), the risk of MSDs was assessed across five hospitals using the MAPO index. Their results showed that 21% of departments were in level one (0 to 1.5), 53% in level two (1.5 to 5), and 26% in level three (above 5), which is consistent with the findings of this study (7). Furthermore, the survey by Abedini et al. demonstrated that the MAPO index in various departments of their hospital was 16.5 for level one, 63 for level two, and 20.5 for level three, all indicating high index values, which also align with the present study's results (13).

The prevalence of musculoskeletal disorders (MSDs) among nursing staff involved in patient handling has shown a high frequency of these disorders among employees (21). Since these disorders have multiple causes, a variety of physical and mechanical risk factors contribute to their onset or progression. In the nursing community, tasks such as bending and straightening to move and reposition patients in bed, transferring patients between beds and chairs, handling equipment, raising arms above shoulder level, standing for extended periods, job-related stress, the lack of modern equipment for patient handling, failure to follow ergonomic principles when lifting patients in postures that minimize body strain, and insufficient staff relative to the number of patients, can all contribute to the increased prevalence of musculoskeletal disorders among nurses.

Conclusion

Based on the findings of this study, the risk of musculoskeletal disorders is high across all departments, particularly in the male surgery, emergency, CCU, and maternity wards of Chabahar County Hospital. By increasing the number of nursing staff and adding auxiliary equipment to these departments, the MAPO index can be reduced, ultimately leading to a decrease in the risk of musculoskeletal disorders.

Ethical issues

This study was approved by the Research Ethics Committee of Iranshahr University of Medical Sciences (Ethical code: IR.IRSHUMS.REC.1403.018). The authors certify that all data collected during the study are as presented in this paper, and no data from the study has been or will be published elsewhere separately.

Ethics approval and consent to participate

This study was approved by the Research Ethics Committee of Iranshahr University of Medical Sciences (Ethical code: IR.IRSHUMS.REC.1403.018).

Consent for publication

verbal

Availability of data and materials

Attached

Competing interests

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Authors' contributions

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Declaration of Conflicting Interests

There is no conflict of interest.

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