



# Musculoskeletal Disorders due to Patient Transportation in Health Workers: A Systematic Review in Iran

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## ABSTRACT

**Aims:** Transportation of patients in hospitals is one of the main reasons for the prevalence of musculoskeletal diseases among health care workers. Considering that the practical action of recognizing and evaluating the studies has been done, therefore the present study has been conducted with the aim of determining the prevalence of musculoskeletal diseases and the determinants affecting the disorders in a systematic manner in Iran.

**Method and Materials:** In this systematic review, English databases of Web of Science, Scopus, Proquest, PubMed as well as databases Magiran, SID in Iran, and also Google Scholar search engine in the period Jan 1990 to Jan 2020 according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement were done. Study process was conducted from 28<sup>th</sup> September to the end of October. Cochrane (adapted for evaluating interventional studies) and Strengthening the Reporting of Observation Studies in Epidemiology (STROBE) checklists (adapted for evaluating cross-sectional studies) were used to evaluate the quality of the articles. To avoid bias in the study, the data were analyzed by two researchers entirely independently. Any disagreement between the researchers was examined by a third party.

**Findings:** Out of 93 articles, finally, 10 articles (2 interventional and 8 cross-sectional articles) entered the final list of studies. Thus, the final articles were performed on health system staff (nurse, nurse's assistance, helper nurse's assistance and service workers). In all studies, the prevalence of musculoskeletal diseases were highly reported among those responsible for transporting the patient.

**Conclusions:** Considering the high prevalence of musculoskeletal disorders among the medical staff, the interventions carried out in the field of teaching the correct method of patient transportation in Iran seem insufficient, so that there is a need for better planning and designing more practical interventions. Also, often enough tools and equipment are not available for easy transportation, which should be considered by hospital managers.

**Keywords:** Transportation of Patients, Musculoskeletal Diseases, Delivery of Health Care, Systematic Review

## Introduction

Musculoskeletal diseases are one of the most important occupational problems among health care workers<sup>[1]</sup>. Health care workers are ranked sixth among the top ten jobs with the highest occupational hazards<sup>[2]</sup>. All jobs are associated with health risks and complications, though health care workers experience various health risks and complications based on their jobs. In the health system, jobs in the health care and treatment sectors are among the jobs with specific risks and complications<sup>[3-5]</sup>. Studies have suggested that musculoskeletal diseases are the main

occupational debilitating factor and disability among health care workers<sup>[6]</sup>. Based on the Bureau of Labor Statistics investigations, musculoskeletal diseases and damages were significantly more frequently reported by nurses and healthcare workers than construction workers, and musculoskeletal diseases account for half of the diseases and injuries of the healthcare workers<sup>[7]</sup>. Musculoskeletal diseases have been reported between 60 to 81 percent in Iran<sup>[8, 9]</sup>. Chobineh et al.'s study on the nursing society has shown the high prevalence of musculoskeletal disorders, and

nearly 90 percent of the study population were at risk of musculoskeletal disorders [10]. Moreover, this study showed an annual prevalence of musculoskeletal disorders, such as low back pain, has been reported to range between 30 to 70% among Iranian nurses[10]. Low back pain among health care workers is a global issue, and findings of more than 80 studies suggest a minimum prevalence of 30% to 60% of musculoskeletal disorders among

nurses[11].

Patient transporting is the main source of these disorders among health care workers in hospitals[12]. Patient transfer is a specific manual activity, including moving or supporting a patient, such as carrying, pushing, pulling, lifting, and lumbar movements[13].

Patient transportation is more difficult and unpredictable compared with carrying objects. Patients may be obese or have an

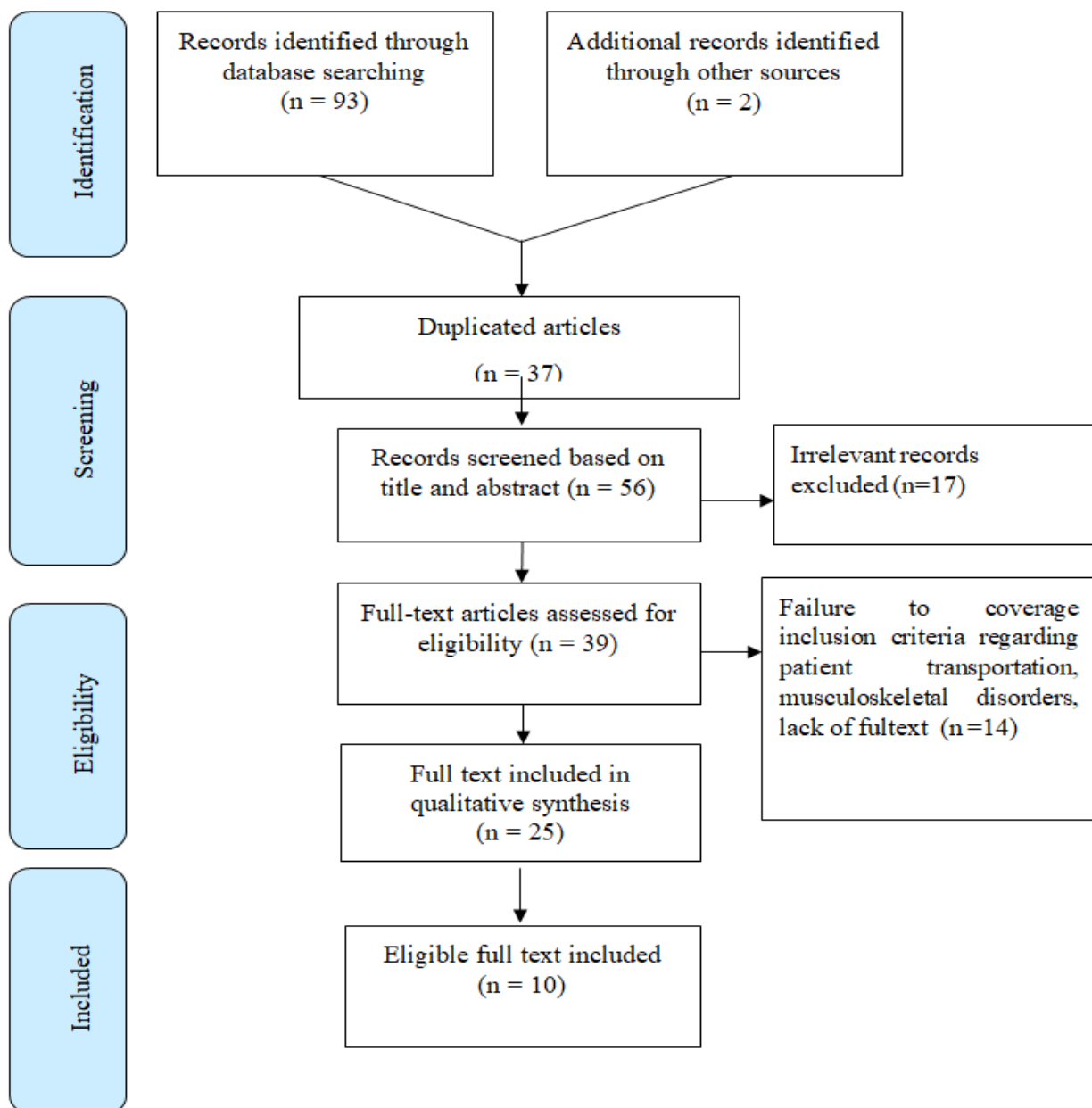


Figure 1) Systematic entry chart for articles

**Table 1)** Review of intervention articles based on Cochran evaluation checklist.

Author and year of publication	Adequate sequence generation	Allocation concealment	Blinding	Incomplete data addressed	Free of selective reporting	Free of other bias	% of yes Answers
Ashghali Farahani et al 2017(12)	Y	Ambiguous	Ambiguous	Y	Ambiguous	Y	50%
Mosavi Ori et al 2016(21)	Y	Y	Y	N	Y	Y	83%

Y=Yes N= No

inappropriate situation during transfer; thus, the highest physical burden to health care workers is manual lifting, moving, and changing the position of patients<sup>[14]</sup>. Since patients should be moved several times for vital care and moved to different positions or location, so in some cases, health care workers may need to move obese patients, which is remarkably energy-consuming and is associated with a significant risk of musculoskeletal diseases<sup>[15]</sup>. Several studies have been conducted on patient transportation in Iran, but so far, it seems there is few that study has been done to identify a more effective approach in this field. Thus, considering the importance of patient transportation among the duties of the health care workers, the present study was conducted to review the studies based on the prevalence of musculoskeletal diseases and affecting factors in Iran in a systematic manner.

### Method and Materials

The present study was a systematic review with the research questions of “what is the rate of musculoskeletal diseases in health care workers responsible for patient handling?” and “what are the determining affecting factors on the musculoskeletal diseases caused by patient handling?” This study was conducted based on Iranian research articles published in national and

international journals. The study was based on the PRISMA statement<sup>[16]</sup>.

A comprehensive electronic search of Iranian study in Persian (Magiran· SID), and in English (Web of Science, Scopus, Proquest and PubMed), and in Google Scholar search engine with keywords of Patient transportation[Mesh], Delivery of Health Care[Mesh], patient's manual transmission [Non-Mesh], musculoskeletal diseases[Mesh], medical staff [Mesh], Nurses [Mesh], Nurse's assistance[Non-Mesh] and Helper nurse's assistance[Non-Mesh] with AND and OR functions which were published abroad from 1990 to 2020 were assessed.

As an example, the strategic search for the PubMed database was as follows: (Patient transportation) [MeSH Terms] OR (Delivery of Health Care) [MeSH Terms] OR (Patient's manual transmission) [Text Word] OR (Musculoskeletal Diseases) [MeSH Terms] AND (Medical staff) [MeSH Terms] OR (Nurses) [MeSH Terms] OR (Nurse's Assistance) [Text Word] OR (Helper nurses' assistance) [Text Word]).

In this study the clinical trials, experimental, semi-experimental and all interventional trial and cresssectional articles which were regarding musculoskeletal disease included for assessment. The target group of the included studies were Iranian health system medical staff including nurses, nurse's

**Table 2)** Details of studies included in the systematic review based on patient transportation and musculoskeletal diseases in Iranian health workers.

Number	First Author	Aim	Type of Study	Target group	Sample Size	Measuring tools	Result	Qualitative Assessment
1	Samaei 2017(24)	Determining the prevalence of low back pain (LBP), risk factors for low back pain, risk assessment of patient transportation and relocation.	Cross-sectional	Nurse	n = 243	1)Nordic Questionnaire 2)PATI checklist	The PATI index is an effective tool in classifying the level of patient transfer risk.	12
2	Akbari 2017(22)	Determining the prevalence of musculoskeletal disorders, assessing the risk of patient's manual transmission and related factors Risk.	Cross-sectional	Nurse	n = 220	1) Nordic Questionnaire 2) PATI checklist 3)MAPO checklist	The prevalence of musculoskeletal disorders has been high among nurses. PATI and MAPO indicators are good tools for assessing patient transfer risk.	11
3	Ashghali Farahani (12) 2017	Determining the effect of teaching how to transport the patient on musculoskeletal disorders.	Interventional	nurse's assistants' helper	n=100	1) Nordic Questionnaire	The patient's training program has been shown to reduce the prevalence of musculoskeletal disorders in the limbs and ankles, but has not been able to reduce other musculoskeletal disorders.	-
4	Mousavi Ouri 2016(23)	Investigation of workload caused by patient transportation.	Cross-sectional	Nurse, nurseassistantns' helper	n=260	1) PATI checklist	The burden of patient transport in nursing staff is at a high level of risk.	11
5	Salmami Nodoooshan (11) 2016	Identifition dangerous conditions related to patient transportation.	Cross-sectional	Nurse	n = 243	1)Researcher-made questionnaire	The prevalence of musculoskeletal diseases has been high in people who move the patient manually. The most common disorder has been low back pain. Due to the lack of mechanical aids, its provision is an urgent need.	12

**Continued Table 2)** Details of studies included in the systematic review based on patient transportation and musculoskeletal diseases in Iranian health workers.

Number	First Author	Aim	Type of Study	Target group	Sample Size	Measuring tools	Result	Qualitative Assessment
6	Mosavi Ori 2016(21)	Determining the effect of patient transfer method training.	Interventional	Nurse	n= 23	1) PATI checklist	The training program for the correct technique of moving the patient, bed to wheelchair and vice versa, improves the skill and better implementation of this technique.	-
7	Abedini 2015(5)	Determining the prevalence of musculoskeletal disorders, assessing the patient's risk of manual transmission and identifying factors associated with musculoskeletal disorders.	Cross-sectional	Nurse, Nurse's assistants, nurse assistants' helper	n= 20	1) Nordic Questionnaire 2) MAPO checklist	The prevalence of musculoskeletal disorders in people has been high. The prevalence of disorders is related to the scores on the MAPo index.	12
8	Allahyari 2014(20)	Estimation of mechanical load on the back in the patient's manual displacement tasks.	Cross-sectional	nurse assistants' helper	n=10	1) Force plate	Placing the patient in a wheelchair puts a lot of force on the back. So that two-person manual carrying does not cause a significant reduction in the force on the waist.	13
9	Kalantari 2014(19)	Determining the risk of manual patient transportation in medical wards and its relationship to the prevalence of musculoskeletal disorders.	Cross-sectional	Service workers	n= 54	1) Nordic Questionnaire 2) Oral Pain Scale 3) MAPO checklist	Due to the relationship between the MAPO index and the prevalence of musculoskeletal disorders, reducing and reducing the risk of these complications will be effective in reducing the risk of these complications.	13
10	Abedini 2013(10)	Assess the risk of musculoskeletal disorders due to patient displacement	Cross-sectional	Nurse, Nurse assistants, nurse assistants' helper	n= 400	1) Nordic Questionnaire 2) PATI checklist	The PATI assessment method is useful for diagnosing and assessing the risk of musculoskeletal disorders due to patient displacement.	12

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assistants, and services workers who were involved in patient transportation. were entered in line with the purpose of the study. Furthermore, articles presented in conferences and seminars and letters to the editor were included in the study.

However the studies which were conducted on participants with congenital or traumatic defects affecting musculoskeletal diseases, and the studies without fullest were excluded from the study.

In the evolution of the found studies, study titles were evaluated first, followed by abstracts, and finally full-text. To prevent study biases, the search process, article selection, quality assessment, and data extraction were made by two researchers independently, and disagreements between the two authors were re-assessed by the third author. Article selection was made based on the PRISMA checklist. STROBE checklist was used to evaluate the quality of cross-sectional studies. Moreover, the Cochrane evaluation checklist was used to assess the quality of interventional studies<sup>[17]</sup>. Biases in selection, performance, diagnosis, data collection and reporting, and other biases were examined<sup>[18]</sup> (Table 1).

Required data of the studies, including first author, publication year, study aim, Type of Study, target group, sample size, study tools, and results, were extracted and reported in Table 2.

### Findings

In the first step, 93 studies were found by searching the keywords in the databases, 37 of which were duplicates. The abstract of the remaining 56 articles were reviewed, and 17 studies were deleted due to irrelevance. In the second step, the full-text of the remaining 39 articles were examined, 14 of which were removed since they did not fulfill the study inclusion criteria. Then, the quality of the 25 studies was evaluated, and ten studies were used in this study (Figure 1).

Eight studies<sup>[5, 10, 11, 19, 20-22-24]</sup> were cross-sectional and two studies<sup>[12, 21]</sup> were interventional Which were performed on the medical staff of the Iranian health system who were responsible for transporting patients including nurse, nurse's helper assistants, nurses assistants' helpers. All the included studies have been performed in the medical wards of hospitals.

Table 1 shows the characteristics of the interventional studies. Among the interventional studies, in the study of Mosavi ori, et al.<sup>[21]</sup>, the patient transportation training program was held in the form of a 3-day workshop, including theoretical and practical training of patient transfer methods, along with group and individual training of participants during the researcher's supervision. In the study of Ashqhali Farahani, et al.<sup>[12]</sup>, 3 training sessions were presented in the form of lectures, role-playing, practical exercises, group discussions, questions and answers, slides, video screenings and educational booklets regarding how to transport the patient. The age of all participants in the assessed studies were below 40 years.

Besides demographic information, various tools were used to collect data in the studies. The Nordic questionnaire was used to determine the prevalence of musculoskeletal diseases within the last 12 months. A Verbal Rating Scale (VRS) was used to determine pain intensity. Movement & Assistance of Hospital Patients (MAPO) and Patient Transfer Assessment Instrument (PATI) checklist was used to evaluate the risk of musculoskeletal diseases caused by patient transportation and relocation in different hospital wards.

Table 2 shows all characteristics of the assessed studies.

### Discussion

The present study systematically reviewed studies on patient transportation and

musculoskeletal diseases, and finally 10 articles were analyzed according to the inclusion criteria.

In Kalantari et al. study<sup>[19]</sup>, evaluation on the MAPO index showed the state of each ward. MAPO index value of 1 reflects musculoskeletal disorders' absent or negligible risk. In contrast, the MAPO index of 2 reflects 2.4 times higher risk of musculoskeletal disorders than the MAPO index of 1, and the MAPO index of 3 reflects 5.6 times higher risk of musculoskeletal disorders than the MAPO index of 1. Results of Kalantari et al. study<sup>[19]</sup>, demonstrated that only one hospital ward (4.34%, emergency department) had a MAPO index of 1, while five hospital wards (21.75%) had a MAPO index of 2, and 17 hospital wards (73.91%) had MAPO index of 3. The highest MAPO index belonged to the orthopedic ward<sup>[19]</sup>. Therefore, paying attention to educating staff in high-risk wards and providing assistive devices for relocation and transporting patients according to the type of ward, requires more attention in the management system of hospitals.

In Abedini et al. study<sup>[5]</sup>, the MAPO index showed that 83.5% of staff are at risk of musculoskeletal disorders in the hospital wards, 20% of which are at high risk. In Akbari et al. study<sup>[22]</sup> the MAPO index showed that 60% of the participants were at high risk for musculoskeletal disorders, while the PATI index showed that only 30% of them were at high risk. Thus, the measurement tools should be considered in interpreting the study results.

The PATI checklist consists of 15 items, the first 9 items of which have been completed by the evaluator through the observation of the nurse, and six items have been filled after the interview with him/her. This index is classified into three categories. In Abedini et al study<sup>[10]</sup>, 4% of the participants were in risk level 1, 8.5% in risk level 2, and 87.5% in

risk level 3 of the PATI index, indicating that the majority of the participants were at the highest risk of musculoskeletal disorders.

In Mousavi Ouri et al.study<sup>[23]</sup>, no case was seen at risk level 1. This was while 8.07% were at risk level 2 and 91.93% were at risk level 3 PATI. In fact, a high percentage of people have the highest level of workload risk due to patient transportation. In a study conducted by Mosavi Ori et al.<sup>[21]</sup>, the evaluation score of the patient transfer method before the intervention was poor in most participants (95%) and after the educational intervention, the majority (80%) reached the first or good level

In the Samaei et al. study<sup>[24]</sup>, low back pain risk was assessed using the PATI index, which showed that 14.3 of nursing staff were at high risk of LBP, and 76.5% of them were at moderate risk. Despite the effectiveness of the interventions on improving the musculoskeletal state of patients, most interventions were cross-sectional, and more extended interventions were required. In Kalantari et al. study<sup>[22]</sup>, the prevalence of musculoskeletal disorders in one or more areas of the body in the last 12 months was 75.9%. Findings of the Nordic questionnaire in Abedini et al.<sup>[10]</sup>, revealed showed that at least 88.2% of people had disorders in one or more areas of their musculoskeletal system. This rate was reported to be 80% in Akbari et al. 's<sup>[22]</sup> study. In the same study, the rate of low back pain was 61.9% among nurses, which was higher than other disorders.

Moreover, in 85% of the hospital wards of Salmani Nodoshan et al. study<sup>[11]</sup>, the responsible personnel in charge of transporting and moving the patient suffered from back injuries.

The prevalence of musculoskeletal disorders of low back pain has also been reported in Mansore Ashghali et al study<sup>[12]</sup>. Moreover, Abedini et al. study<sup>[5]</sup> showed that the rate

of low back pain was 71.5% in nurse, nurse's assistance, helper nurse's assistance who were responsible for patient transportation. Despite the educational program of Ashghali Farahani et al. study [12], this program was only successful in reducing pain in feet and ankles, and it was not successful in reducing all musculoskeletal disorders. The limited time of helper nurse's assistance for skills exercises can be due to lack of manpower and high workload and lack of appropriate electrical and mechanical tools in transporting patients.

Furthermore, according to the study of Abedini et al. study [5], it was found that only 7% of nurses had participated in training courses on how to properly transport the patient. Therefore, the need for proper planning and implementation in training courses on how to properly transport the patient in hospitals should be considered.

In the interventional study of Mosavi Ori et al. study [21], despite their success in improving the PATI index, their study was focused only on patient transfer from bed to wheelchair and vice versa based on ergonomic principles and did not cover other problems of patient handling. Moreover, a low sample size and studying only one group were the limitations of their study.

A study on the helper nurse's assistance indicated that transferring the patient in a wheelchair puts a lot of force on the back, and even two-person manual transport did not significantly reduce this forces. Thus, to reduce these forces, ergonomic interventions such as designing proper patient beds and using electrical and mechanical patient transport devices were required in addition to educational interventions [20].

Lack of equipment in the hospital is a very important issue so that according to a report conducted in the study of Abedini et al. study [5], out of 75 treatment wards from

11 hospitals, despite the sufficient number of wheelchairs in 85.6% of wards there were no mechanical devices for lifting patients. In addition, Salmani Nodoshan et al. study [11], suggested that despite the high number of patient transfers in each working shift, auxiliary devices for patient handling were only present in 3 hospital wards. Note that the only auxiliary patient handling device was the Roll Board which was not used in the majority of the cases.

One of the reasons for the small number of assistive devices in the study of Salmani Nodoshan et al. study [11], was the lack of purchase and supply of it by hospitals. Moreover, not using these devices was attributed to their time-consuming, unavailability, instability, lack of safety, and difficult use.

It should be noted that the lack of review of abstracts of papers published in national and international congresses, conferences, as well as restrictions on access to some databases and lack of access to the full text of the article can be considered as limitations of this study that affecting article selection.

It is suggested that researchers review other measurement tools and examine the challenges and barriers to the proper conduct of patient transport training courses in hospitals to plan, implement and ultimately evaluate training programs with a more comprehensive view.

## Conclusions

According to the results, despite the efforts made in the field of medical staff training in Iran for the correct transfer of patients, the prevalence of musculoskeletal disorders among people who are responsible for transporting patients in the health system is still significant. Because in addition to the defects in the way training courses are held and the inappropriateness of these courses, the lack of tools and equipment is also



one of the important reasons. Therefore, in developing the macro strategies of the health system, attention should be paid to this issue, because improving the health of the medical staff will be the basis for improving the health of the society. Also, in the financial system of hospitals, sufficient funds should be considered to provide auxiliary equipment for the proper and easy movement of the patient.

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### Author Contribution

All authors have their own responsibilities in this review manuscript. All authors read the final draft of the manuscript and confirmed it.

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