

# Work-Related Risk Factors for Musculoskeletal Disorder among Nurses in Indian Hospitals

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## SUMMARY

**Background.** Due to the difficulties of work-related musculoskeletal disorders (WMSD) that are common worldwide, medical personnel have been recognized as high-risk groups.

**Objective.** To evaluate the work-related risk factors that affect musculoskeletal disorder among nurses in Indian hospitals.

**Methods.** In this cross-sectional descriptive study, data were collected from 200 nursing staff working in Jawaharlal Nehru Medical College and Hospital in Aligarh Muslim University, Uttar Pradesh, India. A self-management modified musculoskeletal questionnaire (Nordic questionnaire) was used to assess the occurrence of WMSD in the past 12 months.

**Results.** Lower back pain (79%) followed by the right shoulder and neck (67%) and knee pain (63%) was highest among female nurses in past 12 months. The prevalence of MSD in past 12 months was highest in dentistry (81.25%), followed by orthopedics (62.5%) and surgery (57.78%) department. For tasks that require sitting, lower back pain is highest (49.4%, n = 45) followed by neck (40.6%, n = 37) and elbows (38.4%, n = 35). The lower back discomfort was highest who worked more than 6 hours (76.1%, n = 35), followed by neck (60.8%, n = 28) and right shoulder (56.5%, n = 26). Unexpectedly, 53.5% of nurses believed that the manual patient transfers leads to MSD on their body parts. In addition, 63.5% of nursing staff across all departments unexpectedly report that they agree they are under work pressure/stress and have experienced MSDs.

**Conclusions.** Nurses often have a high risk of WMSD in the lower back and neck; therefore, special measures should be taken to ensure that they work in an ergonomic setting, and appropriate body mechanics should be applied to limit the likelihoods of facing WMSD.

## KEY WORDS

*Work-related musculoskeletal disorders; nursing staff; work factors; psychosocial factors; Nordic Musculoskeletal Questionnaire.*

## INTRODUCTION

Healthcare organizations face many challenges due to aging employees, unemployment, increased patient acuity, number of patients and weight gain. Also, if the nurse is injured on the job, the cost of rehabilitation, absenteeism, and workplace accidents will also increase (1). A study shows that nurses are at seven times greater risk of serious injury than other occupations (2). Due to the occurrence of musculoskeletal disorder (MSD), many workers in various occupations are affected and have a significant impact on some organizations. Musculoskeletal disorders (MSDs) is a common work-related difficulty worldwide, and health care workers have been recognized as a high-risk group (3). An increased risk of MSD has been recognized in occupations having repetitive tasks, hard work, uncomfortable postures, and lifting heavy objects (3, 4). Puagprakong *et al.* (5) investigating the effect of lower cross syndrome on the upper body posture of female office workers, it was found that different types of lower cross syndrome have different effects on upper body sitting posture, and poor sitting posture due to muscle imbalance leads to MSDs. In addition, it has been determined that physical requirements, work environment, and workplace will harm the physical and mental health of nursing staff (6). In addition, time constraints, low participation in decision-making, strict observation, lack of communication, unclear job occupations, and the time spent performing these tasks are all considered nurse situations (7).

Work-related MSDs are very common in medical institutions, with an annual prevalence ranging from 28% to 96% (8). Work-related illnesses have been found to be the leading cause of absenteeism in nursing facilities (9). Based on globally reported data, the prevalence of MSDs among nursing staff is reported to be high, *i.e.*, 89% in Portugal (10), 32.8% to 57.1% in Brazil (11), 10% to 50% in France (12), 85% in Macedonia (13), 78.6% in China (14), 88% in Iran (15) and 35.1% to 47% in the United States (16).

The occurrence of work-related MSD between nursing staff and related risk factors is important for health service decision makers and professionals to reduce the existence of problems. Therefore, it is important to adjust various risk factors in the manual patient care activities that nurses must perform to reduce the impact of WMSD. Manual patient handling is not safe for patients, impacts nurses, and can lead to risk of injury, pain, and adverse health effects (17). Therefore, among healthcare professionals, manual lifting of patients is considered to be the highest risk factor for illness, and increased obesity and age of nurses are also contributing factors (18). There is evidence that training alone is ineffective, and more and more people

agree that the use of ergonomic interventions and equipment play an important role in reducing the risk of musculoskeletal disorders for nurses (19, 20). However, many accidents experienced by patients and nurses are caused by poor ergonomics (21).

A number of studies have shown that the various factors, namely posture, workload, duration of employment and gender, work stress and manual lifting, are factors that affect the risk of WMSD (3, 10, 11, 13, 15, 16, 22-24, 25). In addition, body mass index (BMI) is also related to MSD in various parts of the body, and there is a moderate correlation between high BMI (overweight and obesity) and increased incidence of musculoskeletal discomfort (26). In addition, Chen *et al.* (24) concluded that the influencing factors that lead to MSD include age, work experience, work content, working hours, standing, sitting and walking time at work, work stress level and exercise habits.

To the best of our knowledge, the prevalence of WMSD among nursing staff and related factors is of great importance to policy managers and health service professionals to reduce the occurrence of problems. Therefore, it is necessary to determine the multifactorial factors *viz.*, work factors, employment durations, physiological factors, manual handling and exercise habit contributing WMSDs among nurses in last 12 months. In this study, a self-management modified musculoskeletal questionnaire (Nordic questionnaire) was used to assess the occurrence of WMSD among nursing staff. This study will serve as a benchmark for policymakers to apply recommended guidelines that reduce musculoskeletal discomfort in nurses and thus improve quality of care and performance.

## METHODS

### Study design

The study aims to investigate the factors affecting MSDs of nursing staff in Indian government hospital, and to assess the relationship between MSD and workload-related factors. The research protocol was approved by Ethical Review Committee of the Department (IRB: MED-21-0127-Date of approval: July 21, 2021) and with the 1964 Helsinki declaration. In this cross-sectional descriptive study, data were collected from nursing staff working in Jawaharlal Nehru Medical College and Hospital in Aligarh, Uttar Pradesh, India. In this survey, 227 participants who met the inclusion criteria were recruited voluntarily, and 27 participants did not complete the questionnaire were disqualified from the study. Therefore, finally 200 participants were selected in the study with the response rate of 80.97%. The study period is from August 2021 to October 2021.

Full-time nursing staff (100 men and 100 women) from seven different departments viz., general medicine, surgery, dentistry, gynecology, oncologist, orthopedic, and physiotherapy, voluntarily participate in this study (only those eligible for government benefits and report injuries during their work in the hospital, and receive compensation, treatment, or vacation). In addition, participants should: 1) a registered nurse, 2) minimum one year of working experience, 3) > 18 years of age, and 4) ready to participate in the research. However, those who were pregnant and have prior peripheral nerve disease, trauma and fracture sprains, and other musculoskeletal injuries were excluded from the study. Observed individuals with any missing information was also excluded from the survey.

### Questionnaires

A self-management modified musculoskeletal questionnaire (Nordic questionnaire) was circulated among the nursing staff in two ways; first, it was sent by email, and second, it was physically submitted and collected thereafter. The questionnaire is separated into three parts: background information, job nature, work-related risk factors, physiological factors and its association on body part discomfort. Respondents were questioned to choose from 9 body parts (neck, shoulder, lower back, upper back, wrist, knee joint, elbow joint, lower extremity and upper extremity). Questionnaire comprise whether they have sensed discomfort in the past 12 months, which affected their capability to live or work (a “yes” answer is 1 point and a “no” answer is 0 points). The highest score for discomfort in each part is 3 points, and

the lowest is 0 points. Due to the limited range of scores, the scores of discomfort in each part are further divided into “no” (0) and “yes” (1-3 points = 1). The questionnaire can recognize the dissimilarities in discomfort caused by different work factors, so as to more clearly define the MSD problem. Several studies have shown that the questionnaire has adequate consistency, reliability and validity (27, 28). A self-management modified musculoskeletal questionnaire (Nordic questionnaire) last 15 to 30 minutes.

## RESULTS

### Demographic characteristics

The results of demographic characteristics of all nursing staff in seven departments are shown in **table I**. Full-time nursing staff from seven different departments (100 men and 100 women), namely general medicine, surgery, dentistry, gynecology, oncology, orthopedics, and physiotherapy volunteered to participate in this study. The average age was  $29.01 \pm 9.46$  years and  $30.58 \pm 12.03$  years for women and men employees respectively. The average height was  $157.3 \pm 5.8$  cm and  $169.8 \pm 3.2$  cm for women and men employees respectively. In addition, the average BMI was  $23.5 \pm 3.8$  kg/m<sup>2</sup> and  $23.2 \pm 4.2$  kg/m<sup>2</sup> for women and men employees respectively. Most nurses (65% men and 57% women) had weights within the normal range. However, 24% of men and 26% of women are overweight and obese. The average duration of employment was  $6.39 \pm 4.73$  years and  $8.29 \pm 6.12$  years for women and men respectively. Most nurs-

**Table I.** Demographic characteristics of the participants.

Demographics	Male	Female
Number of respondent (n)	100	100
Age (yrs) (Mean $\pm$ SD)	$30.58 \pm 12.03$	$29.01 \pm 9.46$
Weight (Kg) (Mean $\pm$ SD)	$66.8 \pm 11.44$	$58.76 \pm 10.48$
Height (cm) (Mean $\pm$ SD)	$169.8 \pm 3.2$	$157.3 \pm 5.8$
BMI kg/m <sup>2</sup> (Mean $\pm$ SD)	$23.2 \pm 4.2$	$23.5 \pm 3.8$
Underweight	11 (11%)	17 (17%)
Normal	65 (65%)	57 (57%)
Overweight	18 (18%)	21 (21%)
Obese	6 (6%)	5 (5%)
Duration of employment (Mean $\pm$ SD)	$8.29 \pm 7.12$	$6.39 \pm 4.73$
Educational level		
High school/certificate course	15	14
Diploma	22	18
Bachelor's degree	47	62
Master/PhD	16	6

es have a bachelor degree (female n = 62, male n = 47), followed by a diploma (female n = 18, male n = 22) and a master/doctoral degree (female n = 16, male n = 6).

According to **table II**, in past 12 months, the highest incidence of MSD was in dentistry (81.25%), followed by orthopedics (62.5%), and then surgery (57.78%). It can be seen from all the valid respondents in the general medicine that most of the employees are male (n = 51), accounting for about 58.6% of the total number of employees, followed by 36 females (41.4%). However, 24 (47.1%) men and 18 (50.0%) females reported the incidence of MSD in past 12 months. Overall, the prevalence of MSD in all seven departments has been high (67%) in past 12 months.

In addition, the incidence of MSD in 9 parts of the body in the past 12 months is shown in **table III**. Feedback from various departments showed that the incidence of MSD in the lower back (LB) was the highest, 43.7% in orthopedics, 37.5% in dentistry, and 31.1% in surgery. In addition, the MSD of the right shoulder was 37.5%, the highest in the

dental department, followed by the MSD of the elbow and upper back (31.5%). However, the highest prevalence of cervical MSD was reported in surgery (33.3%), followed by dentistry (25.0%). In addition, a total of 47 (23.5%) nurses reported that of all employees, the prevalence of MSD in the LB was the highest. However, the physical therapy and oncology departments did not report MSD on the right shoulder, neck, wrist, upper back, and knee. In addition, wrist MSD has the highest report rate in orthopedics (31.2%), followed by surgery (26.7%) and gynecology (21.1%).

**Association of work factors and MSD**

**Table IV** shows the pain frequency of 9 body parts in the work-related risk factors to determine its relationship with MSD. The work-related risk factors are distributed into posture, workload (time), and duration of employment. In addition, the influence of other associated factors, namely gender, work pressure, patient’s physical handling and exercise habits on MSD was also evaluated.

**Table II.** The prevalence of MSD in each department in the past 12 months.

Department	Valid responded	Gender		MSD in last 12 Months		
		Male	Female	Male	Female	Total prevalence
General Medicine	87	51 (58.6)	36 (41.4)	24 (47.1)	18 (50.0)	42 (48.28)
Surgery	45	22 (48.9)	23 (51.1)	12 (54.5)	14 (60.8)	26 (57.78)
Dentistry	16	3 (18.7)	13 (81.2)	3 (100.0)	10 (76.9)	13 (81.25)
Gynecology	19	5 (26.3)	14 (73.7)	1 (20.0)	6 (42.8)	7 (36.84)
Oncologist	7	2 (28.6)	5 (71.4)	1 (50.0)	0 (0.0)	1 (14.28)
Orthopedic	16	12 (75.0)	4 (25.0)	7 (58.3)	3 (75.0)	10 (62.5)
Physiotherapy	10	5 (50.0)	5 (50.0)	2 (40.0)	3 (60.0)	5 (50.0)

**Table III.** The prevalence of MSD in 9 body parts in the past 12 months.

Body region	Department							
	All n (%)	G. Med. n (%)	Sur. n (%)	Dent. n (%)	Gyne. n (%)	Onco. n (%)	Ortho. n (%)	Physio. n (%)
Shoulder (left)	21 (10.5)	8 (9.2)	6 (13.3)	3 (18.7)	2 (10.5)	0 (0.0)	1 (6.3)	1 (10.0)
Shoulder (right)	28 (14.0)	10 (11.5)	6 (13.3)	6 (37.5)	3 (15.8)	0 (0.0)	3 (18.7)	0 (0.0)
Neck	33 (16.5)	10 (11.5)	15 (33.3)	4 (25.0)	2 (10.5)	0 (0.0)	2 (12.5)	0 (0.0)
Elbow	36 (18.0)	10 (11.5)	12 (26.7)	5 (31.2)	4 (21.1)	0 (0.0)	4 (25.0)	1 (10.0)
Wrist	36 (18.0)	12 (13.8)	12 (26.7)	3 (18.7)	4 (21.1)	0 (0.0)	5 (31.2)	0 (0.0)
Upper back	34 (17.0)	13 (14.9)	11 (24.4)	5 (31.2)	3 (15.8)	0 (0.0)	2 (12.5)	0 (0.0)
Lower back	47 (23.5)	15 (17.2)	14 (31.1)	6 (37.5)	4 (21.1)	0 (0.0)	7 (43.7)	1 (10.0)
Lower limb	32 (16.0)	11 (12.6)	9 (20.0)	3 (18.7)	4 (21.1)	1 (14.3)	3 (18.7)	1 (10.0)
Upper limb	27 (13.5)	8 (9.2)	9 (20.0)	4 (25.0)	4 (21.1)	1 (14.3)	1 (6.3)	0 (0.0)
Knee	36 (18.0)	15 (17.2)	11 (24.4)	3 (18.7)	5 (26.3)	0 (0.0)	2 (12.5)	0 (0.0)

**Table IV.** Association between MSD in 9 body parts with work and psychological factors during the last 12 months.

Independent variables	Shoulder		Neck	Elbow	Wrist	Upper back	Lower back	Lower limb	Upper limb	Knee
	Left	Right								
Posture										
Sitting (91)	20 (21.9)	24 (26.3)	37 (40.6)	35 (38.4)	23 (25.2)	24 (26.3)	45 (49.4)	14 (15.3)	24 (26.3)	28 (30.7)
Standing (96)	16 (16.6)	22 (22.9)	21 (21.8)	24 (25)	24 (25)	16 (16.6)	27 (28.1)	21 (21.8)	17 (17.7)	22 (22.9)
Walking (13)	1 (7.6)	3 (23.0)	4 (30.7)	0 (0)	1 (7.6)	3(23.1)	4 (30.7)	5 (38.4)	2 (15.3)	2 (15.3)
Workload (Time)										
< 4hr (4)	0 (0.0)	1 (25.0)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)	1 (25.0)	0 (0.0)	0(0.0)	0 (0.0)
4-6 hrs (16)	4 (25.0)	6 (37.5)	3 (18.7)	2 (12.5)	3 (18.7)	3 (18.7)	8 (50.0)	3 (18.7)	3 (18.7)	2 (12.5)
6-8 hrs (146)	68 (46.6)	87 (59.6)	72 (49.3)	45 (30.1)	29 (19.8)	56 (38.4)	98 (67.1)	43 (29.5)	39 (26.7)	47 (32.2)
> 8 hrs (46)	22 (47.8)	26 (56.5)	28 (60.8)	9 (19.5)	6 (13.0)	18 (39.1)	35 (76.1)	18 (39.1)	17 (36.9)	21 (45.6)
Employment duration										
< 2 yrs (81)	14 (17.2)	18 (22.2)	39 (48.1)	23 (28.3)	21 (25.9)	35 (43.2)	32 (39.5)	19 (23.4)	18 (22.2)	31 (38.3)
2-4 yrs (44)	16 (36.3)	16 (36.3)	23 (52.2)	17 (38.6)	18 (40.1)	19 (43.2)	14 (31.8)	17 (38.6)	10 (22.7)	18 (40.1)
5-10 yrs (52)	6 (11.5)	10 (19.2)	12 (23.1)	14 (26.9)	12 (23.1)	14 (26.9)	10 (19.2)	17 (32.6)	15 (28.8)	20 (38.4)
> 10 yrs (23)	3 (13.0)	4 (17.3)	5 (21.7)	4 (17.3)	2 (8.6)	5 (21.7)	4 (17.3)	2 (8.6)	4 (17.3)	2 (8.6)
Gender										
Female (100)	44 (44.0)	67 (67.0)	67 (67.0)	37 (37.0)	23 (23.0)	56 (56.0)	79 (79.0)	57 (57.0)	28 (28.0)	63 (63.0)
Male (100)	36 (36.0)	39 (39.0)	62 (62.0)	38 (38.0)	29 (29.0)	30 (30.0)	59 (59.0)	48 (48.0)	29 (29.0)	52 (52.0)
Work Stress										
Yes (127)	45 (35.4)	68 (53.5)	79 (62.2)	35 (27.5)	31 (24.4)	49 (38.6)	82 (64.5)	53 (41.7)	37 (29.1)	77 (60.1)
No (73)	7 (9.5)	10 (13.7)	11 (15.1)	13 (17.8)	13 (17.8)	15 (20.5)	16 (21.9)	14 (19.2)	9 (12.3)	13 (17.8)
Manual lifting										
Yes (107)	31 (28.9)	44 (41.1)	54 (50.4)	31 (28.9)	29 (27.1)	36 (33.6)	63 (58.9)	32 (29.9)	30 (28.0)	58 (54.2)
No (93)	7 (7.5)	11 (11.8)	13 (13.9)	15 (16.1)	15 (16.1)	12 (12.9)	18 (19.3)	10 (10.7)	14 (15.0)	10 (10.7)
Exercise Habit										
Frequently (73)	8 (10.9)	9 (12.3)	9 (12.3)	8 (10.9)	9 (12.3)	13 (17.8)	14 (19.1)	11 (15.0)	8 (10.9)	8 (10.9)
Sometimes (95)	19 (20)	21 (22.1)	28 (29.4)	25 (26.3)	26 (27.3)	27 (28.4)	34 (35.7)	26 (27.3)	25 (26.3)	29 (30.5)
Not at all (32)	8 (25)	10 (31.2)	14 (43.7)	13 (40.6)	13 (40.6)	12 (37.5)	14 (43.7)	10 (31.2)	12 (37.5)	13 (40.6)

### Posture

According to **table IV**, for tasks involving sitting posture, the incidence of LB pain was the highest (49.4%, n = 45). For the same posture, the second highest reported discomfort occurred in the neck (40.6%, n = 37), followed by the elbows (38.4%, n = 35), knees (30.7%, n = 28), right shoulder and upper back (26.3%, n = 24). In addition, for tasks involving standing posture, the incidence of LB pain was the highest (28.1%, n = 27) followed by elbow and wrist (25.0%, n = 24). However, for tasks involving walking, the incidence of lower limb pain was the highest (38.4%, n = 5) followed by the LB and neck (30.7%, n = 4). In general, for

all postures, nurses who report LB pain also indicated that they had MSD in their shoulders and neck. In addition, the sitting and awkward postures that involve lifting, forceful exertion, pushing, and pulling tasks place higher demands on body parts, leading to MSD.

### Workload (time)

The relationship between MSD and workload (time) is usually determined based the workload, which is divided into four groups (**table IV**). The highest LB discomfort was reported by nursing staffs who worked more than 8 hours (76.1%, n = 35), followed by the neck (60.8%, n = 28) and

right shoulder (56.5%, n = 26) discomfort. This was obvious for employees who work more than 8 hours and have an MSD prevalence of more than 50%. Similarly, 6 to 8 hours of work resulted in a 100% incidence, with the LB (67.1%, n = 98) having the highest prevalence, followed by the right shoulder (59.6%, n = 87) and the neck (49.3%, n = 72). In addition, for 4 to 6 hours of work, the highest reported MSD prevalence was in the LB (50.0%, n = 8), followed by shoulder MSD (37.5%, n = 6). Although, for workloads of less than 4 hours, few cases of body part-related pain has been reported. In short, the most common work-related risk factors with working hours longer than 4 hours were LB, neck and shoulder discomfort.

### Employment duration

The results (table IV) of this study show that nursing staffs with employment duration less than two years had a MSD-related discomfort highest in neck (48.1%, n = 39) followed by upper back (43.2%, n = 35) and lower back (39.5%, n = 32). In addition, nursing staffs with employment duration of 2-4 years had a MSD-related discomfort highest in neck (52.2%, n = 23) followed by upper back (43.2%, n = 19), wrist and knee (40.1%, n = 18). However, compared to nurses with less than 4 years of service, nurses who have been employed for more than 5 years have a very low frequency of MSD-related complaints. Therefore, nurses with less than 4 years of experience have a higher incidence of MSD-related pain and the highest rate of neck discomfort, followed by upper back and knee disorders. This may be due to the job title and the employee's level of information of workstation safety. The current survey has no such impact, although in some cases it may be considered proportional to the number of years employees have worked in a particular department.

### Association between other factors and MSD

#### Gender

The relationship between the MSD and gender shows (table IV) that female employees are at a greater risk of suffering from MSD. In this survey, 79% of female nurses reported LB pain followed by the right shoulder and neck (67%), and knee pain (63%). In contrast, male nurses reported the highest pain in the neck (62%), LB (59%), and knee (52%). Overall, compared to female nurses, male nurses have significantly fewer MSD symptoms in their body parts.

#### Work stress

The discomfort caused by MSD has a lot to do with work stress. 63.5% of nursing staff across all departments unexpectedly report that they agree they are under work pres-

sure/stress, and also said their body parts have experienced MSDs (table IV). The highest prevalence of MSD report was at the LB (64.5%), followed by the neck (62.2%), knee (60.1%) and right shoulder (53.5%).

#### Manual lifting

Manual handling of patients is not safe for patients, has an impact on caregivers, and may have risks of injury, pain, and adverse health effects. Unexpectedly, 53.5% of nurses across all departments believed that the manually handling patient transfers leads to MSD in their body parts (table IV). The greatest discomfort reported was seen in LB (58.9%), followed by knees (54.2%) and neck (50.4%). In addition, nurses who did not use manual patient transfer reported much less discomfort to their body parts.

#### Exercise habit

The survey for this study showed that nurses with regular exercise habits (36.5%) reported a lower prevalence of MSDs compared to nurses who exercised irregularly (47.5%). However, nurses who do not have exercise habits have a high prevalence of MSD in the neck and LB (43.7%), followed by the elbows, wrists, and knees (40.6%) (table IV).

## DISCUSSION

The study aims to investigate the factors affecting MSDs of nursing staff in Indian government hospital, and to assess the relationship between MSD and workload-related factors. The results of this study are not considerably different from those of other related studies. LB problems were the most prominent cause of discomfort reported by female (75%) and male (59%) nurses. Some nurses who have encountered this problem are unable to carry out normal activities and need to see a doctor for this situation. These findings were consistent with other studies (29-32). Furthermore, this survey confirms that the highest prevalence of MSDs was recorded in LB, followed by neck, shoulder, upper back, and knee problems. Although the studies reviewed reported the same issues, the exact order of the issues was not consistent. Neck and shoulder pain are also common musculoskeletal problems for nursing staff. According to the survey, compared to LB, the prevalence of work-related neck and shoulder MSDs in the past 12 months showed a higher rate of reported cases. Existing research shows that the three areas with the highest prevalence of MSD among nurses are the neck, shoulders, and LB, followed by the upper back, elbow/wrists, and knees (33). This in turn causes nurses to take sick leave, reduces their work efficiency, affects their mental state, and increases medical expenses due to additional workload and work stress. These findings are also consistent with the

results of other studies (29, 34). Furthermore, Rai *et al.* (35) investigated the pre-COVID-19 and COVID-19 era impact on sonographer MSDs and reported shoulder pain ( $p \leq 0.001$ ), neck pain ( $p = 0.001$ ), low back pain ( $p = 0.001$ ) and wrist pain ( $p = 0.017$ ) were the most common symptoms. The prevalence of work-related MSDs among nurses varies from study to study. Salama and Eleshnamie (36) reported that 99.0% of nurses were affected by MSD while studying risk factors for 300 nurses. Clari *et al.* (37) revealed one or more cases of upper limb disorders among 48.3% of nurses. Cheng *et al.* (38) used a standardized Nordic musculoskeletal questionnaire for 470 nurses with a prevalence of MSD at the LB (77.2%), neck (64.2%), and shoulders (58.7%). Similarly, Pakistani nurses also reported a high prevalence of musculoskeletal disorders (31.6%) over a 12-month period, with the most common site being the lower back (32%), followed by the shoulder (20%), upper back, and knees (10%) (39). Ahmad *et al.* (40) also reported that the back, neck and shoulder were the areas with the highest prevalence of complaints followed by the knee and wrist/hand. Chen *et al.* (22) conducted a survey of nurses' musculoskeletal discomfort at 793 health facility and reported neck discomfort (63.5%), shoulder discomfort (62.6%), and LB discomfort (59.3%). Furthermore, they concluded that there was a correlation between the amount of work done by the nurses and their satisfaction with their work and the amount of discomfort in their musculoskeletal system. Similarly, current surveys show that the LB pain (79%) was highest among female nurses, followed by the right shoulder and neck (67%) and knee pain (63%) in the past 12 months. It was found that work tasks and psychosocial factors would increase the prevalence of MSD among nursing staff. The task characteristics of each department usually includes transferring patients from the gurney, transferring patients from the bedside to the other side, manipulating the different types of tools and machines, using surgical instruments, pushing/pulling the overhead vertical machine, hygiene care, wound care and working on the required computer workstation. Manual handling of patients is unsafe, impacts nurses, and may lead to risks of injury, pain, and adverse health effects. In present study, unexpectedly, 53.5% of nurses across all departments believed that the manually handling patient transfer's leads to MSD in their body parts. In addition, prolonged standing and sitting lead to a high incidence of LB and upper limb discomfort. Previous studies have uncovered the relationship between work posture and MSDs and concluded that prolonged sitting is linked to musculoskeletal symptoms in the shoulders, neck and LB (41-43). This may be due to workers holding a static posture for a long time to perform manual tasks, raising their arms and involving too many manual equipment (33). In addition, working postures with continuous or restricted postures, such as tasks that

require upper limb movement, eventually force the neck and shoulders to awkwardly align, which may lead to the development of neck and shoulder musculoskeletal discomfort. The prevalence of MSD is also related to other factors, such as gender, manual lifting, work stress, high mental pressure, and exercise habits (31, 43, 44). In addition, nurses who have been employed for more than 5 years have a very low incidence of MSD-related pain in their body parts. The reason may be due to the job position and employees' knowledge of workplace safety. This is consistent with a previous study conducted among nurses in rural Japan, which showed that the duration of employment has nothing to do with the prevalence of MSD (45). Additionally, high workload was found to have a significant impact on the prevalence of MSDs with working more than 2 hours (46). The current survey shows that for 4 to 6 hours of work, the highest reported MSD prevalence was in the LB (50.0%,  $n = 8$ ), followed by shoulder MSDs (37.5%,  $n = 6$ ). Although for workloads of less than 4 hours, there are few reported cases of body part-related pain. Yip (44) pointed out that designation, education level, and experience within working years are related to the incidence of LB pain. In terms of gender, most female nurses working across all seven departments have higher MSD symptoms than male. Overall, the prevalence of MSD across all seven departments has been high at 67% in the past 12 months. This may be due to the high physical requirements of manual handling tasks. In contrast, Esfahani *et al.* (47) concluded that their findings do not support the prevailing view that prolonged sitting at work as part of everyday life is necessarily associated with LB pain; rather, sitting posture, lower levels of physical fitness, and shorter duration of home activities may be associated with reduced extensor endurance in nonspecific chronic LB pain.

In this survey, most nurses (65% male and 57% female) were within the normal weight range and their BMI was unrelated to MSDs. However, 24% of men and 26% of women are overweight and obese; therefore, BMI may be closely related to MSD in these employees. This is consistent with the results of Attarchi *et al.* (48). However, Trinkoff *et al.* (49) stated an association of MSD between BMI and back/shoulder symptoms. Additionally, nurses with regular exercise habits (36.5%) reported a lower prevalence of MSDs than nurses who exercised irregularly (47.5%). However, nurses who lack exercise habits have a high prevalence of MSDs. Narayan *et al.* (50) also reported that physicians who participated in certain physical activities had lower MSD rates than physicians who did not engage in any physical activity. The most critical reason for this type of MSD may be the lack of training to understand relevant work-related situations. Intervention studies have shown that by reducing physical demands, good results have been achieved in the prevention of MSDs in nurses (49).

However, interventions aimed at reducing MSDs in hospitals must take into account not only ergonomics, but also the improvement of the organization of the working environment. Stavrianopoulos (51) reviewed the literature on safety culture development and paid more attention to the characteristics of safety culture development, as human factors affect perception and the implementation of cultural changes. Therefore, the healthcare industry should build a model that best meets their needs based on their assessments and can implement pilot programs to achieve this goal. Healthcare professionals can design different types of equipment to support different types of lifts and select equipment from different vendors to meet their assessment needs. In addition, the latest educational information should be communicated to nursing staff every year to help maintain the plan (52).

### **Recommendation and guideline for the policy makers**

Policy makers may need to limit the number of hours nurses work per week. This attempts to limit the prevalence of MSD among nurses. In addition, the decision maker may emphasize rest when dismissing the task and stop when the nurses begin to experience pain during the task. Other policy improvements may attempt to completely redesign lifting operations to avoid movements that are considered high-risk factors. In addition, more policies are needed to increase awareness of workstation injuries, their importance, and consideration of prevention methods to minimize them. Basic training in work-related accidents, prevention policies and ergonomics will also help nursing staff. Practitioners can use these results to help nurses change their working conditions and implement preventive policies.

### **CONCLUSIONS**

The findings of this study reconfirm the high prevalence of work-related MSDs among hospital nurses. In addition, current results indicate that healthcare professionals are at risk for MSD, especially in the LB, shoulders, neck, and knees. Work tasks and psychosocial factors were identified as the main reasons for employees' MSD. Therefore, ergonomic improvements to the work design and workspace are needed to reduce the risk of MSD and improve the patient care. In addition, medical institutions should invest in prevention programs, training, education, intervention policies, and organization of existing services.

### **Limitations and future scope**

The main limitations of the present study were that the use of a questionnaire to collect data on the occurrence of muscu-

loskeletal complaints was based on self-reported information provided by the participants, and no physiological tests were performed to confirm the diagnosis. Therefore, musculoskeletal complaints caused by factors other than work cannot be eliminated, which means that the prevalence of musculoskeletal complaints reported in this study may be overestimated. Second, the sample size reported in this study is smaller, and a larger sample size may provide a better and stronger support for results. Furthermore, this study only investigated demographic characteristics and job-related factors associated with musculoskeletal discomfort, ignoring other factors that may influence the development of the condition, such as burnout, resilience, satisfaction, and nurses' perceptions about how to deal the mobilizations when transferring patients. In addition, future research needs to assess the utmost effective way to prevent WMSD among nursing staffs. Currently, special referrals are made for certain cases with persistent musculoskeletal symptoms. Since working in the dentistry, orthopedics, surgery, and gynecology departments is considered to have a protective effect on back pain, follow-up will be conducted to determine which strategies the department uses and how to share these strategies with other departments in the hospital.

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### **DATA AVAILABILITY**

Data are available under reasonable request to the corresponding author.

### **CONTRIBUTIONS**

MMA: conceptualization, design, writing. AMA: conceptualization, revision. SZ: analysis, drafting, revision. MR, MS, IA: data collection.

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### **CONFLICT OF INTERESTS**

The authors declare that they have no conflict of interests.



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