ORIGINAL RESEARCH

Musculoskeletal disorder: Risk factors and coping strategies among nurses

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Received: November 19, 2017 **Accepted:** May 21, 2018 **Online Published:** June 25, 2018
DOI: 10.5430/jnep.v8n11p50 **URL:** https://doi.org/10.5430/jnep.v8n11p50

ABSTRACT

Background: It is established that nurses suffer from varying degrees of Musculoskeletal Disorders (MSD) at different regions of their body, which results in frequent loss of work days. Aim of study is to identify the risk factors for developing musculoskeletal disorder and to determine the coping strategies to reduce their frequency.
Methods: This study was conducted in the Outpatient Departments (OPDs), intensive care units of University Hospital and also from the nursing schoolof the Faculty of Nursing, Alexandria, Egypt.
Results: A high proportion of nurses reported MSD (99.0%) during the last year. Also during their whole careers at one or the other body regions, with the shoulder (97.0%) and Neck (95.0%) being the most commonly affected. Nurses with more than two pregnancies and usage of computer for more than two years were those with the most perceived risk factors for MSD. The usage of different part of body by the nurses as a coping mechanism during the nursing procedures (34.0%) and change of posture (30.0%) were the top two statistically significant coping strategies.
Conclusions: The study confirms very high prevalence of MSD among the nursing staff and it was prominent at some specific body parts, of which neck and shoulder were the most affected.

Key Words: Nurses, Musculoskeletal, Risk factors, Coping strategies

1. INTRODUCTION

The term musculoskeletal disorders encompass a gamut of inflammatory and degenerative conditions that affects the muscles, tendons, ligaments, joints, peripheral nerves, and supporting blood vessels with consequent ache, pain or discomfort.[1,2] Musculoskeletal disorders are much more frequent in certain industries and occupations, eventhree or four times higher than the average rate across all industries.[1]

Musculoskeletal disorder (MSD) have been described as one of the main occupational hazards among frontline health care workers in whom they present as a major occupational problem and a significant cause of morbidity.[3] Nursing professionals are commonly identified as being at risk for patient handling injuries, but many other health care professionals providing direct care during the course of a patient's hospital stay are also potentially at risk. Patient handling has been identified as a significant contributor to musculoskeletal injuries among nurses and nurses' aides, with the back, neck, and shoulders being more commonly affected. Despite their high frequency and associated potential for occupational health problems, few epidemiological studies have investigated MSD risk factors among Alexandria nursing professionals. Even though many literature are available on Work related Musculoskeletal Disorder (WMSD),[4–10] there

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is not much studies exist in MSD. This study aims to identify the risk factors for the development of musculoskeletal disorder, andto determine the coping strategies nurses use to reduce thesedisorders.

2. METHODS

Study design and setting: A cross-sectional study was conducted at the university hospital in the Alexandria faculty of nursing, incorporating five main intensive care units namely, Medical Intensive Care Unit (MICU), Cardiac Care Unit (CCU), Neuro Intensive Care Unit (NICU), Surgical Intensive Care Unit (SICU) and the Outpatient Department (OPD) and also at nursing school. The sample size was calculated using the online OpenEpi software based on population size (www.openepi.com).[6] A total sample of 300 was calculated based on the population size 450, and precision of 5% (delta). To allow adequate power during sub analysis a confidence level of 99.9% for (1-β) was selected for this sample size calculation. All nursing professionals in the study settings were eligible for inclusion in the study.

Questionnaire design: The study tool was formulated according to the latest review of related literatures. A four section questionnaire was employed as the survey instrument. Section A sought information on demographic profile such as age, height, weight, and residence. Section B about occupational health in nursing practice and it consists of 11 open ended questions related to their work in clinical area. Section C contained items on perceptions on job risk factors that may contribute to development of MSD while section D gleaned data on coping strategies toward reducing the risk for development of MSD.

2.1 Statistical analysis

All categorical data were represented by frequency/percentage, and continuous data were tested for normality distribution, and it shows that normally distributed. Therefore the continuous data were presented by Mean with standard deviation. Chi-square test were used to distinguish differences in reported MSD among the different nursing cadres. Univariate and Multivariate logistic regression analysis was used to identify key risk factors for this study population. All the analysis were done by SPSS 21.0 version. A p value less than .05 was considered as significant.

2.2 Ethical considerations

The ethical approval was obtained from the Institutional Review Board (IRB) at university hospital in the Alexandria faculty of nursing, Alexandria, Egypt. Official permission from the hospital and nursing directors and authorized personnel was also be obtained prior to data collection. Participation in this study was fully voluntary, and data collection was totally anonymous as no personal identification information was obtained.

3. RESULTS

The study gathered response from 300 nurses working in the faculty of nursing, both in the college and in the university hospital. Table 1 illustrates descriptive statistics of the respondents, where the mean age of nurses was 45.72 $\pm$ 9.92 SD with minimum age of 20 and maximum of 65. The vastmajority of them were residents of Alexandria (n = 237, 79%) and the majority of nurses were married (n = 258, 86%) with two pregnancies contributing the maximum number(n = 165, 60.4%). Their level of education indicates that the majority of respondents had a diploma in nursing (n = 153, 51%), followed by PhD (n = 81, 27%). Majority of them (91%) were employed full time during the last one year and their mean Body Mass Index (BMI) indicates that they are overweight/obese with mean BMI as 29.91 SD $\pm$ 6.44. Vitamin D deficiency was also reported by 55% (n = 165), which was followed by 52% (n = 156) of nurseswho were suffering from calcium deficiency. Self-reported lifestyle diseases like hypertension was reported by 37% (n = 111), followed by diabetes 21% (n = 63).

The data of respondents were analyzed for their routine activities (see Table 2) and it was observed that majority of them are practicing in the college; 68% (n = 204) in the clinical environment; 16% (n = 48) with a mean working hours of 5.85 $\pm$ 5.49 in each course per week. Their work load was also analyzed, which indicates that 56% of them reported with mild workload, whereas 28% experience high workload and 86% of them havethe opinion that their body weight adversely affects them. Furthermore, the majority reported excess standing (87%) and they got exposed to pain after their hard clinical routine (94%). However, 93% of nurses take sufficient time for sleeping and 95% of them sleep 8 hours a day.

Table 3 illustrates that 100% of the respondents experienced work-related ache, pain, discomfort, or injury that lasted for more than three days during their nursing career, while 97% (n = 291) of them experienced the same during the last 12 months (see Table 3). Neck (95%), shoulder (97%) and low back pain (73%) were the major ailments that nurses experienced during the last 12 months of their work. The data indicates that 81% of the nurses noticeda gradual onset of work-related problem in their career and for the work related issues 98% of them sought treatment from healthcare services. But, only 57% of them had any sort of training on ergonomics to prevent occupational hazards and 57% of

them preferred sliding board to reduce strain on their body while carrying out their nursing duties. It is observed that 86% of them left nursing profession to pursue another career as a result of work-related musculoskeletal disorders.

Table 1. Descriptive statistics

	No.	%
Age (years)		
Min.-Max.	20.0-65.0	
Mean ± SD.	45.72 ± 9.92	
Residence		
In Alexandria	237	79
Out of Alexandria	63	21
Marital status		
Single	27	9.0
Married	258	86.0
Divorced	12	4.0
Widow/Widower	3	1.0
If married, please indicate the total number of pregnancies?	(n = 273)	
1	12	4.4
2	165	60.4
3	45	16.5
4	51	18.7
Do you have any children under the age of 6?	(n = 273)	
Yes	87	31.9
If yes, how many number of children under the age of 6?	(n = 87)	
1	57	65.5
2	30	34.5
Level of education		
Diploma in nursing	153	51.0
Baccalaureate	45	15.0
Master degree	21	7.0
PHD	81	27.0
Do you have a post basic nursing qualification?		
Yes	183	61.0
What is your work status in the last 12 months?		
Full time	273	91.0
Part time	27	9.0
Please indicate your work setting?		
College	255	85.0
Hospital	45	15.0
How many nursing courses (CE) you have study in this year?		
Min.-Max.	0.0-15.0	
Mean ± SD.	2.71 ± 3.27	
BMI (Kg/m^2)		
Min.-Max.	22.49-46.88	
Mean ± SD.	29.91 ± 6.44	
Do you suffer from any health problems?		
Yes	297	99.0
If yes: Select		
Heart disease	27	9.0
Diabetes	63	21.0
Hypertension	111	37.0
Rheumatoid	18	6.0
Vitamin D deficiency	165	55.0
Calcium deficiency	156	52.0
Cancer breath	12	4.0
COPD	3	1.0
Eye problem	6	2.0
Asthma	24	8.0

Table 2. Distribution of the studied cases according to information about your practice in the clinical areas (n = 300)

	No.	%
What best describes your current area of practice?		
College	204	68.0
Clinical	48	16.0
Department	15	5.0
Surgical ward	6	2.0
Supervisor	18	6.0
Nursing school	9	3.0
How many hours for clinical area in each course /week		
Min.-Max.	1.0-42.0	
Mean ± SD.	5.85 ± 5.49	
How would you describe the workload in clinical area?		
Low	36	12.0
Mild	168	56.0
High	84	28.0
Very High	12	4.0
Do you think your weight effect on your pain?		
Yes	258	86.0
Are you prone to frequent excess standing in your POSITION?		
Yes	261	87.0
Do you exposure of pain after hard WORK in clinical area?		
Yes	282	94.0
Do you take enough time for sleeping?		
Yes	279	93.0
Do you sleep 8 hours a day?		
Yes	285	95.0

Descriptive analysis was carried out (see Figure 1) on the data based on the risk factors of job and it was observed that majority of the nurses (90% to 100%) felt minimal to moderate (risk factor 2-7) level of job risk.

Responses of nurses (n = 300) on their coping mechanisms were categorized into three categories (almost never, sometimes and almost always) (see Figure 2). It was observed that all the nine coping strategies were followed by majority of nurses sometimes in their work life. But, out of the nine coping strategies, usage of different parts of body in administering nursing procedure was reported "sometimes" by 61% of nurses and "almost always" by 34% of them, which was found statistically significant (p = .031). Similar to the above, the coping strategy followed by them by pausing regularly in order to stretch and change posture was followed "sometimes" by 69% and "almost always" by 30% of them, which also illustrated statistical significance.

It was noticed that 95.3% (n = 243) of the respondents sat in front of their computer for more than four hours a day (see Table 4). They also reported (95.3%) that they are prone to sitting frequently while using a computer in their workstations.

Typically 94.1% of them use their computer continuously with duration of 2-3 hours before taking a break and when they take a break 96.5% of them typically takes rest for 5-10 minutes (see Table 5). However, only a lower frequency of back pain was reported (3.84 $\pm$ 4.0 SD).

A high prevalence of musculoskeletal disorders wasobserved (see Table 6) at different body sites with maximum of 97% at the shoulder (91.9-97.2 CI), which was followed by neck with 95% (91.9-97.2 CI), lower back 73.0% (67.6-77.9 CI) and 40.0% (34.4-45.8 CI) at the upper back of the body. But, the data illustrated statistical significance only in two body sites, namely shoulder and neck.

The data was analyzed for the associated risk factors related with the neck and shoulder pain (see Table 7) of the respondents, which provides statistical significance for the

following three namely, number of pregnancies more than two with p value < .001, usage of computer for more than one year (p = .023) and the usage of computer for two hours and more (p = .006).

Table 3. Distribution of the studied cases according to occupational health in nursing practice (n = 300)

	No.	%
Have you ever experienced work-related ache, pain, discomfort, or injury that lasted for more than three days (not within the previous 12 months) in your nursing career till date?		
Yes	300	100.0
Have you ever experienced work-related ache, pain, discomfort, or injury in any part(s) of your body that lasted for more than three days in the last 12 months?		
Yes	291	97.0
Q3-If you answered 'Yes' to Question 2, please check all that apply (n = 291)		
Neck	285	95.0
Shoulder	291	97.0
Upper back (thoracic)	120	40.0
Low back (lumbar/sacral)	219	73.0
When did you first experience this work-related problem?		
Don't know	0	0.0
Before training as a nurse	12	4.0
As a student nurse	57	19.0
In the first five years after graduation	0	0.0
5-15 years after graduation	192	64.0
>15 years after graduation	39	13.0
What was the onset of work-related problem like?		
Gradual	243	81.0
Sudden	48	16.0
As a result of an accident	91	3.0
Have you ever treated yourself or sought treatment from any health professional as a result of work-related problem?		
Yes	294	98.0
Q7-Have you ever changed the area/specialty of nursing practice as a result of work-related problem?		
Yes	108	36.0
Have you ever had training on ergonomics or how to prevent occupational hazards?		
Yes	171	57.0
Indicate how you may possibly reduce strain on your body when carrying out your nursing duties. Please tick all that apply.		
None of the above	30	10.0
I will prefer to use adjustable bed/plinth	45	15.0
I will prefer to use sliding board	171	57.0
I will prefer to use lifting belt	30	10.0
I will prefer to use splints	9	3.0
Others	15	5.0
Have ever left the nursing profession to pursue another career as a result of work-related disorders?		
Yes	258	86.0

4. DISCUSSION

It is well known that nurses across the globe are exposed to strenuous working conditions, which is warranted by the profession and they themselves cope up with the working conditions. This study intended to explore MSD among the nursing staff, the risk factors and how they respond themselves to cope up and manage the situation. Musculoskeletal disorders are usually related with a work the person is exposed to and the same is reflected in our study settings too.

ISSN 1925-4040 E-ISSN 1925-4059

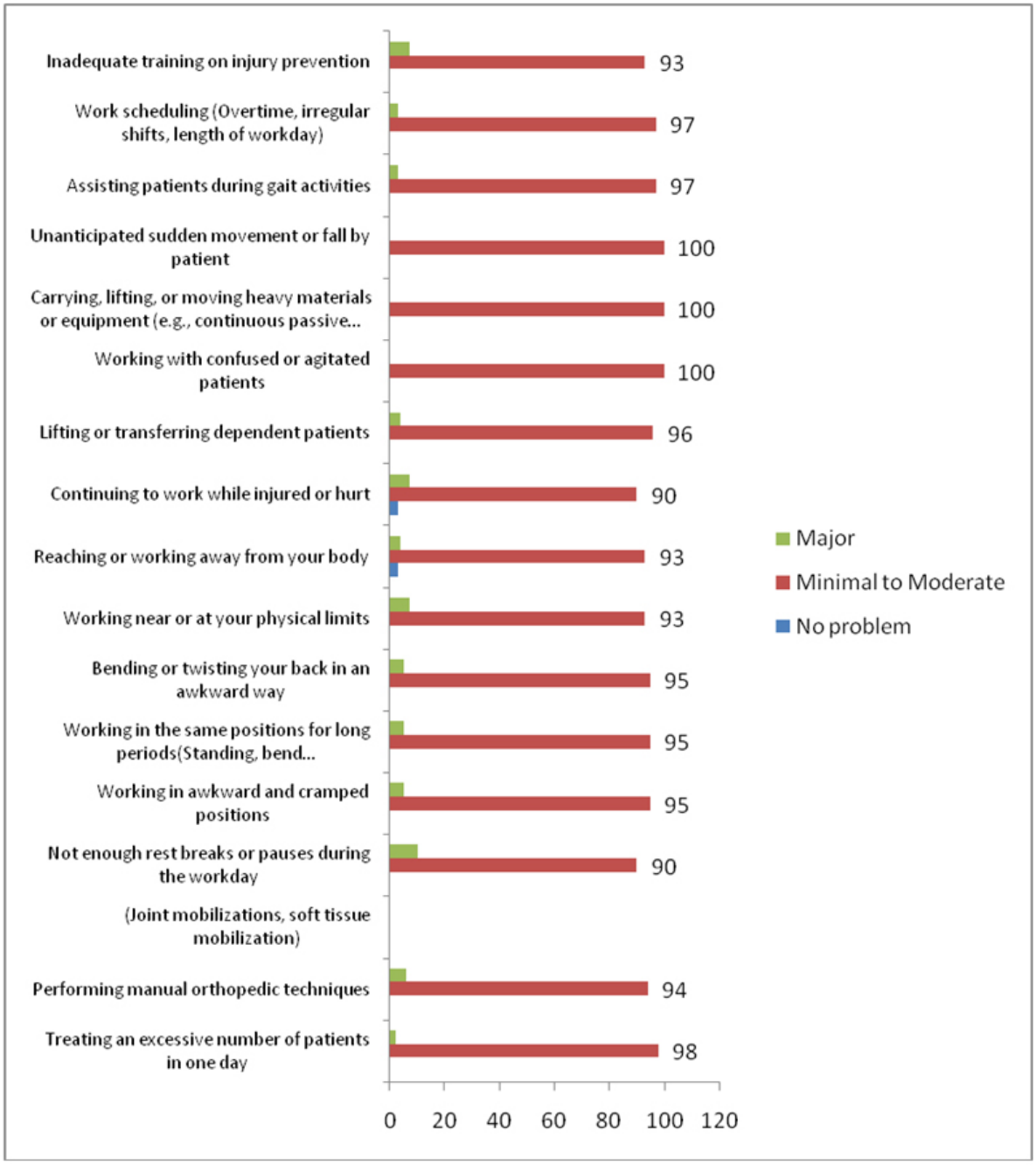

Figure 1. Descriptive analysis of the studied cases according to job risk factor (n = 300)

4.1 Prevalence of MSD

The findings of the study indicate a high proportion of nurses who are working in the university hospital and nursing school suffers from MSD. We also identified an overall prevalence of MSD as 97%, which was higher than the prevalence of MSD reported by previous studies, conducted at different settings.[11–21] Different body sites were taken into consideration in the analysis and we observed neck, shoulder, upper back and lower back as the most prominent areas which are affected, but among the four only two body sites, the neck and shoulder demonstrated statistical significance. However, according to Yan P et al. (2017) the most commonly affected regions were lower back, neck,shoulder, and back, with an annual prevalence of 62.71%, 59.77%, 49.66%, and 39.50%, respectively. Nevertheless, Rathore FA et al. (2017) observed a comparatively lower prevalence of musculoskeletal disorders over a 12-month period as 31.6%, with the most common site being the lower back (32%) followed by the shoulder (20%), upper back, and knees (10%). Davis et al. (2015) and Moreira et al. (2014) also reported highest preva-

lence of MSD pain for nurses and nursing aides in the lower back, followed by shoulders and neck. The very high prevalence of MSD among nurses in this study may be because of the existence of co-morbidities like overweight/obesity and the subsistence of different lifestyle diseases and other health problems.

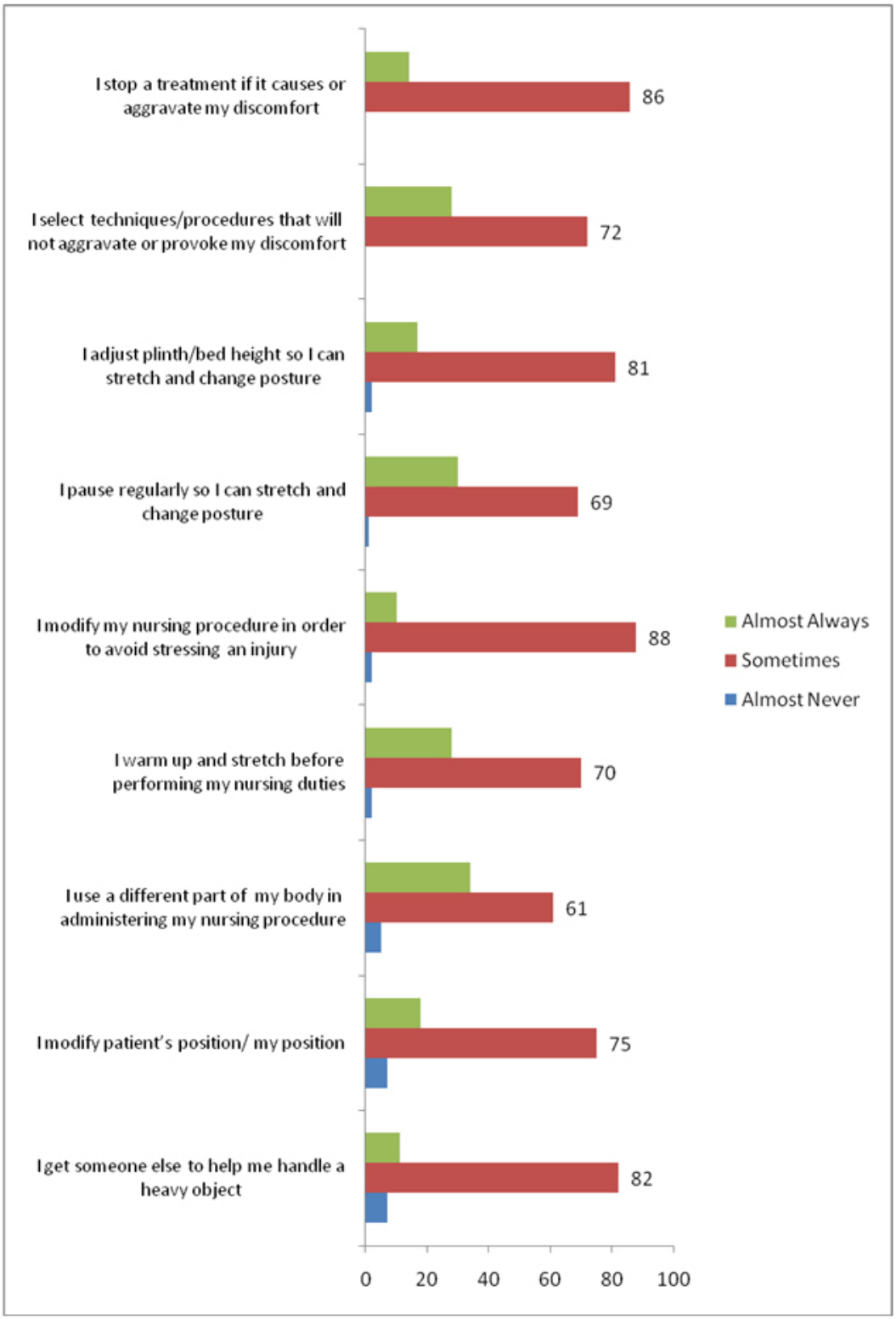

Figure 2. Distribution of the studied cases according to coping strategies toward reducing the risk of work-related musculoskeletal disorders (n = 300)

Table 4. Distribution analysis of the studied cases according to information about computer using during day (n = 300)

Computer Usage	No.	%
When did you start using a computer?		
Not using	45	15.0
College	36	12.0
Master	18	6.0
1-2 years	21	7.0
2-5 years	12	4.0
5-10 years	126	42.0
More than 10 years	55	18.0
What type of computer do you use most of the time? (n = 255)		
Desk top	27	9.0
Laptop/Notebook	54	18.0
I use both desktop and laptop equally	36	12.0
Tables	5	1.7
All	133	59.3
Do you prone to frequent excess sitting when using a computer? (n = 255)		
Yes	243	95.3
Do you sitting on your computer over 4 hours every day? (n = 255)		
Yes	243	95.3
Do you use your laptop/notebook computer in other places besides at a workstation/desk (e.g., lying down on the floor or sitting in a chair)? (n = 255)		
Yes	240	94.1
On an average day, how many hours do you spend on the following tasks? (n = 255)		
a: Typing on computer (hours)		
From (n = 255)		
Min.-Max.	1.0 – 6.0	
Mean ± SD.	2.72 ± 1.17	
To (n = 255)		
Min.-Max.	1.50 – 8.0	
Mean ± SD.	3.80 ± 1.46	
b: Playing computer games(hours)		
From (n = 255)		
Min.-Max.	1.0 – 4.0	
Mean ± SD.	1.42 ± 0.63	
To (n = 255)		
Min.-Max.	0.50 – 4.0	
Mean ± SD.	2.11 ± 1.01	

4.2 Work related risk factors

Since the nurses are exposed to high risk work related physical environment, the chances of developing MSD are more. There are several work related risk factors which contribute to the development of MSD and the authors investigated those factors by assessing 17 different parameters. The findings indicate that 90%-100% of respondents were exposed from minimal to moderate level of risk. A cent percent moderate risk of MSD was observed in three strenuous work related activities namely, working with agitating patients, carrying and moving heavy equipment, and sudden movement of patient. In addition, 90%-98% of respondents also experiences minimal to moderate level of risk, which is demonstrated through the remaining 14 risk factors. Also we identified the risk factors associated with neck and shoulder pain of nurses with those who are having more than two pregnancies and the usage of computer for more than a year. Many previous studies also highlight work related risk factors associated

with MSD among the nurses, which is comparatively less than the findings of this study.[21–29] However, similar to our findings Choi and Brings (2015) also pointed out that work related MSD risk increased when nurses and nursing assistants were manually moving or lifting patients, especially when the patients were overweight or obese, Carneiro et al. (2015) also indicated the presence of multiple risk factors and theirimportant contribution to the obtained risk level. Amin et al. (2014) revealed that psychological job demands, and job strain demonstrated statistically significant mean differences between nurses with and without work related MSDs. Freimannet et al. (2013) observed high prevalence of work related MSD and pain but, they were not able to explain the high frequency of work related MSD in their study setting. The lack of ergonomic training of all nursing staff to prevent occupational hazardsmight be a contributing factor to the high rate of work related risk.

Table 5. Distribution analysis of the studied cases according to information about computer using during day (n = 255) "continue"

	No.	%
On an average day, of the time you spend at your computer, what percentage of that time do you spend		
a: Using your keyboard		
0%-25%	18	7.1
26%-50%	132	51.8
51%-75%	9	3.5
76%-100%	96	37.6
b: Using your mouse		
0%-25%	30	11.8
26%-50%	78	30.6
51%-75%	96	37.6
76%-100%	51	20.0
Do you ever experience binge computing (i.e., use a computer for 4 hours or more per day without taking a break)?		
Yes	255	100.0
Choose the statement that best describes your typing skills		
a. Touch typing (fingers placed on keyboard as taught in typing class)	219	85.9
b. "Hunt and peck" (fingers placed on keys in no particular pattern)	36	14.1
What is your typing speed?		
a. Slow (less than 40 words per minute)	66	25.9
b. Moderately fast (40 to 60 words per minute)	189	74.1
c. Fast (more than 60 words per minute)	0	0.0
d. I am not sure/I don't know	0	0.0
How long do you usually use your computer before taking a break?		
a. less than 1 hour	15	5.9
b. 2 to 3 hours	240	94.1
c. 4 or more hours	0	0.0
When you take a break from your computer, how long does it typically last?		
a. 5 Minutes or less	9	3.5
b. 5-10 Minutes	246	96.5
c. 15 Minutes or longer	0	0.0

4.3 Coping strategies

Self-reported work related coping strategies are more likely used by every worker in all sectors in order to reduce the impact of physical burden. The distribution of coping strategies followed by the nurses towards reducing the risk that they are exposed to was analyzed, which consists of nine different coping strategies. This provided a glimpse to the authors that all the nursing staff participated in the study,

irrespective of their ergonomic training (only 57% had training) followed their own coping mechanisms to manage their work related stress. Findings by Maakipet et al. (2017)[30] in their study also illustrated that the participants developed their own coping strategies to assist them to remain at work, but most focused on individually initiated adaptations or peer support, rather than systemic changes to work systems or practices.The most prominently followed strategies by the nurses in the study were noticed as making use of a different body part to adopt the burden and taking a pause to change the posture during their work. Even though all the nurses are not exposed to ergonomic training, almost all of them adopted the natural coping mechanism.

Table 6. Musculoskeletal disorder prevalence by body site

Body site	% (95% CI)
Neck	95.0 (91.9-97.2)*
Shoulder	97.0 (94.4-98.6)*
Upper back (thoracic)	40.0 (34.4-45.8)
Low back (lumbar/sacral)	73.0 (67.6-77.9)

*Statistically significant using Chi-square and Fisher's exact test.

Table 7. Risk Factors associated with the presence of neck & Shoulder pain among nurses

Risk Factor	%	Logistic regression		
		OR	95% CI	*p* value
Total number of pregnancies				
Less than 2 (n = 177)	63.9%	1.0	-	-
More than 2 (n = 96)	98.3%	12.9	0.9-109.2	< .001*
Computer Usage				
Using more than 1 year	100%	3.5	0.1-14.6	.023*
Not using	71.6%	1.0	-	
Usage of computer				
Less than 1 hour	60.0	1.0	-	
2 and more	98.7%	4.9	1.6-28.6	.006*

*Statistically significant

4.4 Limitations

This study was not able to establish the reason behind the existence of high rate of work related risk in the study settings. The study setting was limited to ICUs of the teaching hospital and the faculty of nursing of a university. Another limiting factor is that the wide majority of respondents (85%) were working in the college environment and a few (15%) were practicing in a clinical setting, which leads to lack of homogeneity of respondents.

5. Conclusion

The study confirms a very high prevalence of MSD among the nursing staff and it was prominent at some specific body parts, of which neck and shoulder were the most affected.The identified two associated major risk factors are, having more than two pregnancies and high usage of computer. Using a different body part and pausing regularly during work were the two major coping strategies observed. Even though the nurses are practicing their own coping mechanisms, their continuous exposure to moderately high work related risk factors, culminate to the high prevalence of MSDs. Further studies are warranted with more subjects and multiple study settings at different hospitals. Scientifically proven ergonomic training methods are recommended to reduce work related risk and other preventive strategies to address the implications of MSD among nurses & education of nurses about MSD prevention.

Conflicts of Interest Disclosure

The authors declare that there is no conflict of interest.

References

[1] Punnett L, Wegman DH. Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. Journal of Electromyography and Kinesiology. 2004; 14: 13-23. PMid:14759746 https://doi.org/10.1016/j.jelekin.2003.09.015

[2] Smith DR, Leggat PA. Musculoskeletal disorders in nursing. Australian Nursing Journal. 2003; 11: 1-4.

[3] Burdorf A, Sorock G. Positive and negative evidence of risk factors for back disorders. Scand J Work Environ Health. 1997; 23(4): 243-256. https://doi.org/10.5271/sjweh.217

[4] Fabunmi AA, Gbiri CA. Relationship between balance performance in the elderly and some anthropometric variables. Afr J Med Med

Sci. 2008; 37(4): 321-326. PMid:19301708

[5] Tinubu BM, Mbada CE, Oyeyemi AL, et al. Work-related musculoskeletal disorders among nurses in Ibadan, South-west Nigeria: a cross-sectional survey. BMC Musculoskelet Disord. 2010; 11: 12. PMid:20089139 https://doi.org/10.1186/1471-2474-11-12

[6] OpenEpi: open source epidemiologic statistics for public health.

[7] Hildebrandt VH, Bongers PM, van Dijk FJ, et al. Dutch musculoskeletal questionnaire: description and basic qualities. Ergonomics. 2001; 44(12): 1038-1055. PMid:11780727 https://doi.org/10.1080/00140130110087437

[8] Kuorinka I, Jonsson B, Kilbom A, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon. 1987; 18(3): 233-237. https://doi.org/10.1016/0003-6870(87)90010-X

[9] Chiou WK, Wong MK, Lee YH. Epidemiology of low back pain in Chinese nurses. Int J Nurs Stud. 1994; 31(4): 361-368. https://doi.org/10.1016/0020-7489(94)90076-0

[10] Smith DR, Leggat PA. Musculoskeletal disorders among rural Australian nursing students. Aust J Rural Health. 2004; 12(6): 241-245. PMid:15615575 https://doi.org/10.1111/j.1440-1854.2004.00620.x

[11] Yan P, Li F, Zhang L, et al. Prevalence of Work-Related Musculoskeletal Disorders in the Nurses Working in Hospitals of Xinjiang Uygur Autonomous Region. Pain Res Manag. 2017; 5757108.

[12] Rathore FA, Attique R, Asmaa Y. Prevalence and Perceptions of Musculoskeletal Disorders Among Hospital Nurses in Pakistan: A Cross-sectional Survey. Cureus. 2017 Jan 26; 9(1): e1001. PMid:28280654

[13] Davis KG, Kotowski SE. Prevalence of Musculoskeletal Disorders for Nurses in Hospitals, Long-Term Care Facilities, and Home Health Care: A Comprehensive Review. Hum Factors. 2015 Aug; 57(5): 754-92. PMid:25899249 https://doi.org/10.1177/0018720815581933

[14] Moreira RF, Sato TO, Foltran FA, et al. Prevalence of musculoskeletal symptoms in hospital nurse technicians and licensed practical nurses: associations with demographic factors. Braz J Phys Ther. 2014 Jul-Aug; 18: 323-33.

[15] Reed LF, Battistutta D, Young J, et al. Prevalence and risk factors for foot and ankle musculoskeletal disorders experienced by nurses. BMC Musculoskelet Disord. 2014 Jun 5; 15: 196.

[16] Alperovitch-Najenson D, Treger I, KalichmanL. Physical therapists versus nurses in a rehabilitation hospital: comparing prevalence of work-related musculoskeletal complaints and working conditions. Arch Environ Occup Health. 2014; 69(1): 33-9. PMid:23930794 https://doi.org/10.1080/19338244.2012.719555

[17] Long MH, Bogossian FE, Johnston V. The prevalence of work-related neck, shoulder, and upper back musculoskeletal disorders among midwives, nurses, and physicians: a systematic review. Workplace Health Saf. 2013 May; 61(5): 223-9. PMid:23639038

[18] Ribeiro NF, FernandesRde C, Solla DJ, et al. Prevalence of musculoskeletal disorders in nursing professionals. Rev Bras Epidemiol. 2012 Jun; 15(2): 429-38.

[19] Harcombe H, McBride D, Derrett S, et al. Prevalence and impact of musculoskeletal disorders in New Zealand nurses, postal workers and office workers. Aust N Z J Public Health. 2009 Oct; 33(5): 437-41.

[20] Eriksen W. The prevalence of musculoskeletal pain in Norwegian nurses' aides. Int Arch Occup Environ Health. 2003 Oct; 76(8): 625-30. PMid:14520578 https://doi.org/10.1007/s00420-003-0453-6

[21] Choi SD, Brings K. Work-related musculoskeletal risks associated with nurses and nursing assistants handling overweight and obese patients: A literature review. Work. 2015; 53(2): 439-48. PMid:26835850

[22] Carneiro P, Martins J, Torres M. Musculoskeletal disorder risk assessment in home care nurses. Work. 2015; 51(4): 657-65. PMid:26409938 https://doi.org/10.3233/WOR-152024

[23] Amin NA, Nordin R, Fatt QK, et al. Relationship between Psychosocial Risk Factors and Work-Related Musculoskeletal. Ann Occup Environ Med. 2014 Aug 9; 26: 23.

[24] Amin NA, Nordin R, Fatt QK, et al. Disorders among Public Hospital Nurses in Malaysia. Ann Occup Environ Med. 2014 Aug 9; 26: 23.

[25] Freimann T, Coggon D, Merisalu E, et al. Risk factors for musculoskeletal pain amongst nurses in Estonia: a cross-sectional study. BMC Musculoskelet Disord. 2013 Dec 1; 14: 334.

[26] Carugno M, Pesatori AC, Ferrario MM, et al. Physical and psychosocial risk factors for musculoskeletal disorders in Brazilian and Italian nurses. Cad SaudePublica. 2012 Sep; 28(9): 1632-42.

[27] Hoe VC, Kelsall HL, Urquhart DM, et al. Risk factors for usculoskeletal symptoms of the neck or shoulder alone or neck and shoulder among hospital nurses. Occup Environ Med. 2012 Mar; 69(3): 198-204.

[28] Long MH, Johnston V, Bogossian F. Work-related upper quadrant musculoskeletal disorders in midwives, nurses and physicians: A systematic review of risk factors and functional consequences. Appl Ergon. 2012 May; 43(3): 455-67. PMid:21851925 https://doi.org/10.1016/j.apergo.2011.07.002

[29] Harcombe H, McBride D, Derrett S, et al. Physical and psychosocial risk factors for musculoskeletal disorders in New Zealand nurses, postal workers and office workers. Inj Prev. 2010 Apr; 16(2): 96-100.

[30] Maakip I, Oakman J, Stuckey R. Gender, Cultural Influences, and Coping with Musculoskeletal Pain at Work: The Experience of Malaysian Female Office Workers. J Occup Rehabil. 2017 Jun; 27(2): 228-238. PMid:27339144 https://doi.org/10.1007/s10926-016-9650-5