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PATTERNS OF WORK-RELATED MUSCULOSKELETAL DISORDERS AMONG NURSES

By

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Abstract

Introduction: Work-related musculoskeletal disorders (WMSDs) include all injuries involving the locomotor system that occur at the job site, affecting soft tissue structures. Nursing is ranked as the top occupation among all the professions that have the potential to develop WMSDs and the prevalence among them ranges from 30% to 88%, depending on which body area is being considered. **Aim of Work:** To describe the pattern of WMSDs, to determine its prevalence among nurses at Main Assiut University Hospital, and to study the association between sociodemographic, work-related ergonomic risk factors, and the occurrence of WMSDs. **Materials and Methods:** A cross-sectional study was conducted among nurses at Main Assiut University Hospital during the period from January to July 2021. Data was collected using a questionnaire that included personal and detailed occupational history. The prevalence of musculoskeletal problems among the participants was determined using the Nordic Musculoskeletal Questionnaire (NMQ). The Dutch Musculoskeletal Questionnaire (DMQ) investigated the associated ergonomic risk factors. **Results:** Nearly 88% of the studied nurses were complaining of WMSDs throughout the previous 12 months of nursing practice. WMSDs affect mainly the low back (68.5%), and the elbow was the least affected site (22%). Emergency room nurses were the most affected group (96.7%), while ward nurses were the least ones (80.7%). **Conclusion:** There was a high prevalence of WMSDs symptoms among studied nurses at Main Assiut University Hospital (88%). The body region most frequently affected was the lower back, followed by the neck and knee while the elbow was the least frequently affected area

Keywords: Prevalence, Work-related musculoskeletal disorders (WMSDs), Nurses, and Occupational risk factors

Introduction

The World Health Organization (WHO) defines the term "work-related musculoskeletal disorders" (WMSDs), as a wide range of inflammatory and degenerative disorders that result in pain and functional impairment. They arise when individuals are exposed to work activities and circumstances that have a major impact on their development or exacerbation (Milhem et al., 2016). Nurses are the largest professional group in the healthcare system, and they have a higher prevalence of WMSDs than other healthcare workers (Clari et al., 2019). WMSDs include all locomotor system injuries affecting soft tissue structures in the head, neck, arms, legs, or back that are caused or exacerbated by workplace tasks such as pushing, pulling, and lifting. They can also affect joints, tendons, muscles, nerves, intervertebral discs, or blood vessels (Alnaser and Aljadi, 2019; Khairy et al., 2019). The low back, neck, and shoulder are the most commonly affected areas by WMSDs. These disorders cause work absence and financial burdens due to decreased work efficiency and long-term disability (Yang et al., 2020).

Aim of Work

To describe the pattern of WMSDs, to determine the prevalence among nurses at Main Assiut University Hospital, and to study the association between sociodemographic, work-related ergonomic risk factors, and the occurrence of WMSDs.

Materials and Methods

Study design: It is a cross-sectional study.

Place and duration of the study: The study was conducted among nurses at Main Assiut University Hospital during the period from January to July 2021.

Study sample: Sample size was calculated using open Epi version 3. According to the results of a previous study, the prevalence of musculoskeletal symptoms among Mansoura University Children Hospital (MUCH) nurses was 85.9 % (Elsherbeny et al., 2018) based on this percentage and with a confidence limit of 5% and a confidence level of 95%, the minimum sample needed for the study was estimated to be 187 nurses. We increased our sample to 200 nurses.

Sampling technique: Stratified sampling: the hospital was divided into five main work sites: Wards (medical& surgical), Intensive care units (ICU),

Operative rooms (OR), and Emergency rooms (ER). The number of participants from each group is determined by their number relative to the total number of nurses. The study included all female nurses at Main Assiut University Hospital who were on duty at the time of the study and their work duration was more than one year. The total number of nurses was 1000 and we choose 200 after using exclusion criteria: Pregnant, and those with a history of recent dislocations, unhealed fractures, autoimmune connective tissue disease, tumors, and recent traumatic soft tissue injuries were excluded.

Study methods: An interview questionnaire was used and consisted of four sections:

A:involved questions about personal demographic data such as (age, residence, marital status, etc.) **B:** included detailed occupational history (job title, work tasks, number of working years in the department, shift work, etc.). **C:** included questions on work-related musculoskeletal symptoms using the Nordic Musculoskeletal Questionnaire (NMQ) (Kuorinka et al., 1987) which is a standardized screening and surveillance tool to identify the body parts affected by musculoskeletal symptoms. The questionnaire shows a body map divided into nine anatomic body regions (neck, shoulders, upper back, low back, elbows, wrist/hands, hips/thighs, knees, and ankles/feet) and asks about the presence of aches, pain or discomfort, for the past 12 months and past 7 days in each of the body areas. It also includes a measure of functional status: for example, "Have you at any time during the last 12 months been prevented from doing your regular work (at home or away from home) because of the trouble?" All answers are dichotomous with "Yes/No" responses. **D:** included data about physical risk factors (prolonged standing, static position, arm or hand exertion, repetitive work, carrying heavy loads, etc.) using the Dutch Musculoskeletal Questionnaire (DMQ) (Hildebrandt et al., 2001).

Consent

All nurses who participated in the study provided verbal informed consent after appropriate clarification regarding the confidentiality of data and the aim and objectives of the study.

Ethical Approval

Before beginning data collection, the proposal was reviewed and

approved by Assiut University's faculty of Medicine's Ethical Committee.

Data Management

Data was entered, cleaned, and analyzed using SPSS version 24. Descriptive statistics were done in the form of frequencies, means, and standard deviations, data was stratified by hospital departments, and differences between the departments were evaluated using Pearson's chi-square test. The frequency distribution of musculoskeletal symptoms' impact on daily activities and the persistence of pain according to different body sites were assessed. Logistic regression was implemented to determine probable risk factors for musculoskeletal symptoms as a whole. The results were stated as Odds Ratios (OR) with 95% Confidence Intervals (95%CI). Values were significant when Probability (P) values were equal to or less than 0.05.

Results

Table (1): Personal characteristics of the studied nurses.

Personal Characteristics	Total	Musculoskeletal complaints	
		No.	%
Age (years)			
<40	150	127	84.7
≥ 40	50	49	98
Age (years) (Mean ± SD)	32.4± 8.8		
BMI[#] (Kg/m²)			
Normal	72	55	76.4
Overweight	61	56	91.8
Obese	67	65	97.0
BMI (Kg/m²) (mean ± SD)	27.7 ± 5.4		
Marital status			
Ever married[##]	154	145	94.2
Single	46	31	67.4
Residence			
Urban	124	104	83.9
Rural	76	72	94.7

[#] BMI: Body Mass Index [##]: Ever married: married, divorced, and widow

Table (1) showed that the average age of studied nurses was 32.47± 8.8 years. A high percentage of nurses who had WMSDs were less than 40 years (84.7%), obese (97%), ever married (94.2%) and living in rural areas (94.7%).

There was a statistically significant higher occurrence of musculoskeletal complaints among older nurses (≥ 40 years old) (98%) compared to the younger group (<40) (84.7%) (p=0.012). Nurses who had experienced work-related musculoskeletal pain or discomfort were overweight and obese (91.8% and 97%) with a significant difference between them and those who did not have work-related musculoskeletal complaints (p=0.001) with a statistically significant difference. Ever married nurses and nurses from rural areas had statistically significantly higher musculoskeletal complaints (p=0.001, (p=0.022) respectively (Results are not tabulated).

Table (2): Musculoskeletal symptoms - Nordic Musculoskeletal Questionnaire (NMQ), among the studied nurses.

Body sites	Yes - Pain in the past 12 months (No=200)		Yes - Prevented regular activities in the past 12 months		Yes - Problems in the past 7 days	
	Frequency	%	Frequency	%	Frequency	%
Total MSDs[#]	176	88	138	78.4	162	92.0
Neck	115	57.5	75	65.2	82	71.3
Shoulders	90	45.0	52	57.8	65	72.2
Elbows	44	22.0	14	31.8	21	47.7
Wrists/Hands	63	31.5	34	54.0	40	63.5
Upper back	96	48.0	54	56.3	69	71.9
Lower back	137	68.5	101	73.7	125	91.2
Hips	55	27.5	33	60.0	28	50.9
Knees	114	57.0	73	64.0	89	78.1
Ankles /feet	92	46.0	52	56.5	66	71.7

[#] MSD: musculoskeletal disorder (Participants may have complaints in more than one site)

Table (2) revealed that the prevalence of WMSDs accounted for 88% (No=176) of the study population who at least had one part of their body affected in the last 12 months, about 78.4% of them, their regular activities were affected and 92% of them experienced pain in the last week. Most of the studied nurses (68.5%) were complaining of low back pain in the last 12 months. About 73.7% of those who experienced low back pain and 65.2% of neck pain were affected in their daily life and regular activities. Also, the pain persisted for the last week in 91.2%, and 71.3% of those with lower back and neck pain respectively.

Table (3): Relationship between the affected body sites by MSD among the studied nurses and different departments.

Body Sites	Wards (Medical& Surgical (No = 83)		Operative room (No =32)		ICU## (No= 55)		Emergency room (No = 30)		All nurses (No=200)		p-value
	No	%	No	%	No	%	No	%	No	%	
Total MSDs#	67	80.7	29	90.6	51	92.7	29	96.7	176	88	**0.05***
Neck	44	53.0	24	75.0	24	43.6	23	76.7	115	57.5	**0.004***
Shoulder	33	39.8	16	50.0	26	47.3	15	50.0	90	45.0	0.645
Elbow	16	19.3	10	31.3	12	21.8	6	20.0	44	22.0	0.567
Hand/ wrist	18	21.7	16	50.0	18	32.7	11	36.7	63	31.5	**0.027***
Upper back	39	47.0	15	46.9	27	49.1	15	50.0	96	48	0.989
Lower back	53	63.9	20	62.5	42	76.4	22	73.3	137	68.5	0.353
Hip	20	24.1	13	40.6	14	25.5	8	26.7	55	27.5	0.338
Knee	44	53	19	59.4	32	58.2	19	63.3	114	57	0.769
Ankle/ foot	29	34.9	16	50.0	29	52.7	18	60	92	46	**0.05***

N.B: Chi-square test was used *: Statistically significant ($p \leq 0.05$)

#MSD: Musculoskeletal disorders ## ICU: Intensive care unit

Table (3) showed that the highest prevalence rate of musculoskeletal symptoms rate was in the emergency room(96.7%) and the lowest rate was among ward nurses (80.7%) with a statistically significant difference between them. The lower back was the most prevalent site in ICU and ward (76.4%, 63.9%) respectively and the least frequent part was the elbow for all departments (although statistically non-significant). Neck pain was significantly higher among nurses in the emergency room (76.7%) and operative room (75.0%). Hand/wrist pain was statistically significantly higher among nurses in the operative room. Ankle/foot was statistically significantly higher among nurses in the emergency room.

Table (4): Prevalence of musculoskeletal complaints and its variation according to occupational and ergonomic factors among the studied nurses

Occupational and ergonomic factors	NO MSD[#]	MSD	p-value
	Frequency (%)	Frequency (%)	
Overall	24 (12)	176 (88)	-------
Departments			
Wards (medical & surgical)	16 (19.3)	67 (80.7)	**0.050***
Operative room	3 (9.4)	29 (90.6)	
ICU[##]	4 (7.3)	51 (92.7)	
Emergency room	1(3.3)	29 (96.7)	
Experience years			
<10	22(21.8)	79 (78.2)	**0.001***
10-20	1(1.7)	57 (98.3)	
>20	1(2.4)	40 (97.6)	
Shift work	16(9.3)	156 (90.7)	**0.004***
Shortage of nurses	14(8.8)	145 (91.2)	**0.006***
Standing for a long time	11(7.2)	142 (92.8)	**0.001***
Awkward back bending	16 (9.7)	149 (90.3)	**0.030***

N.B: Chi-square test was used *: Statistically significant ($p \leq 0.05$)

[#]MSD: Musculoskeletal disorders [##] ICU: Intensive care unit

Table (4) revealed that there was a statistically significant difference between those complaining of MSDs and non-complaining ones as regards working in the emergency room, ICU, and operative room, and those with more than ten years of experience, shift work, working in departments where there is a shortage of nurses, who are standing for long hours and who reported awkward back bending.

Table (5): Binary logistic regression of independent predictors of musculoskeletal complaints among the studied nurses.

Predictors	OR[#] (95% CI)	p-value	AOR[##] (95% CI[###])	p-value
Age (years)	1.43(1.14: 1.80)	**0.002***	1.52 (1.21: 1.90)	**0.001***
BMI[$] (Kg/m2)	1.18(.96: 1.46)	0.110	1.22 (1.00: 1.49)	**0.045***
Marital Status (Ref.=unmarried^)	2.77(.56: 13.54)	0.207		
Residence (Ref.=urban)	5.63(.92: 34.54)	0.061	6.73 (1.18: 38.39)	**0.032***
Department (Ref.=ward)	12.78(2.58: 63.18)	**0.002***	15.27 (3.23: 72.07)	**0.001***
Shiftwork (Ref.= no)	18.57(2.72: 126.81)	**0.003***	16.89 (2.49: 114.51)	**0.004***
Awkward back bending (Ref.= no)	6.72(1.29: 35.09)	**0.024***	5.41 (1.09: 26.73)	**0.038***
Shortage of nurses (Ref.=no)	1.98(.41: 9.54)	0.395		
Prolonged standing (Ref.=no)	4.99(1.15: 21.57)	**0.031***	5.97 (1.42: 25.09)	**0.015***

*: Statistically significant ($p \leq 0.05$), [#] OR: Odds ratio, [##] AOR: Adjusted odds ratio, [###] CI: Confidence interval, ^ Unmarried: Single, divorced, and widow [$]BMI: Body Mass Index

Table (5): presents a binary logistic regression analysis showing that the significant independent predictors of WMSDs among nurses were old age (AOR: 1.52), CI: (1.21: 1.90), and high BMI (AOR: 1.22), CI: (1.00: 1.49). The table also displays that the significant independent predictors of musculoskeletal complaints among nurses include rural residence, awkward back bending, and shiftwork with an adjusted odds ratio (6.73, 5.41, 16.89; respectively). Nurses who worked in the ward (medical or surgical) are less likely to develop musculoskeletal complaints compared to those who worked in other departments (Operative room, ICU, or Emergency room) with a statistically significant difference (p value=0.001). The model predicts about 61 % of the variability of musculoskeletal complaints.

Discussion

WMSDs represent a significant occupational problem among nurses. According to estimates, 3.5% of nurses are leaving their jobs due to back pain (Zayed et al., 2019). In low-middle-income countries (LMICs), WMSDs continue to receive less attention and are underrepresented (Gebreyesus et al., 2020). The current study showed a high prevalence (88%) of WMSDs among the studied nurses (Table 1). This is in line with earlier Egyptian studies that indicated 85.9% of nurses working at Mansoura University Children's Hospital (MUCH) were complaining of MSD (Elsherbeny et al., 2018). Whereas Zayed et al., 2019 reported that the prevalence of WMSDs was relatively higher (92.73%) among nurses at Tanta University Hospitals. This high prevalence of WMSDs in Egyptian hospitals can be explained by work overload, poor working conditions, and a lack of awareness among nurses regarding the prevention of WMSDs. A systematic review (Soylar and Ozer, 2018) concluded that the rate of WMSDs in different parts of the world has varied between 33.0% and 88.0%. On the other hand, in Menoufia University there was a relatively lower prevalence of WMSDs(62.3%) (Mohsen et al, 2017). Regarding age, the prevalence of WMSDs complaints was significantly higher among the older age groups of the studied nurses; those aged more than 40 years (98%), compared to a lower prevalence among nurses less than 40 years old (84.7%) (Table 1) **.** This can be explained by the fact that older nurses had longer working duration and more exposure to physical workloads also are more likely to suffer from diminished functional capacity, which increases their risk of developing WMSDs (EU-OSHA, 2019). This was consistent with the results of Ribeiro et al., 2017 in Portugal who found that higher prevalence of MSD was detected among advanced age and longer time in the profession. On the other hand, these results were in contrary to the findings of Zayed et al., 2019 study which showed that the prevalence of WMSDs was statistically higher among the younger age groups (41.4%), and the prevalence decreased with increasing age to be the lowest at those nurses aged from 50 to 59 years old (9.8%) and this was explained by the fact that younger nurses may be assigned to heavier manual tasks. Concerning BMI, the prevalence of WMSDs was lower among studied nurses with normal BMI (76.4 %), and the prevalence increases

with the increase of BMI among the overweight and obese (91.8% and 97%) respectively which was statistically significant (Table 1). This may be due to the presence of an extra load on different body parts and joints with obesity. A study was conducted in India agreed with our findings (Yasobant and Rajkumar, 2014). Low back was found to be the most affected site (68.5%) among the studied group of nurses, followed by the neck (57.5%) while the least affected site was the elbow region (22%) (Table 2). The risk of back pain is increased due to physical demands and altered body positions like bending, twisting, transferring patients, dressing, and seating patients in beds (Paul et al., 2018). The systemic review achieved by (Ellapen and Narsigan, 2015) from South Africa; reported that the most susceptible anatomical sites for musculoskeletal pain were the lower back, followed by the neck and shoulders. On the other hand, a study was done in Korea found that the low back was the least affected site (Smith et al., 2003). These differences may be attributed to the different activities, procedures, facilities, and supporting equipment. About 73.7% of the studied nurses who experienced lower back pain and 65.2% of neck pain were affected in their daily life and normal activities (Table 2). This denoted that WMSDs are not always transient incidents, but they produce a prolonged disability that affects a nurse's working and daily life. Nurses who have shift work are more liable to burnout and emotional exhaustion leading to an increased risk of injuries (Chang and Peng, 2021). The studied nurses of all departments showed a high prevalence of WMSDs, with emergency room nurses having the highest affection (96.7%), the second was ICU nurses (92.7%), followed by operative room nurses (90.6%) while ward nurses were the least affected (80.7%) with statistically significant difference between them (Table 3). Studied nurses who work in operative room nurses experienced wrist/hand pain more than other groups (50%) and that was statistically significant (Table 3). This may be attributed to their work tasks, such as continuous repetitive movements or unusual motions. This finding was consistent with what was detected by Clari et al., 2019, approximately one in two nurses (48.3%) had experienced one or more episodes of upper limb pain over the previous year. Also, ankle and foot pain were much higher among emergency room nurses (60%) followed by

operative room nurses (50%) (Table 3) and this can be explained by prolonged standing. A recent study was conducted in Ethiopia, had detected that nurses who worked in the ICU or Operating room had a higher risk of developing ankle and foot pain (55.4%) followed by Emergency unit (44.4%) compared to those working in the Wards (40.5%), and outpatient clinics (38.1%) (Getie et al., 2021). ICU nurses do several treatments like infusions and airway management and working in a setting where there aren't enough nurses which create a long-term stressful work environment (Yang et al., 2020). The strain on the local muscles of the nurses in the Operating room increased as a result of their uncomfortable and static positions (Yilmaz and Andsoy, 2021)88.8% of the surgical nurses had musculoskeletal system disorders, and most experienced these problems related to the health industry. The interventions causing physical strain in the participants were identified as constant standing up, patient care, carrying heavy loads, sudden movements, patient transfer and pulling–pushing practices. The nurses used coping methods including walking, exercising, receiving physiotherapist support, pilates and yoga. The most frequently encountered problems were in the back region. A significant relationship was found between musculoskeletal system problems and the clinic of work, years of work, age and gender ($p < 0.05$. This also agreed with the results of Yan et al., 2017 on their study on the prevalence of work-related musculoskeletal disorders among nurses working in hospitals of Xinjiang Uygur, China , and detected that the lowest prevalence was in the internal medicine department, whereas the Emergency department was the highest. Also, this is consistent with a survey among healthcare workers in Emergency care units in Indonesia, which found that a high proportion of Emergency room nurses (92%) have WMSDs, which was attributed to the great number of patients and involvement in frequent lifting (Doda et al., 2020).

On other hand, (Elsherbeny et al., 2018) in Mansoura university found that there was no statistically significant difference between different departments.

ICU studied nurses suffer from low back pain (76.4%) (Table 3) possibly due to biomechanical stress generated by heavy manual handling of patients. It was reported that 90.3% of ICU nurses

in South Korean hospitals have low back pain at least once a month (June and Cho, 2011)once a week ,once a month or once in two or more months. Studied nurses with (10-20 years and more than 20 years) of experience showed a higher prevalence of WMSDs (98.3% and 97.6% respectively) compared to those with less than 10 years of experience (78.2%) with a statistically significant difference between them (Table 4). These findings came in concordance with the study done by Mohsen et al., 2017 in Menofia who found that years of experience had a significant effect on the development of WMSDs.

The studied nurses who worked in shifts had a higher prevalence of WMSDs (90.7%) than those who did not (71.4%) with a statistically significant difference (Table 4). This is in accordance with Elsherbeny et al., 2018 who found that nurses who had shift hours were two times more likely to suffer from WMSDs comparable to those with non-shift.

A logistic regression analysis was applied to the results to notice the predictors of the presence of WMSDs at anybody site. The model reported that there was a statistically significant association between age (p=.001), BMI (p =.045), rural residence (p =.032), and the presence of work-related symptoms. Also, nurses working in (the Emergency room, Operative room, or ICU) are more likely to have WMSDs more than ward nurses (p =.001). The model also reported that there was a statistically significant association between awkward back bending (p =.038), prolonged standing (p=.015), the presence of work shifts (p =.004), and the presence of work-related symptoms (Table 5). In agreement with these results; Amer, 2018 from Ismalia showed that there was statistically significant association between presence of work shift and presence musculoskeletal symptoms (OR:1.26, CI:1.14-1.38) ($p<0.05$). On the other hand, the logistic regression analysis in Elsherbeny et al., 2018 study showed that the age group 30-40 was less likely to develop musculoskeletal complaints. Also, they found non-statistically significant differences regarding the ergonomic risk factors (prolonged standing, static position, repetitive work, carrying heavy loads).

Conclusion:

The current study showed that the whole 12 months prevalence of musculoskeletal symptoms at anybody

site among the nurses under study at Main Assiut University Hospital was 88%. The lower back was the most commonly affected part of the body (68.5%), and the least affected site was the elbow (22%). The sociodemographic risk factors that were associated with the presence of WMSDs were old age, high BMI, being married and rural residence. Working in the Operative room, Intensive care unit, or Emergency room, more than 20 years of experience and shiftwork were significantly associated with WMSDs.

Recommendations:

Following ergonomic guidelines and preventive interventions as manual handling training and education on proper lifting techniques and providing mechanical lift devices.

Conflict of Interest

There was no conflict of interest.

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