

Patterns of Work-related Musculoskeletal Disorders among Health Care Workers

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ABSTRACT

Background: Work –related musculoskeletal disorders (WRMDs) is a high cost problem in the healthcare industry and one of the leading causes of disability among health care workers (HCWs). It is an ongoing problem due to frequent patients handling with limited resources, time constraints & repeated shifts.

Objective: To determine the prevalence & severity of WRMDs among HCWs at Benha University Hospitals (BUHs), to identify the risk factors of WRMDs and finally, to recommend a program for prevention.

Patients and methods: It was a cross-sectional included 343 of HCWs at BUHs from 1st May 2019 to the end of December 2019 using an interview questionnaire incorporating the Nordic Musculoskeletal Questionnaire.

Results: The majority of the studied group were females (81.9%) with a mean age of 35 ± 7.5 years old. Nurses represented more than two thirds of the studied group (67.1%) while 25.9% were doctors and only (7%) were service workers. The prevalence of chronic MSDs among studied group was 81%. Chronic lower back pain (LBP) was the most prominent complaint in the last 12 months (81%), while only (14.3%) complained of chronic elbow pain. (WRMDs) were significantly higher among those who keep prolonged static and awkward posture, those having work shift, over-time work, those who felt hard to keep-up with work pace and those who did not have enough rest time during working hours and did not have regular rest at work.

Conclusion: Work–related musculoskeletal disorders have a great impact on the workers, the organization and the society as a whole. So measures to prevent them are recommended.

Keywords: WRMDs, HCWs, BUH.

INTRODUCTION

Work-Related Musculoskeletal Disorders (WRMDs) are defined as “injuries or disorders of the muscles, nerves, tendons, joints, cartilage and disorders of the nerves, tendons, muscles and supporting structures of the upper and lower limbs, neck and lower back that are caused, precipitated or exacerbated by sudden exertion or prolonged exposure to multiple risk factors ⁽¹⁾. WRMDs may occur due to physical risk factors, psychosocial, workplace organizational factors and personal risk factors. Physical risk factors for WRMDs include force, repetition, vibration, coldness and awkward postures. Psychosocial risk factors include, higher job demands, taking fewer rest breaks, awkward postures, movements or exposure to forces ⁽²⁾. Organizational factors are defined as the distribution of work tasks over time and between workers. The duration of work and rest periods has a profound effect on tissue fatigue and recovery ⁽³⁾.

Globally, WRMDs are the highest contributor to global disability (accounting for 16% of all years lived with disability) and lower back pain remained the single leading cause of disability globally. WRMDs result in a median of 8 missed work days compared to non-fatal injuries/illnesses, which account for only 6 days of missed work ⁽⁴⁾. The prevalence of WRMDs varies between 33%-88% among nurses all over the world, while it was about 84% or higher in some Egyptian hospitals ⁽⁵⁾.

Most of Egyptian studies on WRMDs among medical workers were limited to one professional groups such as nurses, physical therapists, dentists etc. In addition, there is lack of studies about WRMDs among all groups of healthcare workers in Egypt generally and particularly in Benha. Therefore, this study aimed to explore the prevalence of WRMDs among different HCWs and its relation to the work environment & psychological factors.

SUBJECT AND METHODS

Study design: This was a cross-sectional study conducted in Benha University Hospitals. Fieldwork started from 1st May 2019 to the end of December 2019. The target group was health care personnel (physicians, nurses and service workers) fulfilling the inclusion criteria. They were working for at least 5 years in BUHs. Exclusion criteria included pregnancy, chronic diseases like D.M and hypertension and finally, the participant must not have any musculoskeletal injuries due to neurological diseases, metastatic disease or spinal surgery caused by causes other than workplace.

Sampling design: The sample size was calculated according to the following equation with Confidence

$$SS = Z^2 * (P) * (1-P) / E^2$$

Interval 95%, margin of error 5% and study power 80%.



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According to **Rahman et al.** ⁽⁶⁾ the prevalence of WRMDs among health care professionals was (68%), so the yielded sample size is 334. The sample size was adjusted and increased to 343 subjects taking in consideration non-responders and defaulters. Study participants were selected according stratified random sampling technique.

▪ **Study methods and tools:**

I. Data were collected using an interview questionnaire adopted by **Wang et al.** ⁽⁷⁾. It consisted of the following sections:

- (1) **A sociodemographic data:** as age, gender, marital status and average income.
- (2) **Questions about history of musculoskeletal diseases.**
- (3) **Questions about working characteristics:** working location, department, seniority, working intensity and duration of work shift.
- (4) **Standardized Nordic Questionnaire** developed by **Kuorinka et al.** ⁽⁸⁾, which included two main parts. The first part evaluates general health problems of musculoskeletal system at different positions of the body during the last 12 months. The second part assesses pain severity ranging between zero (no pain) to 10 (severe pain) ⁽⁹⁾.
- (5) **Information about Work-related factors:** postural, psychosocial and work-environmental factors. Postural factors is constituted of five items on trunk, four items on neck, nine items on arm/wrist as well as three items on leg, which can be referred to as Rapid Entire Body Assessment (REBA) ⁽¹⁰⁾. While psychological factors focused on personal feelings, work organization and job control, which were partly, drew from the Karasek Job Content Questionnaire (JCQ) ⁽¹¹⁾.

II. General clinical examination and assessment of body mass index (BMI) which was calculated and categorized according to CDC classification ⁽¹²⁾.

The tool was tested for content validity by two experts from the Faculty of Medicine (Community, Environmental and Occupational Medicine Department) and then a pilot study was carried out on 40 personnel to assess clarity and applicability of the tool. It also helped the researcher to determine the time needed for filling out the questionnaire forms. All required modifications were done e.g. the type, sequence, misunderstanding and rephrasing of questions.

Ethical approval: An official permission was obtained from the Dean of Benha Faculty of Medicine and the administrators of Benha University Hospitals to conduct this study. In addition, ethical approval from Research Ethics Committee in Benha Faculty of Medicine was obtained. Informed written consents were obtained from all participants before participation, which included data about aim of the work, study design, site, time, subject and methods and confidentiality.

Statistical analysis

An Excel spreadsheet was established for the entry of data. We used validation checks on numerical variables and option-based data entry method for categorical variables to reduce potential errors. The analyses were carried with SPSS software (Statistical Package for the Social Sciences, version 24, SSPS Inc, Chicago, IL, USA). The normality of the data were assessed using Shapiro-Wilk Test. Numerical data were described as mean \pm SD if normally distributed, or median and interquartile range [IQR] if not normally distributed. Frequency tables with percentages were used for categorical variables. Independent Student t-test and paired t-test were used to compare parametric quantitative variables, while Mann-Whitney tests and Wilcoxon matched pairs test were used to compare non-parametric quantitative variables. Chi-square test or McNemar-Bowker tests were used to analyze categorical variables. Multilinear logistic regression was undertaken to assess the predictors of mortality. A p-value \leq 0.05 is considered statistically significant.

RESULTS

The mean age of the studied group was (35.0 \pm 7.5 years). Almost all participants (93.9%) were married, 71.4 % were average educated and 28.6% had MBCH and Master Degree or above. Regarding monthly income, more than two-thirds (74.3%) had income < 3000 pounds and 25.7 % had > 3000 pounds. 36.8% were normal weight, 12.5% underweight, 33.8% overweight & 16.9% were obese.

More than half of the studied group (54.5 %) worked for \geq 15 years, 53.1% worked for 5 days / week. The average working hours/day for 99.4% of participants was 8 hours. Nearly two thirds of the studied group (67.1%) were nurses, 25.9 % were doctors and only 7% were service workers. 57.4% were working at surgical departments while 42.6% were working at medical departments. The prevalence of chronic MSDs among studied group was 81%.

Table (1): Work environment & psychosocial factors affecting MS pain

Questions	Yes No. (%)	No No. (%)
Do you have work shift?	273 (79.6)	70 (20.4)
Do you often work overtime?	231(67.3)	112 (32.7)
Do you think there is enough operating space at work?	130(37.9)	213(62.1)
Do you have lumbar support on your seat?	0(0)	343(100)
Do you have adjustable workbench?	178(51.9)	165(48.1)
Do you change your posture freely at work?	146(42.6)	197(57.4)
Do you keep the same posture for most of the working hours?	197 (57.4)	146(42.6)
Do you feel your working postures uncomfortable?	238(69.4)	105(30.6)
Do you feel cold at work?	85(24.8)	258(75.2)
Do you feel humid at work?	180(52.5)	163(47.5)
Do you feel there is enough rest time?	0(0)	343(100)
Is it possible to rest regularly?	81(23.6)	262(76.4)
Do you have control over your work progress?	0(0)	343(100)
Do you feel stressed at work?	278(81)	65(19)
Do you feel hard to keep up with work pace?	212(61.8)	131(38.2)
Do you have enough rest time in your working us?	133(38.8)	210(61.2)
How do you feel physical tiredness after work?		
<i>No</i>		6(1.7)
<i>A little bit tired</i>		34(9.9)
<i>Tired</i>		281(81.9)
<i>Can hardly bear</i>		22(6.4)
How do you feel mental tiredness after work?		
<i>No</i>		40(11.7)
<i>A little bit tired</i>		90(26.2)
<i>Tired</i>		175 (51)
<i>Can hardly bear</i>		38 (11.1)

Figure (1) demonstrated the prevalence of chronic (in the last 12 months) MSDs at different body sites. The most affected site with chronic MSDs was lower back (81%) followed by neck (47.2 %). While, elbow was the least affected site (14.2%) with chronic MSDs.

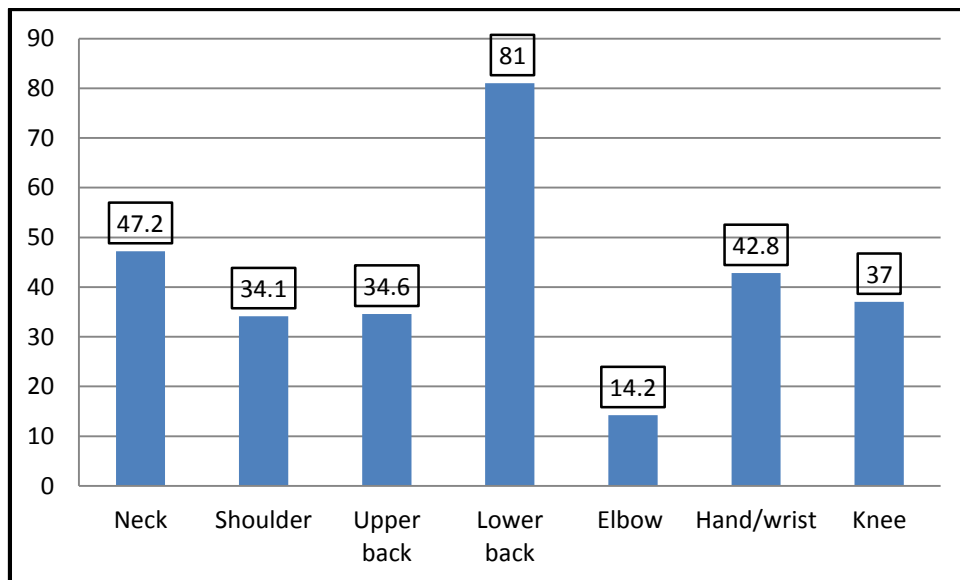


Figure (1) Prevalence of chronic MSDs at different body sites

Table (2) demonstrated the relation between sociodemographic & work related factors and chronic MS pain. As regards gender, females were significantly higher than males regarding shoulder pain (68.4%) (p=.000), upper back pain (75.6 %) (p=.02) and lower back pain (78.8 %) (p=.002). Table (2) illustrated the significant relation between marital status and chronic neck pain as 96.8 % of the studied group with chronic neck pain were married (p=0.04). As regards vocation, nurses were the most affected group .They were the most affected with neck pain (66%) and this was significantly higher than other work groups (p=0.000). Similarly, chronic shoulder pain was higher among nurses (54.7 %) (p=0.01) & chronic lower back pain (61.5%) (p=0.000). Elbow pain was 75.5% (p=0.03). In addition, those working for a period ≥ 15 years showed higher percentage of chronic lower back pain (51.1%) (p=0.008). Those working in surgical departments showed higher percentage of chronic pain. Chronic neck

pain (69.2 %) (p= 0.000) and chronic shoulder pain (68.4%) (p=0.007) were significantly higher among them. Also, upper back pain (64.7%) (p=0.04) and chronic hand and wrist pain (66.7%) (p=0.003) were significantly higher among those working in surgical department. Study participants of monthly income less than 3000 LE had significantly higher percentage of chronic neck pain (82.1%), chronic shoulder pain (60.7%), chronic lower back pain (70.5%) (p=.000) and chronic elbow pain (87.8%) (p=.02). The table illustrated that 39.1% of those who complained of chronic neck pain were overweight (p=.02). In addition, 37.1% of those who complained of chronic lower back pain were overweight (p=.000). Average educated group showed higher percentage of chronic neck pain (80.1%) (p=.004), shoulder pain (59.8%) (p=.001) and lower back pain (67.6%)(p=.004). The majority of those complained of chronic elbow pain had average education (87.8 %)(p=.02).

Table (2): Risk factors and its relation to chronic MS pain

Variables	Neck (156)%	Shoulder (117)%	Upper back (119)%	Lower back (278)%	Elbow (49)%	Hand/Wrist (147)%	Knee (127)%
Age (years)							
<40	69.2	72.6	70.6	73.4	71.4	74.1	74.8
≥40	30.8	27.4	29.4	26.6	28.6	25.9	25.2
Sex							
Males	21.8	31.6	24.4	21.2	18.4	17	16.5
Females	78.2	68.4**	75.6*	78.8**	81.6	83	83.5
Marital status							
Unmarried	3.2	7.7	3.4	5.8	10.2	5.4	4.7
Married	96.8*	92.3	96.6	94.2	89.8	94.6	95.3
Education							
Average educated	80.1	59.8*	73.1	67.6*	87.8*	72.1	74.8
High & postgraduate	19.9	40.2	26.9	32.4	12.2	27.9	25.2
Income							
< 3000 L.E	82.1**	60.7**	77.3	70.5**	87.8*	76.9	78.8
≥ 3000 L.E	17.9	39.3	22.7	29.5	12.2	23.1	21.3
BMI							
Under weight	10.3*	14.5	13.4	13.7**	16.3	11.6	12.6
Normal weight	30.1	36.8	32.8	34.5	38.8	36.1	37
Over weight	39.1	30.8	37	37.1	32.7	31.3	30.7
Obese	20.5	17.9	16.8	14.7	12.2	21.1	19.7
Work duration (Y)							
<15years	44.9	49.6	47.1	48.9**	38.8	49	44.9
≥15 years	55.1	50.4	52.9	51.1	61.2	51	55.1
Working days /week							
4	9	25.6	16	18.3	6.1	12.9	14.2
5	53.8**	47.0**	44.5*	53.6**	55.1	59.9	55.9
6	37.2	27.4	39.5	28.1	38.8	27.2	29.9
Vocation							
Doctor	18.6	39.3	22.7	29.9	12.2	23.1	22
Nurse	66**	54.7**	67.2	61.5**	75.5*	69.4	71.7
Service workers	15.4	6	10.1	8.6	12.2	7.5	6.3
Department type							
Medical	30.8	31.6	35.3	40.3	36.7	33.3	44.1
Surgical	69.2**	68.4**	64.7*	59.6	63.3	66.7**	55.9

Table (3) demonstrated the relation between postural factors and musculoskeletal pain. The majority of those complained of neck pain were turning their neck frequently (77.6%), 58% were keeping their neck twisted for a long time at work and (34%) were keeping their neck flexed over 20 degrees at work (p = 0.000 &.000&.001 respectively). The usual height of arm at work was above shoulder and this was mentioned by all those complained of chronic shoulder pain (100%). About two thirds (60.7%) of those complaining of chronic shoulder pain did not have adjustable workbench (p = .003). As regards upper back pain postural risk factors, statistically significant association could be noticed as 69.7% of the studied group who complained of chronic upper back pain were turning round frequently at work (p =.008). Besides, 79% were bending and turning at the same time frequently (p =

.013), 80.7% were bending for a long time at work (p = .005) and 45.4 % were keeping trunk flexed 20 to 60 degrees at work (p =.001). In addition, 74.1% of the studied group who complained chronic lower back pain were bending and turning at the same time frequently (p = .003), 73.7% were keeping bending for a long time at work (p = .03) and (33.8 %) were keeping trunk flexed between 20 - 60 degrees at work (p = .002). About half (55.1%) of those complained of chronic elbow pain were placing their arms on the edge of angular objects (p = .000). The majority of those with chronic hand & wrist pain (88.4%) were flexing and extending their wrist frequently (p = .009), 83.0% mentioned that the size of used tools are not suitable for hands (p = .01) and 98.0 % of them used to operate with both hands (p = .000). The majority of those with chronic knee pain (85.8%) were keeping their leg flexed for long time (p = .006).

Table (3): Relationship between chronic MS pain& postural and work related factors

Site	Postural &work-related factors	Yes -N. (%)	Test of significance	P value
Neck	<i>Do you turn your head Frequently?</i>	121(77.6)	1.41	.000**
	<i>Does your head remain low for long time at work?</i>	96 (61.5)	.83	.4
	<i>Do you keep your neck twisted for long time at work?</i>	91(58.3)	37.7	.000**
	<i>Neck posture at work</i>			
	flexion 0-10	52 (33.3)	13.4	.001**
flexion 10-20	51 (32.7)			
flexion over 20	53 (34.0)			
<i>Do you did not have adjustable workbench?</i>	75(48.1)	.25	.67	
Shoulder	<i>Do you keep shrugging for long period at work?</i>	19(16.2)	0.02	.9
	<i>Usual height of the arm at work</i>			.000**
	above shoulder	117 (100)	66.1	
below shoulder	0(0)			
<i>Do you did not have adjustable workbench?</i>	71(60.7)	8.79	0.003**	
Upper back	<i>Do you turn round frequently at work?</i>	83(69.7)	7.13	.008**
	<i>Do you bend and turn at the same time frequently?</i>	94(79.0)	6.2	.013*
	<i>Do you keep trunk twisted for long time at work?</i>	77(64.7)	.42	.52
	<i>Do you keep bending for long time at work?</i>	96(80.7)	8.1	.005**
	<i>Trunk working posture</i>			
	flexion 0-20	19(16.0)	23.9	.001**
flexion 20-60	54(45.4)			
flexion over 60	46(38.7)			
<i>Do you did not have adjustable workbench?</i>	60(50.4)	.059	.82	
Lower back	<i>Do you turn round frequently at work?</i>	164(59.0)	.69	.41
	<i>Do you bend and turn at the same time frequently?</i>	206(74.1)	8.9	.003**
	<i>Do you keep trunk twisted for long time at work?</i>	174(62.6)	.025	.8
	<i>Do you Keep bending for long time at work?</i>	205(73.7)	4.85	.03*
	<i>Trunk working posture</i>			
	flexion 0-20	91(32.7)	12.3	.002**
flexion 20-60	94(33.8)			
flexion over 60	93(33.5)			
<i>Do you did not have adjustable workbench?</i>	141(50.7)	.79	.38	
Elbow pain	<i>Do you place your arm on the edge of angular objects?</i>	27(55.1)	13.9	.000**
	<i>Do you often twist your arm?</i>	9(18.4)	1.1	.31
Hand /wrist	<i>Do you often flex or extend your wrist frequently?</i>	130(88.4)	6.81	.009**
	<i>Do you often twist your arm?</i>	78(53.1)	3.51	.06
	<i>Do you keep your wrist twisted for long time?</i>	114(77.6)	.94	.33
	<i>Is the tool size not suitable for hand?</i>	122(83.0)	6.23	.01*
	<i>Do you usually operate with both hands?</i>	144(98.0)	2.69	.000**
Leg & knee	<i>Do you keep standing for long time at work?</i>	94(74)	2.0	.16
	<i>Do you keep your leg flexed for long time?</i>	109(85.8)	7.4	.006**
	<i>Leg posture at work</i>			
Walking	93(73.2)	.43	.51	
Sitting	34(26.8)			

*P < 0.05; ** P < 0.01

Table (4) illustrated the relationship between chronic musculoskeletal pain and psychological, work organization and ergonomic factors. As, chronic MSDs were significantly higher among those who have work shift, especially at shoulder (73.5%), lower back (90.3%), hand (73.5%) & elbow (91.8%) (p = .04, .000, .01 & .02 respectively). Chronic MSDs were higher among those who did not have enough rest time during working hours, but without significant difference except for shoulder pain (69.2%) (p = 0.03). Chronic MSDs were higher among those who had over-time work, but without significant difference except neck (73.1%), shoulder (75.2%) & hand pain (76.2%) (p =.03, .02 & .002 respectively). The higher percentage of those complained of chronic pain at shoulder (70.1%), lower back (86.7%), hand (70.1%) & elbow (91.8%). They mentioned that it was not possible to have regular rest at work, and these findings significantly differed from those who had regular rest (p = .03, .000, .01 & .007 respectively). The table illustrated that 69.2% of those having chronic pain at neck, 68.4 at shoulder, 64.7% at upper back & 66.7% at hand were not changing their posture freely at work and these findings significantly differs from those having the ability to change their posture at work (p = .000, .003, .04 & .003 respectively). Moreover, 70.9% of those having chronic

pain at shoulder & 68% at hand were keeping static posture for prolonged time at work and these findings significantly differs from those having the ability to change their posture freely (p = .001 & .002 respectively).

As regards psychological factors, the majority of those complained of chronic pain at shoulder (74.4 %) and hand (70.7%) mentioned that they felt hard to keep-up with work pace, and these findings significantly differed from those who can cope with work pace (p = .001 & .003 respectively). The majority of those complained of chronic pain at shoulder (68.4%), upper back (75.6%) and lower back (78.1%) mentioned that they felt stressed at work, and these findings significantly differed from those who did not feel work stress (p = .000 , .04 & .001 respectively). About half (50.4%) of those complained of chronic shoulder pain felt physically tired after work (p=.001). About half of those complained of chronic shoulder pain (49.6%) & lower back pain (48.9%) feel mentally tired after work (p = .001 & .03). There was a statistically significant positive correlation between severity of MSDs of all sites & duration of employment (p < 0.05) except for elbow. In addition, there was highly significant positive correlation between lower back pain & duration of employment (p < 0.01) (Figure 2).

Table (4): Relationship between chronic MS and psychological and work organization and ergonomic factors

Questions	Neck -156%	Shoulder -117%	U. back -119%	L. back -278%	Elbow -49%	H.& Wrist -147%	Knee -127%
Do you have shift work?	80.8	73.5*	79	90.3**	91.8	73.5*	79.5
Do you have not enough rest time in your working hours?	59.6	69.2*	65.5	62.2	56	62.6	61.4
Do you often work overtime?	73.1*	75.2*	68.9	68.3	67.3	76.2**	64.6
Do you did not have enough rest time during working hours?	59.6	69.2*	65.5	62.2	56	62.6	61.4
Not rest regularly?	77.6	70.1*	77.3	86.7**	91.8**	70.1*	77.2
How do you feel physical tiredness after work?							
Not at all	14.1	9.4	12.6	12.6	8.1	10.2	8.7
A little bit tired	25.6	19.7	23.5	23.7	32.7	21.1	31.)
Tired	49.4	50.4**	53.8	51.4	49	56.5	51.1
Can hardly bear	10.9	20.5	10.1	12.3	10.2	12.2	8.7
How do you feel mental tiredness after work?							
Not at all	16	10.3	13.4	13.7	8.2	11.6	8.6
A little bit tired	28.2	19.6	25.2)	25.2	34.7	21.8	33.1
Tired	44.9	49.6**	51.3	48.9*	46.9	54.4	49.6
Can hardly bear	10.9	20.5	10.1	12.2	10.2	12.2	8.7
Cannot change your posture freely at work?	69.2**	68.4**	64.7*	59.7	63.3	66.7**	55.9
Do you keep the same posture for most of the working hours?	60.3	70.9**	63.9	59.4	40.8	68.0**	55.1
Do you feel cold at work?	26.9	23.9	26.1	23.7	30.6	27.9	26
Do you feel humid at work?	48.1	52.1	56.3	23.7	57.1	51	50.4
Do you feel stressed at work?	77.6	68.4**	75.6*	78.1**	81.6	83	83.5
Do you feel hard to keep up with work pace?	61.5	74.4**	65.5	63.7	59.2	70.7**	57.5

*P < 0.05; ** P < 0.01

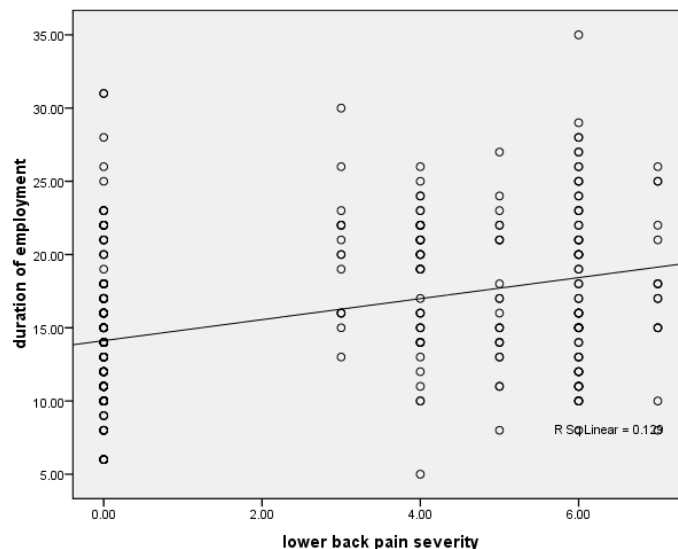


Figure (2): Correlation between lower back pain severity and duration of employment

DISCUSSION

MSDs constitutes a major cause of disability. Low back pain is the first cause of years of life lost (YLLs) in 2017 ⁽¹³⁾. This study is the first study on HCWs in Qualubeyia governorate, as far as the author knows. In our study, the prevalence of chronic MSDs among studied group was 81%. 81% of the studied workers complained of chronic lower back pain in the last 12 months while those suffering of chronic elbow pain represented the lowest percentage (14.2%) (Figure 1). These results may be attributed to bending/twisting the back in awkward ways, standing long periods when treating large number of patients, absence of lumbar support while seating and inadequate rest time. This is matching with **Akodu and Ashalejo** ⁽¹⁴⁾ who studied WRMDs and work ability among nurses in Lagos state. 81 Out of 135 nurses (60%) complained of musculoskeletal pain in the last 12 months. The 12-months prevalence rate of WRMDs was highest for the lower back (43.2%). However, the current study mismatches with **Sorour and El-Maksoud** ⁽¹⁵⁾ who studied the prevalence of musculoskeletal disorders among 58 nurses working in emergency departments. The results of their study showed that the most commonly affected site was neck (67.2%).

Regarding vocation, the present study revealed that nurses were the most affected group with chronic WRMDs (Table 2). These results might be attributed to various risk factors including patient transfer, night shift stress, prolonged static posture stress, manual material handling and awkward posture and insufficient ergonomic knowledge ⁽³⁾. This is matching with **Mohamed and Al Amer** ⁽¹⁶⁾ as (57%) of nurses experienced low back pain and this was higher than any other hospital workers were.

Regarding gender, females were more affected with chronic WRMDs than males (Table 2). This result can be attributed to that females are more prone to WRMDs as they have a lesser muscle tone,

a higher incidence of osteoporosis and have biological or psychological differences from males ⁽¹⁷⁾. This finding nearly comes with **Rahman et al.** ⁽⁶⁾ who studied prevalence of WRMDs among 160 health care professionals in Dhaka city and found that 55.9 % of the studied group who complained WRMDs in the last 12 months were females. The current study results are in contrast with **Elsherbeny et al.** ⁽¹⁸⁾ who conducted a cross sectional study among 311 nurses working in Mansoura Children University Hospital and found that there was no statistically significant difference in prevalence regarding gender.

Regarding marital status, married workers complained more chronic neck pain than unmarried (Table 2). This may be due to domestic work, which increase the musculoskeletal demands with reduced recovery time. This is in contrast with **Mohamed and Al Amer** ⁽¹⁶⁾ and **Elsherbeny et al.** ⁽¹⁸⁾ who found that there was no significant difference between study participants regarding marital status.

Regarding work experience, older HCWs with long working experience (≥ 15 years) were more affected with chronic WRMDs (Table 2). Our results are similar to **Attarchi et al.** ⁽¹⁹⁾ which showed that nurses with higher work experiences were more affected by WRMDs especially low back disorders. These results are in contrast with **Zayed et al.** ⁽⁵⁾ who studied WRMDs among 1000 nurses of Tanta University Hospitals found that nurses with the least years of experience showed the higher prevalence of WRMDs (47.0%) while those with 31-40 years of experience showed the least prevalence (8.0%) with statistically significant association. The results of current study can be explained by that repetitive tasks associated with work may result in inflammatory changes, particularly in muscle tendons. In addition, high physical work demands such as monotonous and repetitive movements, awkward body postures, prolonged standing and heavy lifting are the main causes for WRMDs.

In the present study, those who were working in surgical departments showed higher percentage of chronic body pain (Table 2). This is matching with **Mehrifar et al.** ⁽²⁰⁾ who studied musculoskeletal symptoms of 40 surgeons working in Tehran and stated that the prevalence of MSDs among surgeons was 89.2% in the past 12 months. These results were attributed to routine work of operating room as, patient-handling tasks, working in an awkward position and long-time standing. Even, the preparation for surgical procedures requires much physical strength since it generally involves assisting in patient repositioning, lifting and carrying surgical trays, pushing/pulling carts loaded with surgical trays and standing long hours ⁽²¹⁾. The current results opposed **Yan et al.** ⁽²²⁾ who examined 6674 nurses working in the hospitals in Xinjiang Uygur, China and found that nurses working in the emergency department showed the highest prevalence of WRMDs.

Regarding weight, there was a statistically significant association between BMI and complaining from WRMDs' symptoms (Table 2). This comes in agreement with **Zayed et al.** ⁽⁵⁾ who stated that 82.2% of the complaining nurses were overweight and obese with a statistically significant association between body weight and complaining from WRMDs' symptoms. This may be explained by the presence of an extra load on the different body parts and joints due to overweight and obesity, which may lead to earlier development or aggravation of WRMDs. On the other hand, this finding disagrees with **Mohsen et al.** ⁽²³⁾ who studied WRMDs among 160 nurses in Egypt and revealed that 69.2% of the studied obese nurses had WRMDs and 60.7% were overweight nurses & had WRMDs with no significant statistical relationship between WRMDs and BMI.

Considering neck, we found that postural factors were major risk factors for WRMDs. Chronic neck pain was significantly high among those who were turning their head frequently at work, keeping their neck twisted for a long time at work and keeping their neck flexed over 20 degrees at work (Table 3). This is in agreement with **Asghari et al.** ⁽²⁴⁾ who found that the most common posture adopted by 144 Iranian nurses while performing their tasks in the operating room was the bending posture of the neck (> 20° flexion). This can cause high levels of biomechanical risk, which lead to the development of MSDs.

Considering shoulder, all the studied group who complained of chronic shoulder pain were keeping their arm above shoulder at work (Table 3). This is explained by that sustained awkward position leads to muscle overload, exhaustion and fatigue so oxygenation of the muscle is diminished in front of increased demands of muscle fibers leading to ischemia and pain ⁽²⁵⁾.

Upper back pain was significantly higher among those who were turning round frequently at

work, bending and turning at the same time frequently, bending for a long time at work and keeping trunk flexed 20 to 60 degrees at work (Table 3). These findings are in accordance with **Chiwaridzo et al.** ⁽²⁶⁾ who conducted cross-sectional survey among 208 nurses at Parirenyatwa Group of Hospitals (PGH), they found that perceived work-related factors such as twisting the back, and lifting, transferring of patients and equipment were associated with WRMDs among the nurses at PGH.

Chronic lower back pain was significantly higher among those who were bending and turning at the same time frequently at work, bending for a long time at work and keeping trunk flexed 20 to 60 degrees at work (Table 3). These findings agree with **Gadradj et al.** ⁽²⁷⁾ who mentioned that unfavorable postural factors were recognized to correlate with musculoskeletal symptoms

Chronic elbow pain was significantly higher among those who were placing their arm on the edge of angular objects at work (Table 3). This is consistent with **Wang et al.** ⁽⁷⁾ who studied WRMDs prevalence among 1017 obstetrics and gynecology staff in China. They found that elbow symptoms in particular were influenced by arm placed on edges of angular objects.

Regarding hand and wrist, repetitive movement in the form of flexing and extending wrist frequently at work cause malfunction of the joint lubrication system and inflammation of the tendons ⁽¹²⁾. The present study revealed that chronic hand and wrist pain was significantly higher among those who were flexing and extending their wrist frequently at work (Table 3). In Italy, **Clari et al.** ⁽²¹⁾ concluded that highly repetitive tasks and use of vibrating instruments were determinants of work-related upper extremity cumulative disorders among 148 operating room nurses.

Finally, 85.8% of those with chronic knee pain were keeping their leg flexed for long time (Table 3). This might be attributed to that prolonged knee flexion leads to joint stiffness and pain. This is matching with **Wang et al.** ⁽⁷⁾ who found statistically significant correlation between prolonged knee flexion during sitting and chronic knee symptoms.

This study demonstrated that about two thirds of those complaining of chronic shoulder pain did not have adjustable workbench (Table 3). This is supported by **Wang et al.** ⁽⁷⁾ who found that adjustable workbench decreased MSDs.

Regarding work organization factors in the present study, work shift was found to be associated with increased risk of chronic pain at shoulder, lower back, hand and elbow among HCWs (Table 4). In addition, **Asghari et al.** ⁽²⁴⁾ found that rotating work shift was found to be associated with increased risk of low back pain among operating room nurses. As HCWs working in a rotating shift are more liable to burnout, emotional exhaustion and instability leading to increasing the risk of accidents and injuries and less

work achievement since work shift is a psychosocial risk factor. Nevertheless, **Nutzi et al.** ⁽²⁸⁾ conducted correlational questionnaire study included 116 OR nurses from eight different hospitals in Switzerland and showed that there was no relationship between musculoskeletal pain and shift working.

Moreover, chronic MSDs were higher among those who did not have enough rest time during working hours (Table 4). These findings are in accordance with **Elsherbeny et al.** ⁽¹⁸⁾ who found that the prevalence of musculoskeletal complaints was significantly higher among nurses who were working continuously more than 6 hours. This fact could be explained by that increasing working hours is associated with increased workload. This study finding conflict with **Zayed et al.** ⁽⁵⁾ who found no significant association between WRMDs among nurses and inadequate rest breaks or pauses during the day.

There was significant association between chronic MSDs and overtime work (Table 4). This finding could be explained by that increasing working hours are usually associated with an increased physical load on nurses. This comes in agreement with study conducted by **Yan et al.** ⁽²²⁾ among 6674 nurses in Xinjiang Uygur Autonomous Region. They found that overtime work is a risk factor for MSDs.

The highest percentage of chronic pain was among those working for 5 days/week (Table1). This is similar to **Zayed et al.** ⁽⁵⁾ who revealed that nearly half of nurses with WRMDs symptoms (48.6%) worked three shifts but only (14.8%) of them worked only one shift. These findings could be explained by that increasing working hours are usually associated with an increased physical load and work demands among shift workers and extended working hours. This is incompatible with **Asghari et al.** ⁽²⁴⁾ who reported that number of shifts per week were not associated with the reported symptoms.

There was statistically significant association between work stress and chronic MSDs (Table 4). This comes also in agreement with **Bazazan et al.** ⁽²⁹⁾ who revealed that work schedule and job satisfaction levels among 380 emergency nurses in Iran were significantly associated with the MSDs in different body regions. This disagrees with **Mohamed and Al Amer** ⁽¹⁶⁾ who found that there was no significant association between perceived stress at work environment and low back pain level.

Study limitations:

Considering the findings of this study and their implications, it is important to take into account the limitations of the study: First, this was a cross-sectional study for identifying the temporal relation between potential risk factors and MSDs. It was self-report study, it is possible that our respondents might exaggerate their MSDs and perceived workload. Also may be affected by recall bias since all data collected were self-reported utilizing questionnaires.

CONCLUSION

WMSDs have a great impact on the worker, the organization and the society as a whole. So measures to prevent them are recommended.

RECOMMENDATIONS

Based on the current study results, we recommend adopting some items from NIOSH (The National Institute for Occupational Safety & Health) program to manage WRMDs at Benha University Hospitals. The program includes six steps; 1. Involve hospital administrators. 2. Involve and train hospital workers. 3. Collect medical data. 4. Implement the ergonomic program. 5. Evaluate the ergonomic program. 6. Promote hospital workers recovery through health care management and return-to-work.

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