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The prevalence of work-related musculoskeletal symptoms among surgeons in Riyadh city

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ABSTRACT

Introduction/Importance: Healthcare workers in many specialties are affected by disabling musculoskeletal symptoms and injuries related to the workplace. Ergonomics is the study of aligning the needs of a job and its applications can primarily prevent work-related musculoskeletal disorders (WMD) worldwide. The aim of this paper is to assess the prevalence of WMD in all hospitals in Riyadh, Saudi Arabia and explore any association in regard to individual variables. *Methods:* This is a cross-sectional study using self-administered electronic questionnaires among surgeons working in Riyadh city. *Results:* Of the 327 participants, 77.4% complained of musculoskeletal symptoms, pain being the most reported symptom 89.3%. The most affected body site was the lower back 57%. 47.3% of participants who didn't complain of MSK symptoms slept over 7 hours daily. Only 21.1% of the participants were aware of the recommendations made by the field of surgical ergonomics. *Conclusion:* The prevalence of WMD was 77.4%. About one-fifth only are aware of ergonomics recommendations. We recommend that surgical departments should implement more evidence-based ergonomics training protocols to limit the increasing prevalence of WMD.

Keywords: Work-related musculoskeletal disorders, Surgeons, Saudi Arabia

1. INTRODUCTION

Healthcare workers in many specialties are affected by disabling musculoskeletal (MSK) symptoms and injuries related to the workplace (Alshehri and Alzoughool, 2019; Hashim et al., 2021; Nasaif et al., 2022; Hosseini et al., 2021), known as work-related musculoskeletal disorders (WMD), which are a group of preventable disorders including muscle, tendons and degenerative spine disorders (Epstein et al., 2018; Keyserling, 2000). A cohort study done in France concluded that WMD decreased the quality of life on the physical level (Roux et al., 2005) and another study done in Saudi Arabia mentioned that 37% of surgeons were thinking of early

retirement because of WMD (Alnefaie et al., 2019).

Regarding workplace-related morbidities in the United Kingdom, the Health and Safety Executive report (2011) showed a cost of 13.8 billion euros among ratepayers, with musculoskeletal complications being the most frequent (Alnefaie et al., 2019). WMD are associated with high costs to employers such as absenteeism, lost productivity and disability (Bernard and Putz-Andrson, 1997).

Surgeons' work demands the ability to make critical decisions for their patients, which can cause high stress in the workplace. Other parts of their job as surgeons include daily rounds, surgeries, surgical meetings, teaching, patient consultation and report writing, which leads to high physical demands in the workplace (Ghalaiya et al., 2020).

Many studies have been done abroad, pointing out that surgeons are affected by WMD, which include disk prolapse, carpal tunnel syndrome and pain in the back, neck and shoulder (Forst et al., 2006; Vaghela et al., 2019; Bolduc-Bégin et al, 2017; Alsabah et al., 2018). In a study done at King Abdulaziz University Hospital in Jeddah, 80% suffered from WMD (Alnefaie et al., 2019). Two other studies about WMD among adult reconstructive surgeons and orthopedic trauma surgeons concluded that 66% of surgeons had WMD (Alqahtani et al., 2016; Alqahtani et al., 2016).

Ergonomics is the study of aligning the needs of a job with the ability of the worker and work environment to provide the most efficient workspace possible while simultaneously reducing the risk of injury (Edwards et al., 2022). Ergonomics applications can primarily prevent WMD worldwide (Buckle, 2005).

Although WMD is a common problem for surgeons, only one study in Saudi Arabia has discussed this problem and its significance and it was done in only one hospital in Jeddah City (Alnefaie et al., 2019). Two other studies were done in Dammam city among orthopedic surgeons and the sample was taken from all over the world (Alqahtani et al., 2016; Alqahtani et al., 2016). Also, there is no study in Saudi Arabia evaluating the awareness and practice of ergonomics. This study will estimate the prevalence of WMD in all hospitals in Riyadh, Saudi Arabia and establish any potential association with the demographic data. We will also evaluate the awareness of ergonomics and its practice.

2. MATERIALS AND METHODS

Ethics Consideration

Before collecting the data from the study population, we obtained approval from Prince Sultan Military Medical City Scientific Research Center, IRB approval No.1660. We obtained voluntary consent after explaining the study objectives to the participants. All the data collected from this study were confidential and no personal information was obtained from the participants to ensure their privacy.

Study design and population

This cross-sectional study was conducted from October 2022 to November 2022. Only physicians in the surgical field were enrolled in this study including (General Surgery, Orthopedic Surgery, Urology, Plastic Surgery, Otolaryngology (ENT), Neurosurgery, Obstetrics and Gynecology, Pediatric Surgery, Ophthalmology, Cardiac Surgery, Thoracic Surgery). We collected the study sample by recruiting data collectors that interviewed surgeons from different academic levels (Residents, Specialists/ Registrars, Consultants). A number of tertiary and secondary hospitals were included in the study (Prince Sultan Military Medical Center, King Abdulaziz Medical City, King Saud Medical City, King Fahad Medical City, King Khalid University Hospital, King Salman Bin Abdulaziz Hospital, etc.).

Data collection

Data were collected using a self-administered survey handled by the data collector. Participants were asked to complete a questionnaire that included demographic factors (age, gender, height, weight, medical education level and specialty). The second section aimed to measure their practice hours, specifically operating room hours. The third section assessed their awareness and knowledge about MSK symptoms among surgeons. The last section focused on the prevalence of MSK symptoms and its details, such as location, severity and how much it affects their life and practice.

Data analysis

With a total of 1000 surgeons in Riyadh, the minimum sample size required with a 95% confidence level and a 5% margin of error was determined to be 333 practitioners. Spreadsheets of questionnaire responses were imported from Google Forms and coded using Excel v16.0 (Microsoft, Redmond, WA, USA). The coded data were analyzed using SPSS v24.0 (IBM, Armonk, NY, USA).

Descriptive statistics (mean, standard deviation, frequencies and percentages) were used to describe quantitative and categorical variables. A chi-square test was used for comparison. A P-value <0.05 was considered statistically significant.

3. RESULTS

The study included 327 participants as in Table 1. 75.2% of them were males and 24.8% were females. 38.8% of study participants were consultants, 36.7% were residents and 24.5% were specialists or registrars. As for age, 30% of participants aged 25-30 years old, 22% aged 30- 35 years old and 10.4% aged 51- 60 years old. 29.1% of study participants were smokers. Average sleep hours per day is 6 hours among 43.7% of participants, less than 6 hours in 23.5% and 7 hours in 21.4%.

Number of working hours per week was 40–50 hours in 42.2% of participants, 51- 60 hours in 24.2% of participants and more than 60 hours in 24.8% of participants. Number of hours in the operating room per week was 10- 20 hours among 56.6% of participants, 21–30 hours in 12.5% of participants and more than 30 hours in only 3.4% of participants. It was found that 59.9% of the study participants practiced long surgeries at least once a week (Table1).

Table 1 Socio-demographic characteristics of participants (n=327)

Parameter		No.	%
Degree	Consultant	127	38.8
	Resident	120	36.7
	Specialist / Registrar	80	24.5
Age	25 - 30	98	30.0
	30 - 35	72	22.0
	36 - 40	46	14.1
	41 - 45	37	11.3
	46 - 50	20	6.1
	51 - 60	34	10.4
	60	20	6.1
Gender	Male	246	75.2
	Female	81	24.8
Smoking status	Yes	95	29.1
	No	232	70.9
Average sleep hours per day	<6	77	23.5
	6	143	43.7
	7	70	21.4
	8	35	10.7
	>9	2	.6
Number of working hours per week (h/week)	<40	29	8.9
	40-50	138	42.2
	51-60	79	24.2
	>60	81	24.8
Number of hours in the operating room per week	<10	90	27.5
	10-20	112	34.3
	21-30	41	12.5
	>30	11	3.4
	Other	73	22.3
Practice long surgeries at least once every week	Yes	196	59.9
	No	131	40.1

Regarding operating position, half of the study participants stood all the time, 25.7% stood most of the time and 12.5% stood or sat sometimes. 57.8% of study participants do not exercise at all, 21.4% exercise less than 2 hours a week and 12.2% exercise 2–4 hours a week. 26.5% of all participants suffer from sports injuries (11% are not the same as one's MSK complaint and 16.5% are in

the same area as one's MSK complaint). 21.1% of participants are aware of the recommendations made by the field of surgical ergonomics, while 16.2% apply them in their surgical practice (Table 2).

Table 2 Risk factors of musculoskeletal symptoms among study participants (n=327)

Parameter		N	%
Operating position	Sitting all the time	21	6.4
	Sitting most of the time	16	4.9
	Sometimes sitting/Sometimes standing	41	12.5
	Standing all the time	165	50.5
	Standing most of the time	84	25.7
Exercise hours per week (h/week)	<2	70	21.4
	2-4	40	12.2
	5-7	16	4.9
	>7	12	3.7
	I don't exercise	189	57.8
Suffered any sports injuries	Yes (not the same of my MSK complain)	36	11.0
	Yes (same area of my MSK complain)	54	16.5
	No i haven't suffered of any sport injury	237	72.5
Awareness of the recommendations made by the field of surgical ergonomics	Yes	69	21.1
	No	258	78.9
Applied of this information to surgical practice	Yes	53	16.2
	No	274	83.8
Complain of any Musculoskeletal Symptom	Yes	253	77.4
	No	74	22.6

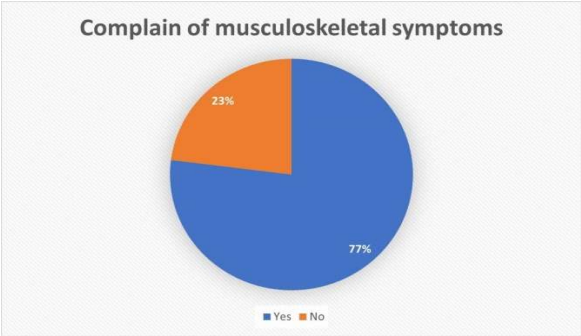

Figure 1 77% of study participants complain of musculoskeletal symptoms

Of 253 participants who suffer from musculoskeletal symptoms, 89.3% describe their complaints as pain, 45.1% fatigue, 33.2% stiffness, and 14.6% numbness. The result showed 79.8% of participants reported musculoskeletal symptoms linked to surgical practice. While 60.1% suffer from symptoms after work while 22.1% suffer during work. It was found that 41.5% use medications to relieve pain, while 36% use physical therapy (only 60% reported symptoms relieved). While 53.4% of patients reported no effect on their quality of life, 31.6% reported limits during daily life activities, 12.6% thought of early retirement due to the symptoms and 10.7% reported limits on completing tasks during work hours. Lower back was the most reported site affected by musculoskeletal pain, followed by upper neck, knees, ankles and neck (Table 3). According to Table 4, there was a significant association between the presence of musculoskeletal pain and average sleeping hours per day and practicing long surgeries at least once a week ($P < 0.05$).

Table 3 Determinants of musculoskeletal pain among participants (n=253)

Parameter		No.	%
Description of musculoskeletal complain	Pain	226	89.3
	Fatigue	114	45.1
	Stiffness	84	33.2
	Numbness	37	14.6
	Other	8	3.16
Symptoms linked to the surgical practice	Yes	202	79.8
	No	51	20.2
Time experiences these symptoms	In the morning	4	1.6
	After work	152	60.1
	During work	56	22.1
	All the day	41	16.2
Symptoms duration	Less than one day	106	41.9
	Up to three days	91	36.0
	More than three days	56	22.1
Attempts to relieve the symptoms	Physical therapy	91	36.0
	Use medication	105	41.5
	Herbal medication	12	4.7
	Nothing	117	46.2
Symptoms relived	Yes	152	60.1
	No	26	10.3
	I did nothing	75	29.6
MSK symptoms effect on quality of life	I haven't experienced any limitations	135	53.4
	Limits me during my daily life activities	80	31.6
	I have thought of early retirement due to the symptoms	32	12.6
	Limits me to complete my task during work hours	27	10.7
Body parts complain from	Lower Back	134	57.0
	Upper back	69	29.4
	Knees	66	28.1
	Neck	60	25.5
	Wrist/Hands	46	19.6
	Hips/Thighs	32	13.6
	Ankles/Feet	62	26.4
	Haven't experienced any trouble	2	0.9
	Elbows	20	8.5
	Shoulders	113	48.1

Table 4 shows the comparison of characteristics between the participants who suffer from musculoskeletal symptoms and the participants who didn't suffer from musculoskeletal symptoms. Of 253 participants who suffered from musculoskeletal symptoms, 30.8% were smokers. Average sleep hours per day in participants who suffer from musculoskeletal symptoms was 6 hours in 47.4%, 24.1% in less than 6 hours and 17.0% in 7 hours of sleep. Number of working hours per week in participants who suffer from musculoskeletal symptoms was 40–50 hours in 42.3% of participants, 51–60 hours in 24.9% of participants and more than 60 hours in 24.5% of participants. In participants with musculoskeletal symptoms, the average number of hours spent in the operating room per week was 10–20 hours in 57.3%, 21–30 hours in 11.9% and more than 30 hours in only 3.2%. According to the findings, 62.8% of study participants with musculoskeletal symptoms perform long surgeries at least once a week.

Table 4 Association between musculoskeletal symptoms with socio-demographic characters, working and sleeping hours of participants (n= 327)

		Complain of any Musculoskeletal Symptoms				Total (N=327)		P value
		Yes		No				
Degree	Consultant	98	38.7%	29	39.2%	127	38.8%	0.818
	Resident	94	37.2%	26	35.1%	120	36.7%	
	Specialist / Registrar	61	24.1%	19	25.7%	80	24.5%	
Age	25 – 30	75	29.6%	23	31.1%	98	30.0%	0.176
	30 – 35	62	24.5%	10	13.5%	72	22.0%	
	36 – 40	34	13.4%	12	16.2%	46	14.1%	
	41 – 45	28	11.1%	9	12.2%	37	11.3%	
	46 – 50	13	5.1%	7	9.5%	20	6.1%	
	51 – 60	23	9.1%	11	14.9%	34	10.4%	
	60	18	7.1%	2	2.7%	20	6.1%	
Gender:	Male	185	73.1%	61	82.4%	246	75.2%	0.103
	Female	68	26.9%	13	17.6%	81	24.8%	
Smoking status	Yes	78	30.8%	17	23.0%	95	29.1%	0.190
	No	175	69.2%	57	77.0%	232	70.9%	
Average sleep hours per day	<6	61	24.1%	16	21.6%	77	23.5%	0.006
	6	120	47.4%	23	31.1%	143	43.7%	
	7	43	17.0%	27	36.5%	70	21.4%	
	8	27	10.7%	8	10.8%	35	10.7%	
	>9	2	0.8%	0	0.0%	2	0.6%	
Number of working hours per week (h/week)	<40	21	8.3%	8	10.8%	29	8.8%	0.874
	40-50	107	42.3%	31	41.9%	138	42.2%	
	51-60	63	24.9%	16	21.6%	79	24.2%	
	>60	62	24.5%	19	25.7%	81	24.8%	
Number of hours in the operating room per week (h/week)	<10	70	27.7%	20	27.0%	90	27.5%	0.955
	10-20	145	57.3%	40	54.0%	185	56.6%	
	21-30	30	11.9%	11	14.9%	41	12.5%	
	>30	8	3.2%	3	4.1%	11	3.4%	
Practice long surgeries at least once every week	Yes	159	62.8%	37	50.0%	196	59.9%	0.047
	No	94	37.2%	37	50.0%	131	40.1%	

4. DISCUSSION

Work-related musculoskeletal symptoms are considered a major health issue in many occupations around the world (Punnett and Wegman, 2004). Especially for surgeons as they have many work duties including performing surgeries, morning rounds, consultations, on calls and clinics which can make these symptoms even worse and can lead to missing some work days, impair their performance and decrease their quality of life (Bernard and Putz-Andrson, 1997). Only one study was done on surgeons working in Saudi Arabia, which was in Jeddah (Alnefaie et al., 2019). In this study, we aimed to obtain a proper and wider view of the prevalence of WMD among surgeons in Riyadh, establish any association with demographics and estimate the prevalence of

ergonomics applications. An important aspect of this study is that the average surgical experience is more than 10 years. The findings of the current study can be summarized as follows: As many as 77.4% of the surgeons are complaining of musculoskeletal symptoms. More than two-thirds of the respondents were not familiar with ergonomic recommendations for surgeons. The most reported body part was lower back followed by shoulders negative correlation between average sleeping hours and musculoskeletal symptoms, which was statistically significant. Those who perform long surgeries at least once every week have musculoskeletal symptoms more than those who don't and this finding was statistically significant.

The result of the present study showed that about 77.4% of the surgeons are experiencing WMD, which is consistent with a study done on surgeons working at King Abdulaziz University Hospital in Jeddah (Alnefaie et al., 2019). This high percentage can be explained by the surgeon's intense workload. In a study done on bariatric surgeons and two other studies done on adult reconstructive surgeons and trauma orthopedic surgeons, in all three studies, 66% of the respondents have musculoskeletal complaints (Alsabah et al., 2018; Alqahtani et al., 2016). The reason for this difference is that the present study included surgeons from various surgical specialties, while the other three studies were focused only on one specialty. Although it's not statistically significant, females were 8% higher than male in reporting musculoskeletal symptoms. This difference was explained in many studies as they have lower pain threshold (Punnett and Herbert, 2000; Fillingim and Ness, 2000). While it was expected that as they get older surgeons will be prone to develop WMD, it was unexpectedly found that older surgeons experienced less symptoms compared to younger ones. Many factors may explain this finding, as they can get more experienced regarding their techniques and skills, which help them, reduce the risk of WMD and they may be able to apply some coping strategies with the work stress and load (Alnefaie et al., 2019). The most reported symptoms were pain, fatigue and stiffness which limit one-third from doing daily activity and 12.6% are considering early retirement. These symptoms mentioned earlier made more than half of them seek medical attention and use medication to relieve the symptoms, while the most reported sites were lower back and shoulder, which was consistent with another study done among surgeons in India (Vaghela et al., 2019). This could have resulted from the operator's position as 75% of the surgeons do the procedures in the standing position (Dolan and Martin, 2001).

About 80% of the surgeons believed that their WMDs are linked to their surgical practice. In the current study, a statistically significant finding supports this statement, as those who practice long surgeries once a week or more are at a higher risk of developing WMD. An interesting statistically significant finding regarding the association between average sleeping hours and musculoskeletal complaints we identified a U-shaped relationship that was consistent with a study done on the adult Korean population (Chun et al., 2018). Although in another study investigating WMD among surgeons, they found no obvious association (Alnefaie et al., 2019). These variations in the previous studies can be explained by sample size variation as well as the method of investigating the association between sleep pattern and WMD.

One of the ways to minimize WMD is through ergonomic application, which is concerned with the understanding of the interaction between humans and the elements of the system. In a systematic review done, there were three studies reporting low productivity and after implementing ergonomics, they noticed a decrease in lost working days, musculoskeletal symptoms and sick leaves (Rivilis et al., 2008). In order to prevent WMD, Kroemer, (1989) recommended surgeons to avoid some specific activities, including repetitive movements with significant power, holding the body segment in an extreme position, prolonged static posture and other activities. Regarding the elements of the operating room, there are multiple ergonomic hazards including inadequate lighting, pressure areas caused by instruments, posture while holding retractors and the height of the operating room table, which can cause back and neck problems if the height of the table is not appropriate for the surgeon (Matern and Koneczny, 2007; Catanzarite et al., 2018). In the present study, most of the surgeons were not aware of ergonomic recommendations. This is due to many reasons, including the lack of implementation of ergonomics interventions to limit surgeons' injuries and the fact that evidence-based ergonomics training protocols are not implemented at hospitals or included in residency programs.

The main limitation of this research is that the respondents' answers may not reflect their actual actions. We tried our best to minimize the bias by investigating more and asking detailed questions. One of the aspects that we focused on was the generalizability of the current study by including surgeons from every hospital in Riyadh.

5. CONCLUSIONS

The present study shows that about seventy eight percent of surgeons are complaining of WMD. Short average sleep hours, practicing long surgeries and the operator's position are probable risk factors for WMD. About one-fifth only are aware of ergonomics recommendations. WMDs limit almost one-third of the surgeons from preceding their daily activities. Our recommendations for program directors are that more evidence-based ergonomics training protocols should be implemented in the residency training programs, as these protocols are well proven to prevent WMD.

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Author Contributions

All authors contributed equally to the conceptualization, visualization, study design, methodology and review of available data, resources, writing-original draft, writing-review and editing and project administration of this paper.

Institutional Review Board Statement

Ethical approval Project No. 1660 was obtained from the Institutional Review Board (IRB) of the Prince Sultan Military Hospital on November 21, 2022.

Informed Consent Statement

The informed consent form stated that participation was voluntary, that the data were collected for research purposes only, that self-identifying information such as name, university number and phone number would not be collected and that confidentiality and privacy would be maintained during all the phases of the study.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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