

# Prevalence of Low Back Pain and Its Associated Risk Factors among Female Nurses Working in a tertiary hospital in Dhahran, Eastern Province, Saudi Arabia

Rasha H. Alziyadi (1)  
 Mohamed H. Elgezery (2)  
 Reham H. Alziyadi (3)

(1) Family medicine department, Ministry of health, Riyadh city, Saudi Arabia

(2) Preventive medicine department, King Fahad Military Medical Complex, Dhahran region, Saudi Arabia

(3) Medical intern, Faculty of medicine, Taif university, Saudi Arabia

## Corresponding author:

Dr. Rasha H. Alziyadi  
 Family medicine department,  
 Ministry of Health,  
 Riyadh city,  
 Saudi Arabia  
 Mobile No. : +966530273333  
 Email: dr\_rasho0o@hotmail.com

Received: November 2020; Accepted: December 2020; Published: January 1, 2021.

Citation: Rasha H. Alziyadi, Mohamed H. Elgezery, Reham H. Alziyadi. Prevalence of Low Back Pain and Its Associated Risk Factors among Female Nurses Working in a tertiary hospital in Dhahran , Eastern Province, Saudi Arabia. World Family Medicine. 2020; 19(1): 173-182 DOI: 10.5742/MEWFM.2021.93967

## Abstract

**Background:** Nurses are exposed to some work-related activities and body positions that affect their musculoskeletal system and predispose them to pain, particularly in the shoulder and back regions. Low back troubles (LBT) affect the quality of life and have grave effects on economics and work because of sick leave and absenteeism.

**Objective:** The aim of this study was to estimate the prevalence of low back pain and to assess the risk factors associated with it among nurses working in tertiary hospital in Dhahran in the Eastern Province in Saudi Arabia.

**Methods:** Nurses working in a tertiary hospital in Dhahran were asked to fill in a self-administered questionnaire that included a section of LBT adapted from the previously validated and modified version of the Standardized Nordic Questionnaire of Musculoskeletal Symptoms.

**Results:** The prevalence of LBT was 74.1% and out of the respondents 44.3% had an attack during the last week. Multivariate analysis revealed that risk factors significantly associated with LBT were moving wheelchair, bending and standing (increasing

the risk), longer breaks, trolley moving, positioning patients, moving beds, and longer sitting time (decreasing the risk).

**Conclusion:** LBT was highly prevalent among nurses, irrespective of their age, body mass index, department and work experience. Risk factors included short breaks and sitting time, long standing times, and some work activities (wheelchair, trolley or bed moving, positioning patients). We recommend that hospital administrations arrange proper rest periods for at-risk staff. Also, nurses should be educated about proper body mechanics when lifting heavy objects.

**Key words:** low back pain; nurse; work; survey; Saudi Arabia.

## Introduction

Low back pain is one of the most common complaints among the general population. It is thought to be one of the greatest causes of disability globally. Low back pain is estimated as the sixth cause of overall disease burden worldwide (1). Low back pain originating from occupational hazard is an important cause of disability (2).

Health care workers encounter low back pain more than other occupational groups with highest prevalence reported in nurses (3, 4). Worldwide, a number of studies have been carried out to investigate the prevalence of low back pain among nurses. The prevalence varied from 40.6% in Hong Kong, to as high as 70% and even more in Gaza, Nigeria, and Switzerland (5-8).

Since nursing is a high stress job, there are many risk factors that participate to the occurrence of low back pain such as high physical workload, standing for a long time, carrying patients and lifting heavy objects, as well as long working hours especially in surgical departments (3, 9).

Several studies have reported that low back pain may be associated with negative consequences among nurses such as decreased productivity and increased absenteeism from work (10).

In Saudi Arabia, few epidemiological studies have investigated the prevalence of low back pain and its associated risk factors among nurses, especially in the eastern region. More local information and studies are needed to improve the working environment and to enhance the occupational safety for nurses. Hence, the aim of this study was to estimate the prevalence of low back pain and to assess the risk factors associated with it among nurses working in a tertiary hospital in Dhahran in the Eastern Province of Saudi Arabia.

## Methods

**Study setting:** This study was conducted in a tertiary hospital located in Dhahran city in the Eastern Province of the Kingdom of Saudi Arabia.

**Study design:** This study had a cross sectional design.

**Study population:** The target population of the study were female nurses working in a tertiary hospital in Dhahran . The total number of nurses was around 790 nurses.

### Eligibility criteria:

- **Inclusion criteria:**  
All working Saudi and non-Saudi registered female nurses.
- **Exclusion criteria:**
  - Male nurses.
  - Pregnant ladies.
  - Nurses with back pain before getting the job.
  - Nurses with previous history of surgery.

**Sample size:** Thirty percent of the total number of female nurses that fit with the inclusion criteria were selected to participate in the study.

**Sampling technique:** Stratified random sampling technique was used. The hospital was divided into different wards and functioning units. Thirty percent of each stratum was chosen randomly.

**Data collection tool:** Self-administered questionnaire was used including a section about demographic data regarding age, weight, height and number of children and pregnancy, the second part is about working conditions regarding patient care activity and the third part is concerned about low back trouble that was adapted from the previously validated and modified version of the Standardized Nordic Questionnaire of Musculoskeletal Symptoms (SNQ) that was established by Kuorinka et al. (11).

**Data collection technique:** The questionnaire was collected from nurses in their place of work.

### Study variables:

(a) The dependent variable was low back pain, which was defined as any ache or discomfort in the spinal region (between the lower costal margin and gluteal fold) whether or not extending from there to one or both legs at least one day during the past 12 months (11, 12).

(b) The independent variables included age, height, weight, number of children, level of physical activity, length of employment, working department, and working hours.

Data entry and analysis:

Data analysis was carried out using SPSS version 22 for windows. Numerical variables were checked for normality by Shapiro Wilk test. All numerical variables were found to follow normal distribution; therefore, values were summarized as mean  $\pm$  standard deviation and Independent samples T test was performed for comparison between nurses with and without LBT. For qualitative data, Pearson's Chi square test was used to examine association between sex and age groups. Backward stepwise binary logistic regression was carried out to predict the risk factors of LBT. Significance was adopted at  $p < 0.05$  for interpretation of results of tests.

**Pilot study:** The questionnaire was pretested initially among 10% of nurses to test the tool, methodology, and the analysis for modification if needed.

**Ethical considerations:** The study received ethical approval from the Institutional Review Board of the tertiary Hospital in Dhahran city, Kingdom of Saudi Arabia. Confidentiality of the collected data and participant's privacy were assured, and the data were used only for research purposes. Written informed consent was obtained from each participant. The study did not have any physical, psychological, social, legal, economic, or any other anticipated risks to participants, and it did not present a direct benefit for the study's participants.

## Results

In this study, 263 nurses responded to the questionnaire. Figure 1 shows that the majority of respondents had a history of suffering from low back pain ( $n = 195, 74.1\%$ ). Table 1 and Figures 2 and 3 show the characteristics of LBT in the respondents. The majority have not been hospitalized nor had to change jobs because of LBT, while only 7.2% were hospitalized and 6.2% changed their jobs/duties. About half of the nurses who suffered LBT had an attack of pain that lasted one week or less, while 13% suffered an episode that extended more than 30 days (but not daily pain). About half the nurses with LBT had to reduce their work and leisure activities during the last 12 months. The total length of time (during which LBT prevented accomplishing normal activities ranged from one to seven days in 53.8% of respondents. Most respondents with LBT (78.9%) did not consult a doctor or any specialist for this pain during the last 12 months. As regards recent attacks of LBT, 44.3% had pain during the last 7 days.

Table 2 shows the sociodemographic characteristics of the respondents and their association with low back pain. The mean age was 36 years old. Half the respondents had one or no pregnancy and one or no children. The average body mass index was 26.1. The median years of work was 10 years with interquartile range = 6 – 16 years. As regards the current department, 18.3% of respondents worked in orthopedic, 17.9% in pediatric, and 16.3% in internal medicine departments. Most respondents (78.7%) worked for more than two years in their current departments and had shifts (84%). The average hours of work per week was 48. About two thirds had two breaks daily. There was no significant association of any of these respondents' characteristics and the occurrence of LBT.

Table 3 demonstrates frequency of work activities that can cause low back pain in nurses with and without LBT. The activities included trolley or chair pushing, positioning patients, helping patients get to toilet or taking bath, ambulation of patients, moving furniture and bed, and bending. There was no significant association of any of these activities and the occurrence of LBT.

Table 4 outlines other daily activities and their association with LBT. Most nurses used to stand or walk 4 hours or more and sit for two hours or less. Also, exercise was practiced by less than half the nurses (with or without LBT). A significantly higher percentage of nurses with LBT used to sit for less than two hours. Standing and walking were not significantly associated with LBT. Although the percentage of nurses with LBT who practiced exercise was less than those without LBT (39.5% vs 48.5% respectively), this difference did not reach statistical significance. Neither the frequency of exercise nor its duration was significantly different between the two groups.

Table 5 shows the results of a backward stepwise binary logistic regression analysis that was carried out to identify risk factors of LBT in the respondents. Sociodemographic factors and activities of nurses were included in the first step of the analysis, then in each step a variable was excluded that did not contribute significantly to the model. The factors that contributed significantly were retained to the last step. Some factors had a p value of Wald test above 0.05, but modified other significant factors, so they were also retained. Factors that increased significantly the risk of LBT included moving wheelchair, bending and standing; each increasing the risk by two fold for each increase in times of activities. Factors that were associated with decreased risk included longer breaks, trolley moving, positioning patients, moving beds, and sitting; each decreasing the risk to half or less for each decrease in duration or times of the activity.

## Discussion

Many health care workers are exposed to some work-related activities and body positions that affect their musculoskeletal system and predispose them to pain, particularly in the shoulder and back regions (13-15). Nurse work involves activities such as bending, twisting, lifting of heavy objects, and awkward static posture that are likely to cause back pain (12, 16-18). LBT affects the quality of life and has grave effects on economics and work as it leads to sick leave and absenteeism.

We found the prevalence of LBT high among our respondents as the majority of respondents (74.1%) had a history of LBT and out of them 44.3% had an attack during the last week; which is in line with other studies that were conducted in Saudi Arabia and worldwide. The reported rates from Saudi Arabia were 84.4 % from Taif (19) and 76.5 % from Mecca (20). Other reported rates worldwide were 75% in Greek nurses (21), 71% in Japan (22), 86% in Italian nurses (23), 76% in Dutch nurses (14), 82% in Taiwan (24), and 79.3% in Egypt (25). The rate of this prevalence is much greater than that for the general population which is 18.8% in Saudi Arabia (26). Moreover, the rate of LBT in the present study is even higher than rates reported by previous studies which were 46% in Nigeria (27), 54.7% in Japan (17), 51% in Tunisia (13), 30% in Ireland (28), and 61.3% in Turkey (4).

Although health workers in general (doctors, nurses, dentists) are at high risk of suffering from LBT, nurses seem to have an even higher risk (4, 12, 14, 17, 21, 27, 29-34). This may explain the higher rate found in our study as many of the previous studies included other health care workers besides nurses. Potentially contributing factors to this high rate in nurses are the nature of their work activities as well as the greater susceptibility of women generally to back pain, as this type of pain was more commonly reported by women than men (4, 13, 20, 35, 36). The high prevalence of LBT among nurses may reflect the unawareness of body mechanics and lack of back muscles fitness

Figure 1: prevalence of low back trouble among the respondents.

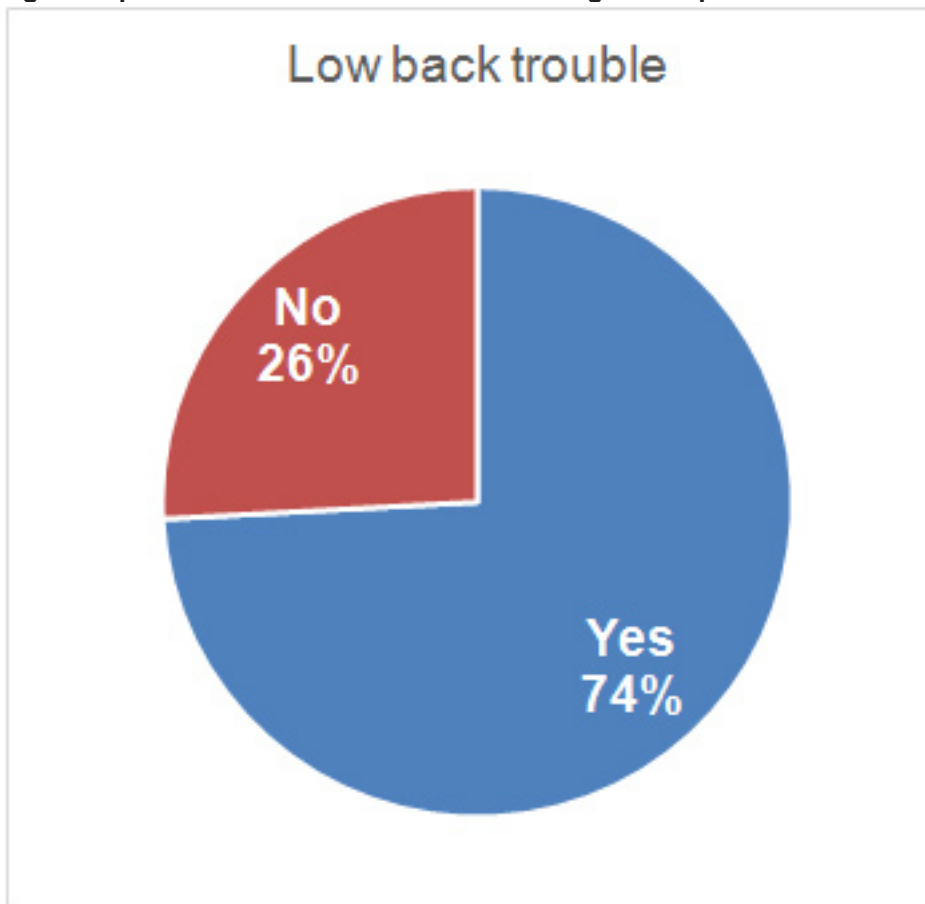


Table 1: Characteristics and effects of low back trouble (LBT) on the studied nurses (n = 195).

		n	%
2- Have you ever been hospitalized because of LBT	no	180	92.8%
	yes	14	7.2%
3- Have you ever had to change jobs or duties because of LBT?	no	182	93.8%
	yes	12	6.2%
4- What is the total length of time that you have had LBT pain during the last 12 months?	0 day	24	12.4%
	1-7 day	106	54.9%
	8-30 day	22	11.4%
	more than 30 day, but not every day	25	13.0%
	every day	16	8.3%
5a- Has LBT caused you to reduce your work activity during the last 12 months?	no	87	50.0%
	yes	87	50.0%
5a- Has LBT caused you to reduce your leisure activity during the last 12 months?	no	95	54.9%
	yes	78	45.1%
6- What is the total length of time that LBT has prevented you from doing your normal work (at home or away) during the last 12 months?	0 day	58	33.5%
	1-7 day	93	53.8%
	8-30 day	14	8.1%
	more than 30 day	8	4.6%
7- Have you been seen by a doctor, physiotherapist, chiropractor or other such person because of LBT during the last 12 months?	no	138	78.9%
	yes	37	21.1%
8- Have you had LBT at any time during the last 7 days?	no	97	55.7%
	yes	77	44.3%

LBT: low back trauma; n: number.

Figure 2: Effects of low back trouble (LBT) on the respondents

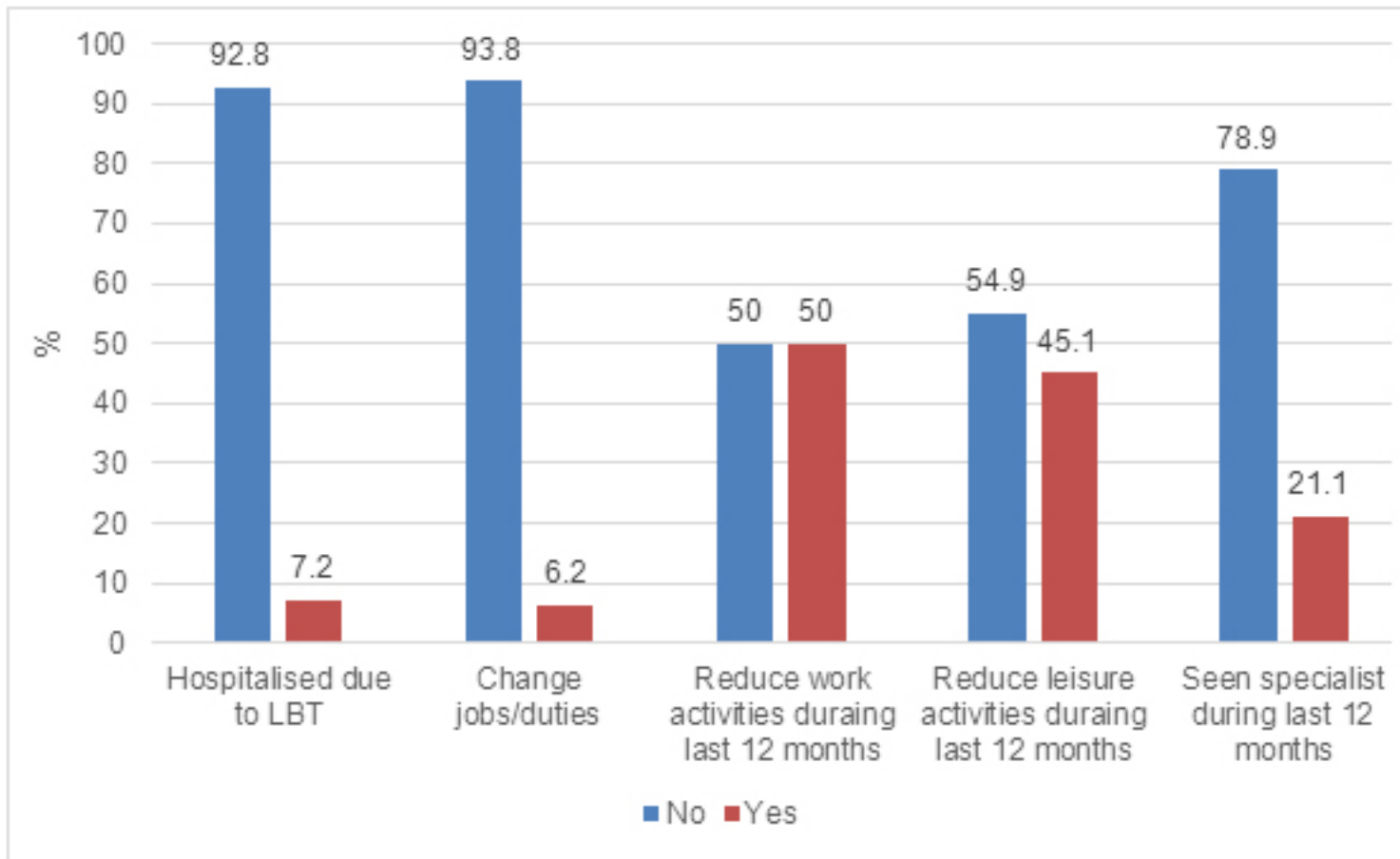
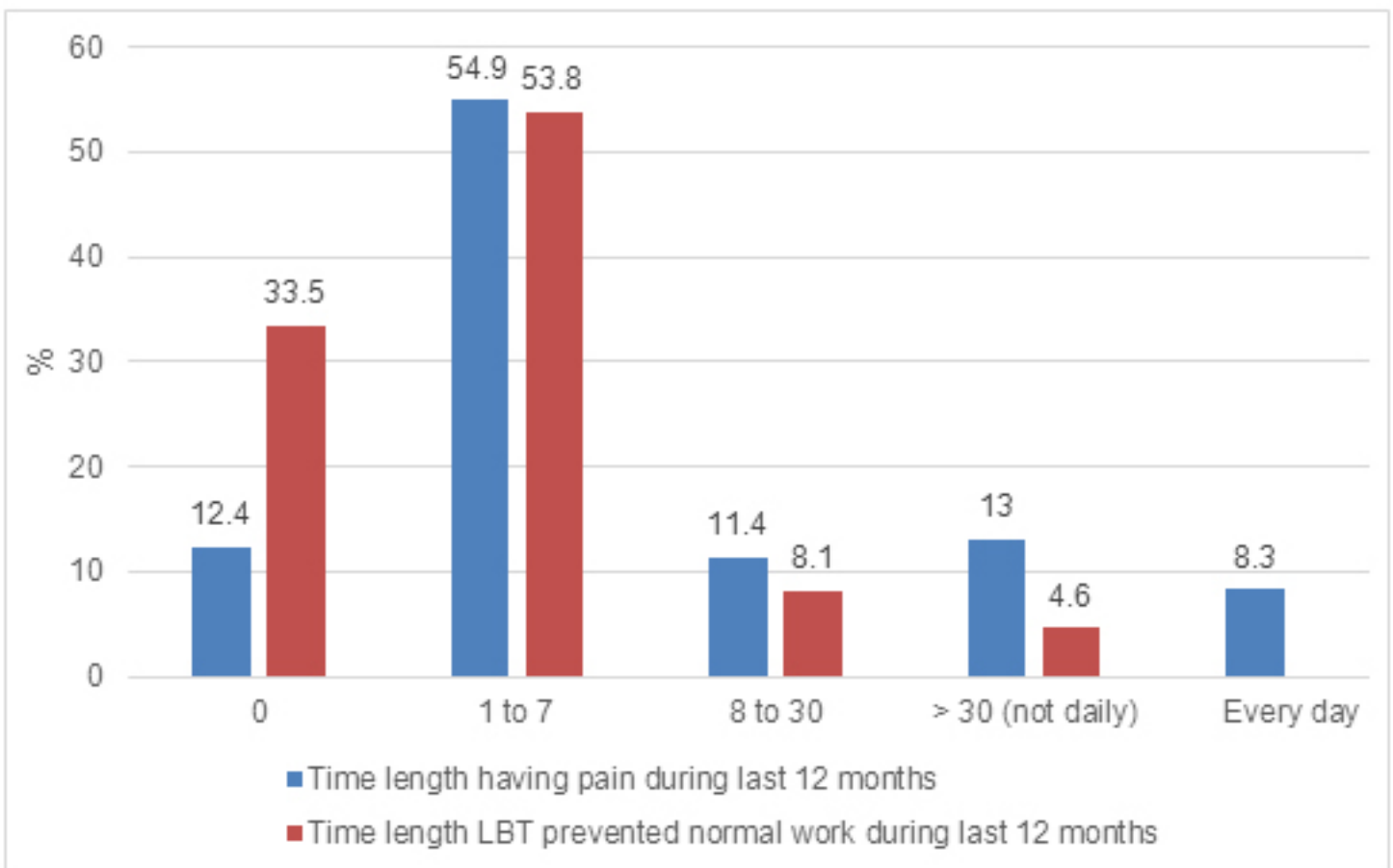


Figure 3: Time length of having pain or and prevention of normal work during the last 12 months in respondents with low back trouble (LBT)



**Table 2: Association between low back trouble (LBT) and sociodemographic characteristics of the studied nurses (total number = 263).**

		Total (n = 263)		No LBT (n = 68)		LBT (n = 195)		p
Age mean $\pm$ SD		36 $\pm$ 8		36 $\pm$ 9		36 $\pm$ 8		0.664
Pregnancy Median, IQR		1 0 to 2		1 0 to 2		1 0 to 2		
Child Median, IQR		1 0 to 2		1 0 to 2		1 0 to 2		
BMI Median, IQR		26.1 4.7		26.8 5.4		25.9 4.4		0.162
Years Median, IQR		10 6 to 16		10 6 to 15		10 6 to 16		0.904
Department n, %	surgery	34	12.9%	8	11.8%	26	13.3%	0.425
	medical	43	16.3%	6	8.8%	37	19.0%	
	pediatrics	47	17.9%	16	23.5%	31	15.9%	
	ICU	16	6.1%	6	8.8%	10	5.1%	
	OB	16	6.1%	3	4.4%	13	6.7%	
	ER	23	8.7%	6	8.8%	17	8.7%	
	OR	22	8.4%	4	5.9%	18	9.2%	
	OPD	48	18.3%	15	22.1%	33	16.9%	
CW	14	5.3%	4	5.9%	10	5.1%		
Duration of work in the present department n, %	less than 1 year	27	10.3%	6	8.8%	21	10.8%	0.888
	1-2 years	29	11.0%	8	11.8%	21	10.8%	
	more than 2 years	207	78.7%	54	79.4%	153	78.5%	
Type	fixed	42	16.0%	12	17.6%	30	15.4%	0.661
	shift	221	84.0%	56	82.4%	165	84.6%	
Average work hours per week mean $\pm$ SD		48 $\pm$ 6		49 $\pm$ 5		48 $\pm$ 7		0.114
Breaks	1	69	26.2%	13	19.1%	56	28.7%	0.297
	2	160	60.8%	45	66.2%	115	59.0%	
	more than 2 per day	34	12.9%	10	14.7%	24	12.3%	

IQR: interquartile range; LBT: low back trauma; n: number; SD: standard deviation.

**Table 3: The association between work activities that can cause low back pain and occurrence of low back trouble (LBT) pain (n = 263).**

Activity	LBT	Number of times per day doing the activity				p
		not done or less than 2 times per day	2-5 times per day	6-10 times per day	more than 10 times per day	
Trolley	no	38 (55.9%)	18 (26.5%)	8 (11.8%)	4 (5.9%)	0.404
	yes	98 (50.3%)	71 (36.4%)	19 (9.7%)	7 (3.6%)	
Chair	no	38 (55.9%)	24 (35.3%)	3 (4.4%)	3 (4.4%)	0.444
	yes	113 (57.9%)	52 (26.7%)	17 (8.7%)	13 (6.7%)	
Position	no	14 (20.6%)	28 (41.2%)	16 (23.5%)	10 (14.7%)	0.565
	yes	47 (24.1%)	64 (32.8%)	58 (29.7%)	26 (13.3%)	
Toilet	no	42 (61.8%)	16 (23.5%)	6 (8.8%)	4 (5.9%)	0.860
	yes	112 (57.4%)	47 (24.1%)	25 (12.8%)	11 (5.6%)	
Bath	no	52 (76.5%)	12 (17.6%)	4 (5.9%)	0 (0.0%)	0.674
	yes	139 (71.3%)	44 (22.6%)	9 (4.6%)	3 (1.5%)	
Ambulation	no	39 (57.4%)	20 (29.4%)	3 (4.4%)	6 (8.8%)	0.756
	yes	97 (49.7%)	70 (35.9%)	9 (4.6%)	19 (9.7%)	
Furniture	no	25 (36.8%)	24 (35.3%)	7 (10.3%)	12 (17.6%)	0.774
	yes	62 (31.8%)	73 (37.4%)	28 (14.4%)	32 (16.4%)	
Move bed	no	30 (44.1%)	18 (26.5%)	6 (8.8%)	14 (20.6%)	0.100
	yes	71 (36.4%)	81 (41.5%)	19 (9.7%)	24 (12.3%)	
Bend	no	24 (35.3%)	25 (36.8%)	8 (11.8%)	11 (16.2%)	0.129
	yes	48 (24.6%)	62 (31.8%)	39 (20.0%)	46 (23.6%)	

LBT: low back trauma; n: number; \* significant at  $p < 0.05$ .

**Table 4: Association between daily activities and occurrence of low back trouble (LBT) pain (n = 263).**

		No LBT (n = 68)		LBT (n = 195)		P
		n	%	n	%	
Standing	less than 2 hours	2	2.9%	6	3.1%	0.706
	2-4 hours	4	5.9%	7	3.6%	
	4 hours or more	62	91.2%	182	93.3%	
Sitting	less than 2 hours	48	70.6%	165	84.6%	0.011*
	2 hours or more	20	29.4%	30	15.4%	
Walking	less than 4 hours	13	19.1%	25	12.8%	0.203
	4 hours or more	55	80.9%	170	87.2%	
Exercise	no	35	51.5%	118	60.5%	0.193
	yes	33	48.5%	77	39.5%	
Times	less than 2 sessions per week	24	72.7%	50	64.9%	0.426
	3 to 5 sessions per week	9	27.3%	22	28.6%	
	5 or more sessions per week	0	0.0%	5	6.5%	
Length	20 min per session with some sweating or increased breathlessness	19	57.6%	42	54.5%	0.681
	20 min per session with high sweating or increased breathlessness	1	3.0%	7	9.1%	
	30 min per session with some sweating or increased breathlessness	13	39.4%	28	36.4%	

LBT: low back trauma; n: number; \* significant at  $p < 0.05$ .

**Table 5: Backward stepwise binomial logistic regression analysis of risk factors and prevalence of low back pain among hospital staff (n = 263).**

	p	Odds ratio	95% C.I. for odds ratio	
			Lower	Upper
Breaks	.087	.510	.236	1.102
Trolley	.044*	.432	.191	.976
Chair	.042*	2.417	1.031	5.664
Position	.085	.573	.304	1.080
Move bed	.039*	.523	.283	.969
Bend	.024*	2.032	1.096	3.770
Standing	.090	2.327	.875	6.185
Sitting	.031*	.281	.088	.891
Constant	.138	10.905		



We investigated the association between LBT and various risk factors that encompassed sociodemographic characteristics, lifestyle, and work activities and duration. The occurrence of LBT in the present study was not associated with age, number of pregnancies or siblings, BMI, duration of work, and departments. Similarly, Homaid et al. (20) did not find a statistically significant relationship between LBT and age, BMI, specialty, or work experience. This is in contrast to other studies that reported the presence of a significant relationship of some of these factors with LBT (4, 25, 36). Yassi et al. (36) and Karahan et al. (4) found that younger individuals had a higher prevalence of LBT than the older age group and attributed this to the allocation of younger and less experienced staff to more physically demanding work. Also other studies have reported that LBT was more common among nurses aged 30 - 40 years and in age group 20 – 30 years (25, 37, 38). In addition, a study showed – in contrast to our results – that nurses working in an ICU are at a higher risk of developing back pain (39). Again these contrasts could be partially explained by differences in the study population as studies involved a variety of health workers. There was no significant difference in BMI between nurses with and without LBT in this study, which is in agreement with Aljeesh, and Nawajha (6). However, a BMI of 30 kg/m<sup>2</sup> was significantly associated with LBT in other studies (13, 25).

Many lifestyle factors were condemned in literature as potential risk factors for LBT, including sedentary life and standing for long periods (4, 13, 27, 40, 41). Also, work related activities that demand lifting heavy objects or bending, play a role in precipitation of back injuries and pain (16, 27, 32). However, the only factors in our study that were found to be significantly associated with LBT were moving chair, bending and standing (increasing the risk), longer breaks, trolley moving, positioning patients, moving beds, and longer sitting time (decreasing the risk).

Similar activities were revealed by previous studies to be risk factors of LBT. French et al (31) have shown that nurses attributed their LBT mainly to transferring and lifting patients without assistance (4) and that the percentage of LBT was higher among health care workers that performed such activities while neglecting sound body mechanics. However, one study in Taiwan (24) and a systematic review (42) reported the absence of significant association between workplace manual work and low back pain.

This study was subject to some limitations. Being a questionnaire-based study, it was amenable to recall bias. Also, nurses who suffered from back pain may have been more willing to participate. Finally, work psychological stress was not investigated in this study, but it was mentioned as a potential risk factor (4).

### Limitations

This study was limited by its cross-sectional nature that revealed associations between variables without revealing the causal relationship.

### Conclusion

This study found a high prevalence of LBT among nurses, irrespective of their age, BMI, department and work experience. Risk factors included short breaks and sitting time, long standing times, and some work activities (wheelchair, trolley or bed moving, positioning patients). It is recommend that hospital administrations arrange proper rest periods for at-risk staff. Also, nurses should be educated about proper body mechanics when lifting heavy objects.

### References

1. Buchbinder R, Blyth FM, March LM, Brooks P, Woolf AD, Hoy DG. Placing the global burden of low back pain in context. *Best Practice & Research Clinical Rheumatology* 2013;27(5):575-589.
2. Driscoll T, Jacklyn G, Orchard J, Passmore E, Vos T, Freedman G, et al. The global burden of occupationally related low back pain: estimates from the Global Burden of Disease 2010 study. *Annals of the rheumatic diseases* 2014;73(6):975-981.
3. Jensen JN, Holtermann A, Clausen T, Mortensen OS, Carneiro IG, Andersen LL. The greatest risk for low-back pain among newly educated female health care workers; body weight or physical work load? *BMC musculoskeletal disorders* 2012;13(1):87-93.
4. Karahan A, Kav S, Abbasoglu A, Dogan N. Low back pain: prevalence and associated risk factors among hospital staff. *Journal of advanced nursing* 2009;65(3):516-524.
5. Yip YB. A study of work stress, patient handling activities and the risk of low back pain among nurses in Hong Kong. *Journal of advanced nursing* 2001;36(6):794-804.
6. Aljeesh Y, Nawajha S. Determinants of low back pain among operating room nurses in gaza governmental hospitals. *J Al Azhar Univ Gaza (Nat Sci)* 2011;14:41-54.
7. Sopajareeya C, Viwatwongkasem C, Lapvongwatana P, Hong O, Kalampakorn S. Prevalence and risk factors of low back pain among nurses in a Thai public hospital. *Journal of the Medical Association of Thailand = Chotmaihet thangphaet* 2009;92 Suppl 7:S93-99.
8. Maul I, Laubli T, Klipstein A, Krueger H. Course of low back pain among nurses: a longitudinal study across eight years. *Occup Environ Med* 2003;60(7):497-503.
9. Al-Eisa E, Al-Abbad H. Occupational back pain among rehabilitation nurses in Saudi Arabia: The influence of knowledge and awareness. *Workplace health & safety* 2013;61(9):401-407.
10. Al Dajah S, Al Daghdhi A. Prevalence and risk factors of low back pain among nurses in Sudayr region. *European Scientific Journal, ESJ.* 2013;9(33):198-205.
11. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, et al. Standardised Nordic questionnaires for the analysis of musculoskeletal symptoms. *Applied ergonomics* 1987;18(3):233-237.
12. Yip VYB. New low back pain in nurses: work activities, work stress and sedentary lifestyle. *Journal of advanced nursing* 2004;46(4):430-440.

13. Bejia I, Younes M, Jamila HB, Khalfallah T, Salem KB, Touzi M, et al. Prevalence and factors associated to low back pain among hospital staff. *Joint Bone Spine* 2005;72(3):254-259.
14. Bos E, Krol B, van der Star L, Groothoff J. Risk factors and musculoskeletal complaints in non-specialized nurses, IC nurses, operation room nurses, and X-ray technologists. *International archives of occupational and environmental health* 2007;80(3):198-206.
15. Landry MD, Raman SR, Sulway C, Golightly YM, Hamdan E. Prevalence and risk factors associated with low back pain among health care providers in a Kuwait hospital. *Spine* 2008;33(5):539-545.
16. Engkvist I-L, Hagberg M, Hjelm EW, Menckel E, Ekenvall L, Group PS. The accident process preceding overexertion back injuries in nursing personnel. *Scandinavian journal of work, environment & health* 1998;367-375.
17. Ando S, Ono Y, Shimaoka M, Hiruta S, Hattori Y, Hori F, et al. Associations of self estimated workloads with musculoskeletal symptoms among hospital nurses. *Occupational and environmental medicine*. 2000;57(3):211-216.
18. Karahan A, Bayraktar N. Determination of the usage of body mechanics in clinical settings and the occurrence of low back pain in nurses. *International Journal of Nursing Studies* 2004;41(1):67-75.
19. Keriri H. Prevalence and risk factors of low back pain among nurses in operating rooms, Taif, Saudi Arabia. *Am J Res Commun* 2013;1(11):25-31.
20. Homaid MB, Abdelmoety D, Alshareef W, Alghamdi A, Alhozali F, Alfahmi N, et al. Prevalence and risk factors of low back pain among operation room staff at a Tertiary Care Center, Makkah, Saudi Arabia: a cross-sectional study. *Annals of occupational and environmental medicine* 2016;28(1):1-9.
21. Alexopoulos EC, Burdorf A, Kalokerinou A. A comparative analysis on musculoskeletal disorders between Greek and Dutch nursing personnel. *International archives of occupational and environmental health* 2006;79(1):82-88.
22. Smith DR, Mihashi M, Adachi Y, Koga H, Ishitake T. A detailed analysis of musculoskeletal disorder risk factors among Japanese nurses. *Journal of safety research*. 2006;37(2):195-200.
23. Lorusso A, Bruno S, L'abbate N. A review of low back pain and musculoskeletal disorders among Italian nursing personnel. *Industrial health* 2007;45(5):637-644.
24. Lin P-H, Tsai Y-A, Chen W-C, Huang S-F. Prevalence, characteristics, and work-related risk factors of low back pain among hospital nurses in Taiwan: a cross-sectional survey. *International journal of occupational medicine and environmental health* 2012;25(1):41-50.
25. Abou El-Soud AM, El-Najjar AR, El-Fattah NA, Hassan AA. Prevalence of low back pain in working nurses in Zagazig University Hospitals: an epidemiological study. *Egyptian Rheumatology and Rehabilitation* 2014;41(3):109-113.
26. Al-Arfaj AS, Al-Saleh SS, Alballa SR, Al-Dalaan AN, Bahabri SA, Al-Sekeit MA, et al. How common is back pain in Al-Qaseem region. *Saudi medical journal* 2003;24(2):170-173.
27. Omokhodion F, Umar U, Ogunnowo B. Prevalence of low back pain among staff in a rural hospital in Nigeria. *Occupational Medicine* 2000;50(2):107-110.
28. Cunningham C, Flynn T, Blake C. Low back pain and occupation among Irish health service workers. *Occupational Medicine* 2006;56(7):447-454.
29. Corona G, Amedei F, Miselli F, Padalino M, Tibaldi S, Franco G. Association between relational and organizational factors and occurrence of musculoskeletal disease in health personnel. *Giornale italiano di medicina del lavoro ed ergonomia* 2005;27(2):208-212.
30. Engels JA, Van Der Gulden J, Senden TF, van't Hof B. Work related risk factors for musculoskeletal complaints in the nursing profession: results of a questionnaire survey. *Occupational and environmental medicine* 1996;53(9):636-641.
31. French P, Flora LFW, Ping LS, Bo LK, Rita WHY. The prevalence and cause of occupational back pain in Hong Kong registered nurses. *Journal of advanced Nursing* 1997;26(2):380-388.
32. Smith DR, Wei N, Zhao L, Wang R-S. Musculoskeletal complaints and psychosocial risk factors among Chinese hospital nurses. *Occupational medicine* 2004;54(8):579-582.
33. Smith DR, Choe M-A, Yang Jeon M, Ran Chae Y, Ju An G, Sim Jeong J. Epidemiology of musculoskeletal symptoms among Korean hospital nurses. *International journal of occupational safety and ergonomics* 2005;11(4):431-440.
34. Vieira ER, Kumar S, Coury HJ, Narayan Y. Low back problems and possible improvements in nursing jobs. *Journal of advanced nursing* 2006;55(1):79-89.
35. Menzel NN, Brooks SM, Bernard TE, Nelson A. The physical workload of nursing personnel: association with musculoskeletal discomfort. *International journal of nursing studies* 2004;41(8):859-867.
36. Yassi A, Khokhar J, Tate R, Cooper J, Snow C, Vallentyne S. The epidemiology of back injuries in nurses at a large Canadian tertiary care hospital: implications for prevention. *Occupational Medicine* 1995;45(4):215-220.
37. Sikiru L, Hanifa S. Prevalence and risk factors of low back pain among nurses in a typical Nigerian hospital. *African Health Sciences* 2010;10(1):26-30.
38. Tinubu BM, Mbada CE, Oyeyemi AL, Fabunmi AA. Work-related musculoskeletal disorders among nurses in Ibadan, South-west Nigeria: a cross-sectional survey. *BMC Musculoskeletal disorders* 2010;11(1):12-20.
39. June KJ, Cho SH. Low back pain and work-related factors among nurses in intensive care units. *J Clin Nurs* 2011;20(3-4):479-487.
40. Violante FS, Fiori M, Fiorentini C, Risi A, Garagnani G, Bonfiglioli R, et al. Associations of psychosocial and individual factors with three different categories of back disorder among nursing staff. *Journal of occupational health* 2004;46(2):100-108.
41. Mohseni-Bandpei MA, Fakhri M, Bargheri-Nesami M, Ahmad-Shirvani M, Khalilian AR, Shayesteh-Azar M. Occupational back pain in Iranian nurses: an epidemiological study. *British Journal of Nursing* 2006;15(17):914-917.
42. Roffey DM, Wai EK, Bishop P, Kwon BK, Dagenais S. Causal assessment of workplace manual handling or assisting patients and low back pain: results of a systematic review. *The Spine Journal* 2010;10(7):639-651.