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THE ASSOCIATION BETWEEN MUSCULOSKELETAL DISORDERS AND WORK-RELATED RISK FACTORS IN HOSPITAL EMPLOYEES OF BANGLADESH

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ABSTRACT

Objective: To identify association between work-related musculoskeletal disorders and work-related risk factors among different hospital employees.
Method: A total of 645 hospital employees (male 349 and female 296) were analyzed. The questionnaires were assessed characteristics of socio-demographics, health-related behaviors, job-related factors, and work-related musculoskeletal symptoms. Work-related musculoskeletal symptoms were assessed by using modified Nordic musculoskeletal questionnaire. All analyses were stratified by gender, and multiple logistic regression modeling was used to determine associations between work-related musculoskeletal symptoms and work-related risk factors.
Results: The risk of developing work-related musculoskeletal disorders was 1.6 times higher among male workers in the housekeeping than males in the administration department (OR = 1.61, 95% CI = 0.56-3.42), and 1.5 times higher among male workers with work duration >5 years than those with work duration ≤5 years (OR = 1.58, 95% CI = 0.57-3.89). All of the aforementioned cases demonstrate statistically significant association with work-related musculoskeletal disorders. Moreover, the risk of developing work-related musculoskeletal disorders was 2.1 times higher among female workers aged >30 than those aged 30 or younger (OR = 2.1, 95% CI = 0.92-5.12); 3.43 times higher among females in the nursing than those in the administration department (OR = 3.43, 95% CI = 0.37-4.42); 2.08 times higher among females on manual lifting >10 kg than those who were not (OR = 2.08, 95% CI = 0.82-3.87); 1.12 times higher among females who performed physical exercise than those who performed without physical exercise (OR = 1.12, 95% CI = 0.35-2.93), and; 2.17 times higher among females with poor sleeping satisfaction than those with good sleeping satisfaction (OR = 2.17, 95% CI = 1.34-3.50). They all showed statistical significant association with work-related musculoskeletal symptoms.
Conclusion: Minimizing ergonomic risk factors alone does not suffice to effectively prevent musculoskeletal diseases among hospital employees. Instead, work assignments should be based on gender, department, working hours and work intensity.

Keywords: *Musculoskeletal disorders, Risk factors, Relationship, Hospital employee.*

1. Introduction

The dramatic changes and improvements in technology that have taken place in the working environment during recent decades have resulted in emerging risks in the field of occupational health and safety (Kim et. al, 2010).
The European Working Conditions Survey showed that in 2005, 20% of workers from the 15 European member states believed that their health was at risk because of work-related stress and reported muscular pains (Park, 1989). In the Netherlands, statistics indicate that in 2001 psychological and musculoskeletal disorders each caused about 22% of the total costs of work related sick leave and disability. German data indicated that the estimated economic cost of these disorders was approximately € 3,000 million in 2001. Overall, the average annual incidence was 9.2 fatal occupational injuries per 100,000 workers globally. During the five-year period, there was a decrease in the absolute number of fatal

injuries by 16% and the incidence by 34%. Health and safety at work is not only essential for employees' well-being but is a vital economic factor for enterprises and countries as a whole (Abas et al., 2011). Workers in healthcare settings comprise a vulnerable group for adverse health effects in the workplace and need to be protected. They usually perform the most stressful jobs, staying indoors in air conditioning all day with potential exposure to toxic agents, and are also at risk from shifting work and unpredictable working hours that will increase the risk of occupational fatigue and injuries (Kim, 2001). Providing a risk assessment is one method for evaluating the circumstances of employees working in healthcare settings. Although the concept of the need to identify and anticipate emerging risks related to occupational safety and health in healthcare workplace for hospital personnel, particularly by describing the prevalence and types of occupational discomfort reported, and to examine their relationship to the hospital working environment.

2. Materials and Method

2.1. Data

This study surveyed 1,020 workers of 4 hospitals in Bangladesh from July 1, 2016 to June 31, 2017. Among them, 810 workers responded in the survey (a response rate of 79%). Among them 645 responded had given complete answers. The study analyzed the responses of 645 participants (349 males and 296 females). The survey's questionnaire asked respondents about their socio-demographics, health-related behaviors, job-related factors, and work-related musculoskeletal symptoms. Work-related musculoskeletal symptoms were assessed by using the Nordic musculoskeletal questionnaire. Based on a gender-stratified analysis, multiple logistic regression modeling was used to determine associations between musculoskeletal symptoms and work-related risk factors.

2.2. Measurement of independent variables

Semi structured questionnaires were distributed to respondents for self-administration to discover the general and occupational traits of respondents and degrees of their work-related musculoskeletal symptoms. Respondents were classified into those who currently engage in manual lifting, cigarette smoking or regular exercise, and those who did not. The research subjects were also distinguished in terms of daily sleeping hours, between those who reported sleeping six hours or longer, and those who slept less than six hours. The research subjects were additionally divided into those who reported getting enough sleep to recover from fatigue and those did not. The hospital workers were grouped in terms of marital status, distinguishing between those who were married, and those who were not married due to divorce or bereavement or who were separated. Hospitals consist of departments responsible for administration, housekeeping, dental, doctors, nurse, laboratory, physiotherapy and radiology. The administration department performs services related to the clerical, patient service or manage other administrative staff. The housekeeping department is responsible for cleaning of all surfaces and maintaining a high level of hygiene. The doctors department monitor and provide general care to patients on hospital wards and in outpatient clinics. The dental department gives their service in dental care. The nursing department is relevant with patient care activities and ensures safety and quality care in hospital wards. The laboratory department performs tests on patients. They receive samples from their clients for analysis. The physiotherapy department focuses on the prevention of complications and improvement of patient condition. Radiology department is concerned with medical imaging. On the basis of average weekly working hours, hospital workers were grouped into those who worked less than 45 hours per week, and those who worked 45 hours or longer. In terms of the employment period, they were classified into two groups: those who had worked for less than or equal 5 years and those who had worked more than 5 years. The hospital workers were classified into those who worked on a shift schedule and

settings has been emphasized recently by modern healthcare management, few studies focus on safety and health issues for hospital personnel, particularly in Taiwan(Lin et al., 2008). Research is needed to identify specific risk factors in these working environments to provide a comprehensive picture of perceived adverse health effects in hospital personnel and their risk factors. It will prompt healthcare organizations to examine the effects of the workplace environment on the health and safety of their employees. These data will allow the development of new solutions for occupational health and safety in hospitals in order to adequately manage the changes in the working environment. Therefore, the purpose of this paper is to provide a general picture of the perceived adverse health effects of the

those who did not. The survey respondents were asked to give a "yes" or "no" answer to the question. They had also option to give supportive answers to the questions if appropriate.

In this study general characteristics of the study subjects included age, marital status, educational status, body mass index, cigarette smoking, physical exercise, daily hours of sleep, satisfaction with sleep and work related characteristics of the study subjects included departments, work duration, weekly working hours, shift work, overtime work, manual lifting >10 kg (Susan, 2018), work intensity, contradictory requirements, decision making power, good working environment, coworkers support and absence/sick leaves.

2.3. Evaluation of work-related musculoskeletal disorders

We used the Nordic musculoskeletal questionnaire (NMQ), developed by Kuorinka in 1987, to assess the quality of musculoskeletal disorders. We translated the NMQ into Bengali, and added the visual analogue scale (VAS) to measure the intensity of the pain. The NMQ has advantages compared to other survey methods, as respondents find it easier to complete the NMQ's simpler questionnaire, and the NMQ's standardized results make comparison more straightforward when conducting epidemiological studies. We asked the study participants, "Have you suffered any ache, pain, discomfort, or numbness of your neck, shoulder, elbow, wrist/hand, upper back, lower Back during the last 12 months?" In addition, we inquired "Have you experienced any trouble carrying out daily activities other than work (e.g. housework and hobbies) because of the physical difficulty during the last 12 months?", and "Have you had any physical difficulty during the last 7 days?" The respondents were then requested to gauge their pain on a 10- point scale from 0 to 9 points. Among the respondents who experienced any symptom in any of the 6 body areas in the past 12 months, we determined those who suffering symptoms with a pain score of five or more points in the last week to be positive criteria for musculoskeletal symptoms.

2.4. Data analysis

All of the analyses were stratified by gender. The χ^2-test was carried out to examine differences in general and occupational characteristics between the male and female workers, and to determine the distribution of such traits among the group of respondents who reported musculoskeletal symptoms and the group of those who did not. We first identified statistically significant general and occupational variables via the χ^2-test, or univariate analysis, and then set the variables as independent variables and musculoskeletal symptoms as dependent variables to perform multiple logistic regression analysis. The analysis was executed using SPSS version 21.0. *P* value of 0.05 was defined as the criterion for statistical significance.

2.5. Ethical considerations

Approval for the study was obtained locally from the appropriate authority of Khulna University. The research participants were informed about the nature of the study and what participation would entail for them, by receiving a printed information sheet (Puotiniemi & Kyngas, 2004). Participants were also asked to contact the researcher for further questions. Participation in the research was voluntary and anonymous. Items in the questionnaire were very general; they did not included private items, provoke feelings or address intimate relationship. Items that may potentially harm participants or the University itself were also not included in the questionnaire.

3. Results

3.1. Gender characteristics of the study subjects

Table 1 shows that age, marital status, educational status, body mass index, cigarette smoking, physical exercise, satisfaction with sleep (categorized by general characteristics of study subjects), and departments, work duration(years), manual lifting>10kg, absence/sick leave of work related characteristics were significantly associated with work related musculoskeletal disorder (chi-square test; $p < 0.05$). Those personnel who were aged >30, body mass index >25, physical exercise (no), nurses, weekly working hours ≥45, overtime work (yes), manual lifting >10 kg (yes), contradictory requirements (no), decision making power (no), co workers support (yes), and absence/sick leave(no) were more likely to perceive represents majority than were other participants. Other factors such as daily hours of sleep, weekly working hours, overtime work. work intensity, contradictory requirements, decision making power, good working environment, co workers support were not significantly associated with the perception of discomfort ($p > 0.05$).

Table 1: Comparison of work-related musculoskeletal disorders by general and work related characteristics of the study subjects

Independent variables	Category	Total N (%)	Male WRMSDs N (%)	Female WRMSDs N (%)	χ2	P***
*Age (years)	≤30	118 (18)	78 (12)	40 (6)	3.38	<0.05
	>30	527 (82)	271 (42)	256 (40)		
Marital status	Married	447 (69)	252 (39)	195 (30)	5.42	<0.05
	Unmarried	189 (29)	94 (14.5)	95 (15)		
	Divorced	9 (2)	3 (0.5))	6 (1)		
Educational status	No diploma	226 (35)	111(17)	115 (18)	3.48	<0.05
	Diploma	419 (65)	238 (37)	181(28)		
Body Mass index (kg/m^2)	≤25	196 (30)	101(16)	95 (14)	10.63	<0.001
	>25	449 (70)	248 (38)	201 (32)		
Cigarette smoking	Yes	293 (45)	292 (45)	1(0)	6.71	<0.01
	No	352 (55)	57 (17)	295 (38)		
Physical exercise	Yes	193(30)	99 (16)	94 (14)	10.46	<0.001
	No	452 (70)	250 (39)	202(31)		
Daily sleeping hours	≥6	363 (56)	203 (31)	160 (25)	1.02	0.37
	<6	282 (44)	146 (23)	136 (21)		
Satisfaction with sleep	Yes	330 (51)	172 (27)	158 (24)	6.23	<0.01
	No	315 (49)	165 (26)	150 (23)		
**Departments	Doctors	105 (16)	71 (11)	34 (5)	18.25	<0.01
	Dental	10 (2)	6 (1)	4 (1)		
	Administration	31 (5)	21 (3)	10 (2)		
	Physiotherapy	92 (14)	55 (9)	37 (5)		
	Nursing	195 (30)	50 (8)	145 (22)		
	Laboratory	66 (10)	41 (6)	25 (4)		
	Radiology	31 (5)	20 (3)	11 (2)		
	Housekeeping	115 (18)	62 (10)	53 (8)		
Work duration (years)	≤5	248 (38)	133 (21)	115 (17)	10.08	<0.001
	>5	397 (62)	216 (33)	181 (29)		
Weekly working hours	<45	188 (29)	98 (15)	90(14)	0.02	0.9
	≥45	457 (71)	251 (39)	206 (32)		
Shift work	Yes	516 (80)	252 (39)	264 (41)	2.51	0.10
	No	129 (20)	97(15)	32 (5)		
Overtime work	Yes	442 (69)	200 (31)	242(38)	2.78	0.048
	No	203 (31)	99(15)	104 (16)		
Manual lifting>10 kg	Yes	458 (71)	275 (43)	183 (28)	3.12	<0.001
	No	187(29)	74 (11)	113 (18)		
Work intensity	Low	204(32)	144(23)	60(9)	0.008	0.95
	High	441(68)	205 (31)	236 (37)		
Contradictory requirements	Yes	56(9)	51 (8)	5(1)	0.06	0.80
	No	589(91)	298 (46)	291 (45)		
Decision making power	Yes	36 (6)	28(4)	8(2)	1.09	0.30
	No	609(94)	321(50)	288(44)		
Good working environment	Yes	594(92)	325(50)	269(42)	1.02	0.30
	No	51 (8)	24(4)	27(4)		
Co workers support	Yes	570(88)	299(46)	271(42)	0.48	0.40
	No	75(12)	50(8)	25(4)		
Absence / sick leaves	Yes	83(13)	38(6)	45(7)	10.08	<0.001
	No	562(87)	311(48)	251(39)		

*General characteristic starts **Work related characteristic starts *** By chi-squared test.

The 645 study subjects consisted of 349 males (61.0%) and 296 females (39.0%), with an average age of 42.3 (the average age for the males stood at 43.5 and that of the females at 41.1). The analysis of occupational characteristics revealed that the nursing department had the largest number of workers, 195 persons, or 30%, while 397 employees, at 62%, reported an employment period of more than 5 years. The respondents who worked more than 45 hours per week accounted for the largest proportion, at 71%, or 457 workers. Those who worked on a shift schedule numbered 516 participants, comprising 80%. The number of respondents who worked overtime came to 542, making up 84%, while 441 or 68% reported higher work intensity. The respondents perform manual lifting >10 kg is 71% or in number 458, while those who can make decision in work is 36 in number or at 6% .83 respondents, or 13%, said they had experienced taking a leave of absence or sick leave and 88% said they get co workers support and they are 570 in number . 604 respondents or 94% reported they have good working environment.

Among all of the respondents who were >30 years of age, 271 workers, or 42% were male, and 256 or 40% were female reported musculoskeletal disorders. Of the workers with symptoms, 39%, or 252 people, were males, while 30% of them, or 195, were females those who were married. Body mass index who were >25, 248 or 38% were male and 201 or 32% were female.

3.2. Multiple logistic regression analysis of musculoskeletal symptoms:

Following gender stratification analysis, we applied multiple logistic regression modeling to determine correlations between musculoskeletal symptoms and work-related risk factors. We adopted the following significant variables of the previous univariate analysis as control variables: age, department, work duration (years), shift work, manual lifting >10 kg, marital status, satisfaction with sleep, body mass index, physical exercise. Table 2 shows that the risk of developing work-related musculoskeletal disorders was 2.12 times higher among male workers who were >30 years of age than workers ≤30 years of age. The OR 2.49 times higher among male workers in the dental department than males in the administration department (OR = 2.49, 95% CI = 0.81-2.64), and 1.58 times higher among male workers with work duration >5 years than those with work duration ≤ 5 years (OR = 1.58, 95% CI = 0.67-3.89). All of the aforementioned cases demonstrated a statistically significant association with work-related musculoskeletal disorders. Moreover, the risk of developing work-related musculoskeletal disorders was 2.10 times higher among female workers aged >30 than those aged 30 or younger (OR = 2.10, 95% CI = 0.92-5.12); 3.43 times higher among females in the nursing department than those in the administration department (OR = 3.43, 95% CI = 0.37-4.42); 1.60 times higher among females on shift schedules than those who were not (OR = 1.60, 95% CI = 1.02-2.59); 1.88 times higher among females who performed more intensive work than those who performed less intensive work (OR = 1.88, 95% CI = 1.17-3.02), and; 2.17 times higher among females with lower sleep satisfaction than those with higher sleep satisfaction (OR = 2.17, 95% CI = 1.34-3.50). All of the aforementioned cases also displayed a statistically significant association with work related musculoskeletal disorders.

4. Discussion

This study examined the correlations between hospital employees' musculoskeletal disorders and their occupational characteristics. Risk factors that contribute for the development of work-related musculoskeletal disorders can be categorized into ergonomic risk factors, structural factors regarding the working environment, and individual factors including gender and age. This study aimed to identify the relationship between work-related musculoskeletal disorders and risk factors, with a focus on individual and structural working environment factors, and explored prevention methods.

The identification of emerging occupational health risks is aimed at early intervention to prevent any possible negative effects of these risks on workers' health and safety. From the perspective of hospital personnel, the results of the present survey on emerging risks for occupational discomfort, as well as the effects of individual and structural environments and the usage of safety devices, should be seen as a basis for discussion among hospital stakeholders to set health policy priorities for further workplace health and safety planning. Studies revealed that more than 70% of hospital personnel perceived work-related adverse effects on their health within one year.

Table 2: Adjusted odds ratios and 95% confidence intervals for work-related musculoskeletal disorders according to related factors

Independent variables	Category	Male WRMSDs OR (95% CI)	Female WRMSDs OR (95% CI)
Age (years)	≤30	1	1
	>30	2.12 (1.32-4.2)	2.10 (0.92-5.12)
Department	Administration	1	1
	Housekeeping	1.61 (0.56-3.42)	1.92 (0.51-3.64)
	Doctor	1.49 (1.03-3.79)	0.64 (0.12-1.91)
	Dental	2.49 (0.81-2.64)	2.35 (0.47-4.73)
	Nursing	1.89 (0.41-2.58)	3.43 (0.37-4.42)
	Laboratory	0.72(0.23-1.97)	0.34 (0.12-0.91)
	Physiotherapy	1.56 (0.31-3.13)	1.22 (0.28-2.93)
	Radiology	2.08 (0.61-4.32)	1.12 (0.18-3.34)
Work duration (years)	≤5	1	1
	>5	1.58 (0.67-3.89)	1.79 (0.71-3.2)
Shift work	No	1	1
	Yes	0.94 (0.58-1.54)	1.60 (1.02-2.59)
Manual lifting>10 kg	No	1	1
	Yes	1.87 (1.05-3.25)	2.08 (0.82-3.87)
Work intensity	Low	1	1
	High	1.53 (0.95-2.47)	1.88 (1.17-3.02)
Satisfaction with sleep	Yes	1	1
	No	2.52 (1.57-4.04)	2.17 (1.34-3.50)
Co workers support	Yes	1	1
	No	1.12 (0.51-2.92)	0.94 (0.23-1.98)
Physical exercise	Yes	1	1
	No	1.48 (0.32-3.56)	1.12 (0.35-2.93)

The main types of discomfort were related to musculoskeletal or sensory ailments such as neck/upper shoulder pain, fatigue, lower back pain, headache, eye discomfort, throat irritation, wrist discomfort, nose discomfort, and varicose veins. These ailments have a huge national and economic cost. In France, the cost of work-related lower back pain was estimated at € 1,300 million in 2002 (Myong et al., 2008). Another study showed musculoskeletal symptoms were mostly prevalent in the neck, the shoulder, the low back, the wrists/hands and the upper back regions. Poor psychosocial complaints were also made on the job (Quansah, 2005). Our findings did not show a significant relationship between working hours and perceived discomfort, this may be because the average age of the participants was not much high and because of the healthy worker effect in the study hospital. Many studies have reported a strong relationship between long working hours and the health of workers.

Employees perceived increased working time as being linked to health and safety risks (Harrington, 2001). Particularly in hospital doctors (including dentists) who are also at risk from a combination of shift work and long and unpredictable hours during on-call work. This causes poor mental health as a result of extreme fatigue and stress (Lee, 2005). Similarly, Previous study found that working long hours (more than 48 hours per week on a regular basis) is an important occupational stressor that reduces job satisfaction, multiplies the effects of other stressors and increases the risk of health problems (Lee, 2005).

This relationship between working hours and perceived adverse health effects suggests the need to examine the phenomenon of long working hours in the healthcare industry. Health and well-being can be influenced both positively and negatively by work. Work can provide a goal and meaning in life, but can also cause ill health, accelerate its course, or trigger its symptoms (Cho, 2001). Our results show that the structural or physical working environment was mentioned as a potential emerging risk for adverse occupational health by the respondents. To solve this problem, hospital authorities should examine the components of the physical environment such as the ventilation systems, exposure to biological or infectious agents, working space, X-ray and

medical radiation, noise and vibration, working temperature, ergonomic design, and workplace lighting.

To improve the workplace health and safety of workers in every aspect related to their work, the hospital should adopt the EU framework directive based on the following general principles of prevention: avoiding risks, combating the risks at source, and adapting the work to the individual (Cho, 2001). With regard to the influence of personal characteristics on the health of staff, gender has a significant effect on the perception of work-related discomfort. The study found in a multiple logistic regression analysis that female staff members were more likely than males to perceive work related discomfort. Nurses were the main female participants in the study, and many studies have reported that nurses have a high prevalence of lower back problems or musculoskeletal complaints (Fredriksson et al., 1999). The risk factors for this have been documented as job stress, monotonous tasks, high perceived workload, and time pressure. Fatigue is associated with emotional labor and the persistence of discomfort is likely to cause further disease or stress and will affect the individual's quality of life (Lee, 2014).

The scenario of work-related musculoskeletal disorders showed a significant difference between genders, as 349 males, 61% of all study subjects, reported symptoms, whereas 296 females (39%) did so. According to a study that surveyed the health status of Korean workers (Lee, 2011), women who preferred to maintain their own heritage and to reject the host country heritage were at risk for work-related musculoskeletal disorders. A smaller number of female workers than their male counterparts have had their symptoms legally recognized as occupational injuries, yet female workers reported a 1.15 times higher incidence of work-related musculoskeletal disorders than males did. Another study on the incidence of musculoskeletal disorders and the public health management system (Jung, 2001) found that a significantly higher ratio of females reported work-related musculoskeletal symptoms than males did. Female workers have been known to be vulnerable to musculoskeletal disorders, but different studies cite different causes.

One study, which examined 56 previous studies on work-related musculoskeletal disorders, noted that being a 'female' was a risk factor for upper extremity musculoskeletal disorders, which stemmed from other work-related exposures, psychosocial factors, cultural factors, and biological differences (Treaster, 2004).Some studies have shown that female workers are more exposed to factors such as layoffs due to corporate restructuring, early retirement, temporary employment and job insecurity than male counterparts and thus suffer from greater job stress, whereas other research concluded the burden of juggling between work and family exacerbates musculoskeletal disorders. In female, it was observed an association between insufficient sleep and job demand. Irregular exercise was associated with insufficient job control, job insecurity in female. Problem drinking was associated with shift worker. Insufficient sleep was related with stress perception. (Kim et al., 2016).

This study revealed, that in comparison to males, female workers endure more frequent shift work, overtime work, work intensity and suffer poorer working environment (Table 1), which may have served as a risk factor for work-related musculoskeletal disorders. In the multivariate analysis, shift work and labor intensity had a statistically significant impact on the prevalence rate of work-related musculoskeletal symptoms only among female workers. Among hospital workers in administration and nursing departments, females reported a far higher prevalence of work-related musculoskeletal disorders. The gender disparity may have occurred because males and females in the same department perform different tasks under different job titles, creating discrepancies between risk factors for male and female workers. The housekeeping employees stand up for long periods of time while working and do cleaning services in unstable postures and keep hospital clean.

The cleaners in the housekeeping department showed a relatively more equal division of labor between genders (Table 1). Male doctors conducted work that carried lower ergonomic risk factors, including promoting health services and management of health services. They recorded a higher prevalence of work-related musculoskeletal disorders than women did. A multiple logistic regression analysis of work-related musculoskeletal symptoms in doctors department found that men in the working in doctors department were more than 1.5 times more likely to carry risks of musculoskeletal

disorders than female. Likewise, both males and females showed a difference in the prevalence rate of work related musculoskeletal symptoms among departments. As a series of prior studies (Dumais, 1993) have discovered males and females working for the same department seemed to have experienced different exposures to ergonomic risk factors because men and women are expected to perform different gender roles, causing a division of labor based on gender. The hospital industry relies on shift work more frequently than other industries, because it needs to respond to patient inquiries 24 hours a day. Of the research subjects, 57.8% worked on a shift schedule, which was above the average of 29.9% among their European counterparts surveyed in 2007 (Anges, 2007).

In three separate surveys, 50.0% of hospitals and restaurants said their operations were based on shift work in 2003, 0.3% in 2007 and 34.0% in 2011, showing extreme variations depending on the survey year (OSHRI, 2010), as 18.3% of respondents reported working on a shift schedule in 2006, but only 8.4% in 2010. This study's subjects showed a higher ratio of workers on shift schedules (male 39% and female 41%) compared with those of workers researched by other studies. In this study, multiple logistic regression analysis revealed that women on shift schedules experienced statistically significantly higher numbers of work-related musculoskeletal symptoms. Shift work also increased work related musculoskeletal disorders in a statistically significant manner, according to a retrospective cohort study (Angersbach, 1980).

One study observed that public health and medical workers' musculoskeletal disorders increased in proportion to shift work, because shift work reduced relaxation hours and increased working hours. In addition, a study of 1,163 nurses discovered that work-related musculoskeletal disorders were twice as common in a group of nurses who worked on a shift for two weeks or longer a month than a group of those who worked on a shift for shorter periods (Lipscomb, 2002). The hospital industry finds it impossible to completely eliminate shift work. Nonetheless hospitals need to seek ways to minimize shift work to reduce the occurrence of work-related musculoskeletal disorders, as this study has demonstrated that the hospital businesses have reported a higher ratio of workers on shift schedules. The hospitals' higher reliance on shift work, at the same time, is also likely to cause sleep deprivation (Kim et.al, 2006). A lack of sleep has proven to induce physiological dysfunction and build up fatigue, a major cause of sleepiness during working and subsequent accidents, as well as increasing risks of employees' work efficiency loss and accidents. 49% of research subjects, or 315 people, felt dissatisfied with their sleep, and this group reported a statistically significantly higher number of work-related musculoskeletal symptoms than the group of workers who felt satisfied with their sleep. Multiple logistic regression analysis yielded a similar result, as the risk of work-related musculoskeletal symptoms more than doubled in both males and females who were dissatisfied with their sleep. Another study also concluded that sleep disorders weaken the capacity for physical recovery and diminish pain tolerance, inducing subjective pain(Lee et al., 1999)

However, this study had a cross-sectional design, and thus was capable of establishing an association between sleep satisfaction and work-related musculoskeletal symptoms, but incapable of verifying a causal relationship. One study set pain as an independent variable and sleep disorders as a dependent variable and demonstrated a statistically significant association, indicating a reverse causal relationship in which musculoskeletal pain causing sleep dissatisfaction could exist (Alsaadi et al., 2012). Further research is required to establish a causal relationship between sleep satisfaction and work-related musculoskeletal symptoms. In this study, 441 workers, or 68%, belonged to the group of high work intensity, and both males and females in this group experienced a significantly higher incidence of work-related musculoskeletal symptoms.

However, multiple logistic regression analysis revealed that only females of the high work intensity group displayed a higher odds and statistically significant incidence of work related musculoskeletal symptoms (Table 2). Another study of hospital workers reached a similar conclusion that the group of workers whose duties increased per hour reported a higher odds ratio of prevalence of work-related musculoskeletal symptoms than the group of workers with no hourly increase in duties (Choi et al., 2007).

The leading musculoskeletal risk factors in the hospital business are repetitive motion, excessive force, and unnatural and static postures. Hospital workers are exposed to repetitive motion while lifting, carrying, washing,

and changing beds. Hospital workers are exposed to excessive force when lifting heavy objects, transferring patients and cleaning. Hospital workers are exposed to unnatural postures as they perform their duties to patients. Hospital employees' are exposed to the static postures of standing up without any moving for a prolonged time at operation theaters, intensive care units or coronary care units (Choi et al., 2007).

Hospital workers are exposed to a variety of ergonomic risk factors simultaneously, more than 60% of workers at hospital and restaurants reported three or more symptoms of pain, and only 16% of the respondents felt no symptoms. As demonstrated above, hospital workers are already exposed to many musculoskeletal risk factors, and therefore the shortage of workers increases the labor intensity of the current workforce, further aggravating their musculoskeletal disorders. Therefore, structural factors need to be improved in a way that augments the working environment to ensure that working conditions and labor intensity do not deteriorate, in addition to the need to address ergonomic risk factors (KILSH, 2007).

5. Conclusion

Based on these results, there is a need for proper health and safety prevention and early intervention strategies to combat these adverse health effects in hospital personnel. Work related discomfort may be prevented or counteracted by improving the workplace environment by examining the physical and chemical environments and adjusting occupational physical settings, by job redesign (e.g. changing the shift work schedule), training (e.g. in use of protective devices), by strengthening social support (e.g., caring about a colleague's discomfort), and by reorienting health promotion activities within healthcare settings.

Therefore, the hospital should adjust the provisional health and safety programs and strategies to fit the specific context and conditions of its physical environment to improve the health and well-being of hospital personnel. Future research could analyze the relationship between an employee's health profile and workplace environment, extending the analysis to broad environmental factors such as biological agents to scrutinize the factors influencing the employee's health.

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