

Work-related musculoskeletal disorders among health care professionals: A cross-sectional assessment of risk factors in a tertiary hospital, India

Abstract

Background: Work-related musculoskeletal disorders (WMSDs) are responsible for morbidity in many working populations. Apart from lowering the quality of workers' life and reducing the productivity, WMSDs are the most expensive form of work disability, attributing to about 40% of all costs toward the treatment of work-related injuries. WMSDs are considered to be multifactorial that are caused due to the interactions between various risk factors, which result in conditions that vary across different occupations. Although health care profession is known to be at a high risk for WMSDs, it is one of the least-studied occupations. Most of the previous studies on WMSDs among health care workers were limited to any one of the professional groups such as nurses, physical therapists, dentists, and others. Hence this study was aimed at looking into the WMSDs affecting five different health care professionals working in a tertiary care hospital. It compared the prevalence and distribution of WMSDs among the five groups, evaluated the multiple risk factors that contribute to the development of WMSDs, and identified the high-risk group. **Materials and Methods:** It was a cross-sectional study conducted among dentists, laboratory technicians, nurses, physicians, and physiotherapists of various clinical departments in a tertiary care hospital in Chennai, India, from January to June 2013. Face-to-face interviews as well as observational analysis of various tasks were employed. Different combinations of validated and standardized questionnaires were used for collecting different types of data. **Results:** A high proportion of health care professionals reported WMSDs at one or the other body region, lower back being the most commonly affected area. Working in the same position for long periods, working in awkward or cramped positions and handling an excessive number of patients or samples in one day were found to be the most commonly reported job risk factor that contributed to the development of WMSDs, in this study. **Conclusion:** Among all the health care professionals assessed in this study, nurses were found to be at the highest risk, whereas physicians were at the lowest risk. A longitudinal study using quantitative analytical tools may give a more accurate estimate of WMSDs and job risk factors, which would pave

way for making more precise recommendations to eliminate the risk factors and thereby prevent WMSDs.

Key words: Health care professionals, risk factors, WMSDs

INTRODUCTION

Musculoskeletal disorders (MSDs) in the workplace have a huge impact, emerging as a growing problem in our modern societies,^[1] they represent the second largest cause of short-term or temporary work disability after the common cold.^[2] Work-related musculoskeletal disorders (WMSDs) are responsible for morbidity in many working populations and are known as an important occupational problem with increasing compensation and health costs, reduced productivity, and lower quality of life.^[3] WMSDs are characterized as multifactorial.^[4]

WMSDs are also reported to cause lost work time or absenteeism, increase work restriction, transfer to another job,^[5,6] or disability than any other group of diseases^[7-9] with a considerable economic toll on the individual, the organization and the society as a whole.^[10] Findings of scientific research have identified physical,^[11] psychosocial/organizational,^[12-14] and individual^[15] occupational "risk factors" for the development of WMSDs. These studies have measured the levels of a variety of factors across a range of

Sandul Yasobant, Paramasivan Rajkumar¹
Department of Research, Indian Institute of Public Health, Gandhinagar, Ahmedabad, Gujarat,
¹Department of Environmental Health Engineering, Sri Ramachandra University, Chennai, India

For correspondence:

Dr. Sandul Yasobant, Indian Institute of Public Health, Gandhinagar, SPIESR Campus, Drive-in-Road, Ahmedabad, Gujarat, India.
E-mail: dryasobant@gmail.com

Access this article online

Website: www.ijoem.com

DOI:
10.4103/0019-5278.146896

Quick Response Code:



occupations at different levels of risk, and investigated their associations with the incidence (or prevalence) of MSDs for the populations concerned.^[16,17]

Moreover, WMSD is the most expensive form of work disability.^[18,19] It was estimated that the cost of WMSD was approximately 245 billion dollars in 1995 in the United States; 26 billion Canadian dollars in 1998 in Canada, and 38 billion Euros in 2002 in Germany.^[20] India has been battling with conventional public health problems such as communicable diseases, malnutrition, high rate of population growth, and inadequate medical care, apart from the occupational health problems.^[21] MSD is one of the major occupational health problems in India and estimates have shown that MSD contributes to about 40% of all costs toward the treatment of work-related injuries.^[22]

Health care profession is known to be at high risk for WMSDs.^[23-25] Health care professionals are reported to be vulnerable to sustaining musculoskeletal disorders during the course of their work routine.^[26] It is estimated that almost one-third of all cases of sick leave among health care workers are related to MSDs.^[27] Even in developed countries, it appears that WMSDs among health care providers are under-reported.^[28] In developing countries such as India it is much negligible. Studies of WMSDs among health care providers have mainly focused on physicians, dentists, physical therapists, lab technicians, and nurses.^[29-31] Back, neck, shoulder, and knee problems are the most common complaints among medical, dental, and nursing personnel.^[32-34] Most of the previous studies on WMSDs among health care workers were limited to any one of the professional groups such as nurses, physical therapists, dentists, and others. This study compared the prevalence and distribution of WMSDs among five different groups of health care professionals working in a tertiary care hospital in Chennai, India. It also evaluated multiple risk factors that contribute to the development of WMSDs and identified the high-risk group.

MATERIALS AND METHODS

It was a cross-sectional study conducted among dentists, laboratory technicians, nurses, physicians, and physiotherapists of various clinical departments in a tertiary care hospital in Chennai, from January to June 2013. A nonprobability sampling as convenient to the investigators was employed after obtaining ethical clearance from the Institutional Ethical Committee.

In all the above-mentioned categories of professionals, clinicians and clinician-cum-academicians with willingness to take part in the study were included as study participants. The health care professionals who are purely academicians,

those with current musculoskeletal trauma and those who refused to participate were excluded from the study.

Face-to-face interviews as well as observational analysis of various tasks were employed. Different combinations of validated and standardized questionnaires were used for collecting different types of data. Section-A is a general questionnaire on details of demography, medical and occupational history, diet pattern, lifestyle, and personal habits. It also includes questions to determine if the symptoms were work related. Section-B is a questionnaire that gathers information about workstation and nature of various tasks. Section-C is a rating scale to identify job risk factors based on worker perceptions about various conditions and tasks that may contribute to the development of work-related musculoskeletal disorders, by a scoring method using an ordinal scale of 0–10. Section-D is the Nordic Musculoskeletal Questionnaire (NMQ), a standardized screening and surveillance tool to find out the body regions affected by musculoskeletal symptoms. In this study, it was used to identify the high-risk group for different body regions.

Data descriptives were derived. Univariate analysis compared the demographic variables of the participants with work-related factors. Job risk factors among the different subgroups were analyzed using independent sample *t*-test for continuous variables, and Chi-square test for nominal or ordinal variables and odds ratio has been reported considering null hypothesis to be significant if *P* value is <0.05, which is the level of significance. Data analysis was carried out using the software R 3.0.1 version.

RESULTS

The mean age, height, weight, and body mass index of all respondents were 32.5 ± 8.1 years, 1.6 ± 0.1 m, 66.5 ± 13.4 kg, and 24.9 ± 4.3 , respectively. The total years of work experience and total working hours per week was found to be 8.6 ± 8.1 years and 48 ± 4 h, respectively. The summary of descriptive information of all respondents is presented in Table 1.

Table 1: Descriptive statistics for demographic variables collected from study participants

Variables	Min	Max	Median	Mean±SD
Age (years)	21	73	30	32.5±8.1
Height (m)	1.3	1.8	1.6	1.6±0.1
Weight (kg)	35	103	67	66.5±13.4
Body mass index (kg/m ²)	14.3	38.7	25.1	24.9±4.3
Total years of work experience (years)	0.2	50	6	8.6±8.1
Experience in study organization (years)	0.2	25	4.5	6.6±6.2
Total working hours per week	30	60	48	48±4

SD: Standard deviation

This study population contains 64.3% (41.4% male and 58.6% female) of exclusive clinical practitioners and 35.7% of those who are both clinicians as well as academicians. Among all, 68.5% of the participants were married. Only 3.6% participants were smokers and 8.6% were alcoholics, which is a negligible portion. Of all, 35% were involved in other types of physical activities such as sports, exercises, and yoga routinely, whereas only 12.2% take part in recreational activities out of working schedule. In this study population, 61.4% of the participants work in a single-shift duty of 8 h duration, whereas 38.6% work in three shifts, the shift duration being 6 h in the morning, 6 h in the evening and 12 h in the night. Most of the participants (77.1%) work in the same station as there is no job rotation, whereas the rest of them (22.9%) have job rotation once in 3 months or biannually, which is shown in the Figure 1.

Table 2 demonstrates differences between the "with MSDs" group and the "without MSDs" group for age, gender, shift work, years of employment, and work hours per shift. In general, participants in the musculoskeletal complaint group were younger, obese, had lesser years of experience but more working hours per shift, and were exclusively clinicians. There were no statistically significant differences in terms of smoking, alcoholism, and physical or recreational activities between the two groups.

Working in the same position for long period (37.10%), working in awkward and cramped positions (29.20%), and performing the same task over and over (29%) were reported as the highest job risk factors among all participants [Figure 2]. In addition, physiotherapists reported that performing manual orthopedic techniques and assisting patients in gait activities were major risk factors in their profession. Figure 3 shows the highest job risk factors for the different categories. Almost all job risk factors significantly vary among the different groups ($P < 0.05$).

About half (50.7%) of the participants reported symptoms at least in one part of their bodies, over the past 12 months. Among all the symptoms, low back pain was the highest (45.7%), followed by neck pain (28.5%) and shoulder pain (23.5%), whereas hip/thigh pain (7.1%) and elbow pain (5%) was the least reported, as shown in Figure 4. Irrespective of regions, body pain during last 12 months was complained by 56% of nurses 55% of physiotherapists, 54% of dentists, 39% of lab technicians and 38% of physicians.

Overall, musculoskeletal pain complained by all participants was 50.7%, and among that 26.4% was found to be of work-related origin. Work-related pain was found to be high in Nurses, Dentists, and Physiotherapists, whereas non-work-related pain was found to be predominant in Physicians and Lab Technicians, as shown in Figure 5.

DISCUSSION

Prevalence of musculoskeletal disorders varies across occupational groups and over national boundaries. Subjectivity of terms, variations in assessment tools, organizational differences in work settings, and cultural differences in perception, and reporting of pain and disorders are adduced for the variation in rates of WMSDs in different studies. The gender pattern of WMSDs found in this study is similar to the result of most studies. Many previous studies reported a female predominance in the prevalence of musculoskeletal disorders in both the general population^[35,36] and working population.^[33,37] In this study, it was found that female health professionals have 1.9 times higher risk (OR = 1.9) for developing MSDs than male health professionals. It was also found that overweight (OR = 2), obese (OR = 1.26) professionals have a greater chance of developing WMSDs. But the age group distribution and work experience reveals that younger age group of <30 years, with <5 years of professional experience) have a greater chance of developing WMSDs, which supports the study findings of Cromie *et al.*,^[37] but is opposed to the study by Tinubu *et al.*^[33] It may be due to lack

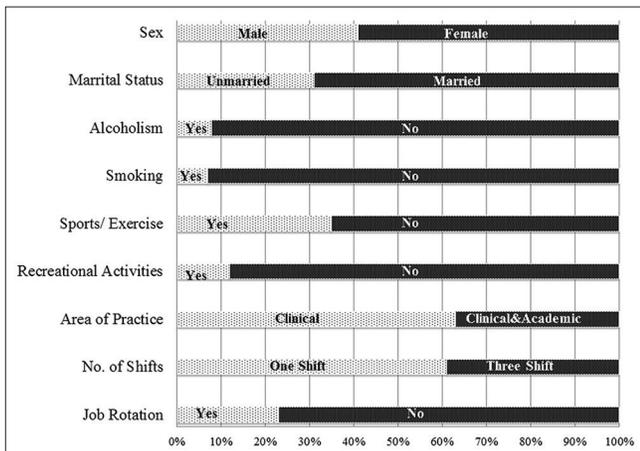


Figure 1: Basic information about the participants

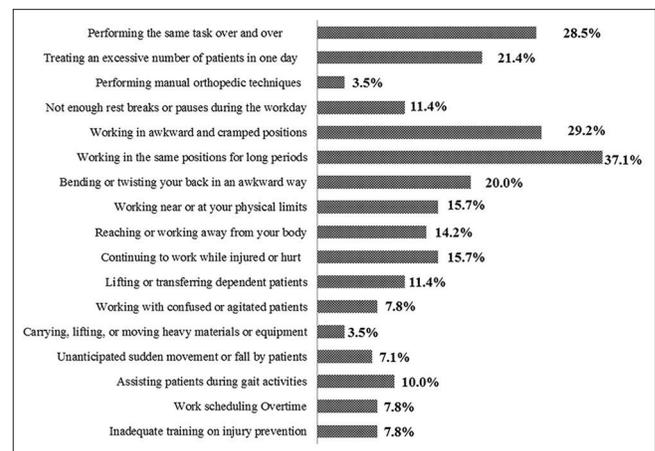


Figure 2: Self-reported Job risk factors among all participants

Table 2: Predictors of MSDs among healthcare professionals

Predictors	Category	Total (n=140)%	Without MSDs (n=69)%	With MSDs (n=71)%	OR	95% CI	P value
Age	<30 years	72 (51.4)	34 (49.2)	38 (53.5)			
	30-50 years	65 (46.4)	34 (49.2)	31 (43.6)	0.82	0.42-1.16	
	>50 years	3 (2.2)	1 (1.5)	2 (2.8)	0.3	0-16.5	0.343
Gender	Male	58 (41.4)	34 (49.2)	24 (33.8)			
	Female	82 (58.6)	35 (50.7)	47 (66.2)	1.9	0.96-3.76	0.091
BMI	Under Wt.	10 (7.1)	6 (8.7)	4 (5.6)			
	Normal	39 (27.8)	16 (23.2)	23 (32.3)	2.16	0.52-8.89	
	Over Wt.	21 (15)	9 (13.1)	12 (16.9)	2	0.43-9.26	
	Obese	70 (50)	38 (55.1)	32 (45.1)	1.26	0.33-4.87	0.462
Marital status	Married	96 (68.5)	48 (69.5)	48 (67.6)			
	Unmarried	44 (31.5)	21 (30.4)	23 (32.4)	1.1	0.54-2.24	0.946
Area of practice	Clinical	90 (64.2)	42 (60.8)	48 (67.6)			
	Clinical and academics	50 (35.7)	27 (39.1)	23 (32.4)	1.1	0.54-2.24	0.512
Experience	<5 years	65 (46.4)	36 (52.1)	29 (40.8)			
	5-10 years	35 (25)	18 (26.1)	17 (23.9)	1.17	0.51-2.67	
	10-15 years	15 (10.7)	5 (7.2)	10 (14.1)	2.48	0.76-8.08	
	>15 years	25 (17.8)	10 (14.5)	15 (21.1)	1.86	0.73-4.76	0.331
Physical activity	No	91 (65)	40 (57.9)	51 (71.8)			
	Yes	49 (35)	29 (42.1)	20 (28.1)	1.85	0.91-3.74	0.123
Recreational activity	No	123 (87.8)	59 (85.5)	64 (90.1)			
	Yes	17 (12.2)	10 (14.4)	7 (9.8)	0.65	0.23-1.8	0.561
Smoking	No	135 (96.4)	64 (92.7)	71 (100)			
	Yes	5 (3.6)	5 (7.2)	0 (0)	0	0-0	0.063
Alcoholism	No	128 (91.4)	60 (86.9)	68 (95.7)			
	Yes	12 (8.6)	9 (13.1)	3 (4.3)	0.29	0.08-1.14	0.118
Shift	Single	86 (61.4)	43 (62.3)	43 (60.6)			
	More	54 (38.6)	26 (37.6)	28 (39.4)	1.08	0.55-2.13	0.968
Job rotation	No	108 (77.1)	52 (75.3)	56 (78.8)			
	Yes	32 (22.9)	17 (24.6)	15 (21.2)	0.82	0.37-1.81	0.769
Stress	Low	31 (22.1)	21 (30.4)	10 (14.1)			
	Moderate	63 (45)	27 (39.1)	36 (50.7)	0.3	0.11-0.83	
	High	46 (32.9)	21 (30.4)	25 (35.2)	0.85	0.37-1.96	0.36

MSDs: Musculoskeletal disorders, OR: Odds ratio, CI: Confidence interval

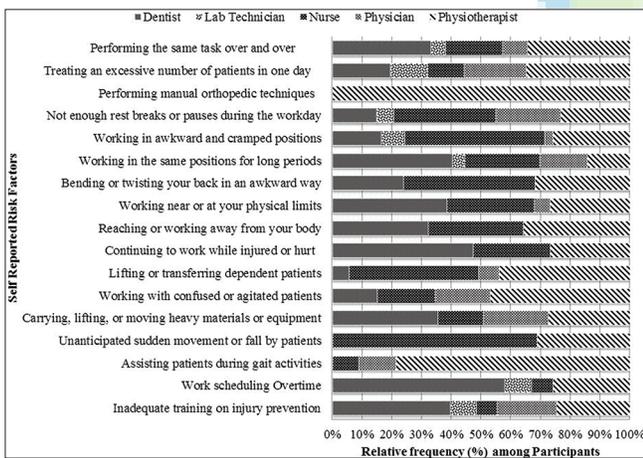


Figure 3: Self-reported job risk factors among different participants

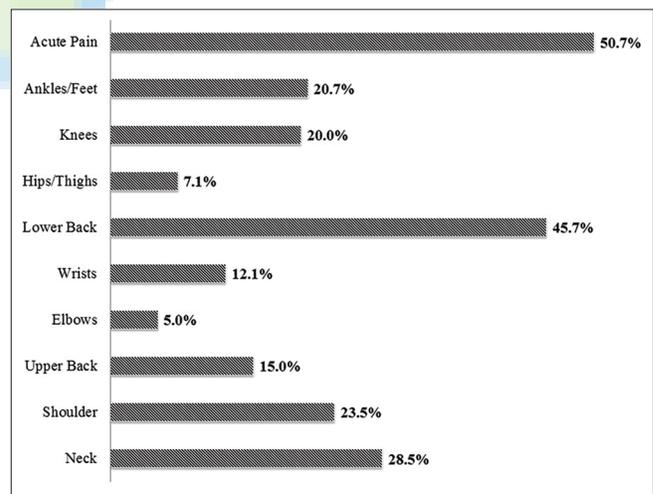


Figure 4: Body region pains among all participants

of orientation to the work station or vigorous working style of the youngsters as compared with the older professionals, who are well adapted to the work station and mostly follow safe working principles. Those professionals involved in both clinical as well as academic work (32.4%) have 1.1 times higher chance of developing WMSDs as compared with those who are exclusively involved in clinical work (67.6%). The participants who work in 3 shifts have greater chance of developing WMSDs (OR = 1.08) as compared to those who

work in single shift (61.4%), which is similar to the result of a previous study by Shafiezadeh *et al.*^[38] This study showed that job rotation (28.2%) may protect from the risk of developing WMSDs. The participants who are involved actively in other physical activities have 1.85 times greater chance of developing WMSDs than those who are not involved in other physical activity. This is in consistence with previous findings.

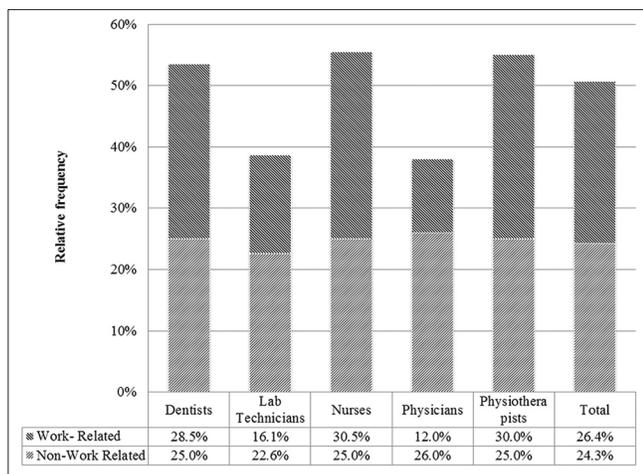


Figure 5: Musculoskeletal pains and work-relatedness among different participants

All the above demographic variables in our study were found to be nonsignificant for developing WMSDs as *P* value was not <0.05 in any of the variables.

From this study, an association was found between occupation and prevalence of WMSDs among the health workers. In this current study, we found the WMSDs prevalence to be 26.4% and it is much lesser than a previous study by Emmanuel *et al.* among tertiary health care workers, in which it was reported as 68.7%.^[35] Among all, low back pain (45.7%) was the predominant complaint, followed by neck pain (28.5%), shoulder pain (23.5%), and knee and ankle pain (20%). The least of complaints were reported at wrist (12%), hip/thigh (7.1%), and elbow (5%), which supports the study results of Emmanuel *et al.*^[35]

The highest prevalence of WMSDs found among nurses (55.5%) is similar to a previous study by Karaha *et al.*^[39] who assessed the prevalence and risk factors for low back pain among a variety of Turkish hospital workers, including nurses, physicians, physical therapists, technicians, secretaries, and hospital aides, in which the highest prevalence was reported by nurses (77.1%). Similarly, the studies by Emmanuel *et al.*^[35] and Tinubu *et al.*^[33] found highest WMSDs prevalence among nurses reporting 30.4% and 78%, respectively. Several authors have reported high prevalence of WMSDs among nurses in developed countries.^[40,41] The major complaint from nurses was hip/thigh pain (60%), followed by ankle/feet (55%), and knees (53%). It may be because of working in the same positions for long periods (44.4%), bending or twisting back in an awkward way (41.7%), and working in awkward or cramped position (63.9%), which were the most perceived job risk factors precipitating WMSDs among the nurses. But this finding is inconsistent with the findings of the study by Tinubu *et al.*^[33]

The results obtained in our study indicate not only that the surveyed dentists demonstrated improper working habits but

also that they lack basic knowledge of ergonomics. Similar to the results obtained from previous studies, the most frequent MSDs were reported in the shoulder (39.4%), followed by upper back (38.1%), neck (37.5%), and wrist (29.4%). Also, the findings about working position and dentistry reported by Kierklo *et al.*^[42] are consistent with our results. The above-reported region-wise body pain correlates well with job risk factors such as working in the same sitting position (71%), performing the same task over and over (48.4%), and continuing to work while injured (35.5%).

The current study has revealed that assisting patients during gait activities (50%), repetitive tasks (50%), and working in awkward or cramped positions (35%) are the factors perceived by physiotherapists as most likely to limit their capacity to continue working in a physically demanding role.^[28,43] It is also noteworthy that some of these risk factors are inherent to the nature of clinical work of physiotherapy professionals.^[44] With respect to the affected body regions, the highest incidence is in the elbow (28.6%) and wrist (23.5%), as most of the physiotherapists use manipulative techniques for longer periods and repetitively. This is followed by neck pain (22.5%) and back pain (18.8%). This is inconsistent with the findings of a previous study conducted by Salik *et al.*^[28] in which back pain (26%) was the predominant complaint followed by wrist pain (18%). At the same time, it is strongly consistent with the findings of another study (Cromie *et al.*^[37]), which showed that increased prevalence of wrist/thumb symptoms was associated with the use of mobilization and manipulation techniques. Risk factors pertaining to workload were associated with a higher prevalence of neck and upper limb symptoms, and postural risk factors were associated with a higher prevalence of spinal symptoms.

In the present study, the percentage of symptoms reported by laboratory technicians was low (21.1%), as compared with those obtained by other authors. However, among the studies focusing on laboratory workers, only Kilroy and Dockrell^[45] described the global prevalence of MSD symptoms, but they considered the period of the preceding 3 months as against the period of 12 months in the present study. Among this group, shoulder pain (18.2%) was the chief complaint followed by neck pain (17.5%), back pain (15.6%), and wrist pain (11.8%). The major job risk factors were found to be processing an excessive number of samples (14.3%) and working in awkward postures (10.7%). It may not be negligible, and can be minimized with proper education of laboratory ergonomics.

Compared to the study by Mehrdad *et al.*^[36] as well as to that of other health care professionals in the present study, the MSDs reported by physicians was much lower (18.3%). Elbow pain (28%), back pain (19%), and shoulder and wrist pain (12%) were the main complaints. The major job risk factors of working in the same posture (28%) and treating an excessive number of patients (24%) put together produces a

risk of developing WMSDs among physicians. Overall, the prevalence of MSDs among these physicians is similar to the general population, which is 18% for low back pain and 7% for neck pain. The reason for this should be the absence of repetitive and/or strenuous task.

CONCLUSION

A high proportion of health care professionals reported WMSDs at one or the other body region, low back being the most commonly affected area. The occurrence of WMSDs is higher among nurses than other health care professionals followed by physiotherapists and dentists. The laboratory technicians and physicians are the least affected. Working in the same positions for long periods, working in awkward or cramped positions and handling an excessive number of patients or samples in one day were found to be the most commonly reported job risk factors for the development of WMSDs, in this study. Hence this study concludes that among all the health care professionals assessed in this study, nurses were found to be the high-risk group, whereas physicians were found to be at the lowest risk.

The nonprobability sampling method employed in this study prevents generalization of the results. Also, the questionnaire on job risk factors used in this study are self-reported, and hence subjective bias might be there.

We recommend that awareness, education, and training programs on prevention and coping strategies for musculoskeletal disorders be made mandatory for health care professionals especially for the high-risk groups such as nurses, dentists, and physiotherapists not only to reduce the occurrence of WMSDs among them but also to promote efficiency in patient care. An integrated health promotion model should be planned for health care professionals in workplace.

A better planned long-term study eliminating the limitations of the current study, using more quantitative analytical tools may give an accurate estimate of WMSDs and job risk factors with exposure to risk levels among health professionals and thereby, a better means to accurately recommend and implement policies and strategies to combat these risk factors for WMSDs among health care professionals. The future work may be expanded to include other categories of health care professionals as well as other professionals involved in health care industry who are at high risk for WMSDs including ward boys, sanitary workers, emergency personnel, and others.

ACKNOWLEDGMENTS

We are thankful to participants of the study who gave us unconditional support and NMQ team to permit us for using the scale in this study.

REFERENCES

1. Yelin EH, Felts WR. A summary of the impact of musculoskeletal conditions in the United States. *Arthritis Rheum* 1990;33:750-5.
2. Yelin EH, Henke CJ, Epstein WV. Work disability among persons with musculoskeletal conditions. *Arthritis Rheum* 1986;29:1322-33.
3. Karwowski W, Marras WS. Occupational ergonomics: Principles of work design. Florida: CRC Press; 2003.
4. David GC. Ergonomic methods for assessing exposure to risk factors for work-related musculoskeletal disorders. *Occup Med (Lond)* 2005;55:190-9.
5. Aptel M, Aublet-Cuvelier A, Cnockaert JC. Work related musculoskeletal disorders of the upper limb. *Joint Bone Spine* 2002;69:546-55.
6. Kilbom A. Editorial/Prevention of work-related musculoskeletal disorders in the workplace. *Int J Ind Ergon* 1998;21:1-3.
7. Badley EM, Rasooly I, Webster GK. Relative importance of musculoskeletal disorders as a cause of chronic health problems, disability, and healthcare utilization: Findings from the 1990 Ontario Health Survey. *J Rheumatol* 1994;3:505-14.
8. Riihimaki H. Editorial: Hands up or back to work—future challenges in epidemiologic research on musculoskeletal diseases. *Scand J Work Environ Health* 1995;21:401-3.
9. Leijon M, Hensing G, Alexanderson K. Gender trends in sick listing with musculoskeletal symptoms in a Swedish county during a period of rapid increase in sickness absence. *Scand J Soc Med* 1998;26:204-13.
10. Kemmlert K. Labour inspectorate investigation for the prevention of occupational musculoskeletal injuries (licentiate thesis). Solna, Sweden: National institute of occupational health; 1994.
11. Winkel J, Mathiassen S. Assessment of physical work in epidemiology studies: Concepts, issues and operational considerations. *Ergonomics* 1994;37:979-88.
12. Bongers PM, de Winter CR, Kompier MA, Hildebrandt VH. Psychosocial factors at work and musculoskeletal disease. *Scand J Work Environ Health* 1993;19:297-312.
13. Devereux JJ, Buckle PW, Vlachonikolis IG. Interactions between physical and psychosocial work risk factors increase the risk of back disorders: An epidemiological study. *Occup Environ Med* 1999;56:43-53.
14. Devereux JJ, Vlachonikolis IG, Buckle PW. Epidemiological study to investigate potential interaction between physical and psychosocial factors at work that may increase the risk of symptoms of musculoskeletal disorder of the neck and upper limb. *Occup Environ Med* 2002;59:269-77.
15. Ringleberg J, Voskamp P. Integrating Ergonomic Principles into C-Standards for Machinery Design. TUTB Proposals for Guidelines. Brussels: European Trade Union Technical Bureau for Health and Safety; 1996.
16. Safety of Machinery—Human Physical Performance-Part 4. Evaluation of Working Postures in Relation to Machinery. PrEN1005-4. Republic of Bulgaria, 2009. Assessed from- <https://law.resource.org/pub/bg/ibr/bds.en.1005-4.2005.a1.2008.pdf>.
17. Campo M, Weiser S, Koenig KL, Nordin M. Work-related musculoskeletal disorders in physical therapists: A prospective cohort study with 1-year follow-up. *Phys Ther* 2008;88:608-19.
18. European Agency for Safety and Health at Work. Work-related neck and upper limb musculoskeletal disorders, 1999. National Research Council. Musculoskeletal disorders and the workplace. The Robens Centre for Health Ergonomics European Institute of Health & Medical Sciences University of Surrey Guildford, Surrey, U.K Assessed from -<https://osha.europa.eu/en/publications/reports/201>.
19. Occupational Health and Safety Act. Available from: http://www.elaws.gov.on.ca/html/statutes/english/elaws_statutes_90o01_e.htm [Last assessed on 2012 Dec 12].
20. Waddell G. A new clinical model for the treatment of low back pain. *Spine* 1987;22:128-56.

21. National Research Council. Musculoskeletal Disorders and the Workplace. National Academy Press; Washington, D.C.2001. Assessed from- <http://www.nap.edu/openbook.php?isbn=0309072840>.
22. European Agency for Safety and Health at Work Fact Sheet. Available from: <http://www.osha.europa.eu> [Last assessed on 2012 Dec 12].
23. Smith DR, Wei N, Ishitake T, Wang RS. Musculoskeletal disorders among Chinese medical students. *Kurume Med J* 2005;52:139-46.
24. Thornton LJ, Barr AE, Stuart-Buttle C. Perceived musculoskeletal symptoms among dental students in the clinic work environment. *Ergonomics* 2008;51:573-86.
25. Smith DR, Leggat PA. Musculoskeletal disorders among rural Australian nursing students. *Aust J Rural Health* 2004;12:241-5.
26. Saiyed HN, Tiwari RR. Occupational health research in India. *Ind Health* 2004;42:141-8.
27. Alexopoulos EC, Stathi IC, Charizani F. Prevalence of musculoskeletal disorders in dentists. *BMC Musculoskelet Disord* 2004;5:16.
28. Salik Y, Ozcan A. Work-related musculoskeletal disorders: A survey of physical therapists in Izmir-Turkey. *BMC Musculoskelet Disord* 2004;5:27.
29. Guo HR, Chang YC, Yeh WY, Chen CW, Guo YL. Prevalence of musculoskeletal disorder among workers in Taiwan: A nationwide study. *J Occup Health* 2004;46:26-36.
30. Praemer A, Furner S, Rice DP. Musculoskeletal conditions in the U.S. 1999. Available from: <http://www.medicalreporter.health.org/tmr1099/orthopaedics.html>. [Last accessed on 2012 December 08].
31. Alexopoulos EC, Stathi IC, Chairman F. Prevalence of musculoskeletal disorders in dentists. *BMC Musculoskelet Disord* 2004;5:16.
32. Alexopoulos EC, Burdorf A, Kalokerinou A. A comparative analysis on musculoskeletal disorders between Greek and Dutch nursing personnel. *Int Arch Occup Environ Health* 2006;79:82-8.
33. Tinubu BM, Mbada CE, Oyeyemi AL, Fabunmi AA. Work-Related Musculoskeletal Disorders among Nurses in Ibadan, South-west Nigeria: A cross-sectional. *BMC Musculoskelet Disord* 2010;11:12.
34. Picavet HS, Schouten JS. Musculoskeletal pain in the Netherlands: Prevalence, consequences and risk groups, the DMC (3)-study. *Pain* 2003;102:167-78.
35. Emmanuel C, Obembe AO, Bamidele S. Work-Related Musculoskeletal Disorders among Health Workers in a Nigerian Teaching Hospital. *TAF Prev Med Bull* 2012;11:583-8.
36. Mehrdad R, Dennerlein JT, Morshedizadeh M. Musculoskeletal Disorders and Ergonomic Hazards among Iranian Physicians. *Arch Iran Med* 2012;15:370-4.
37. Cromie JE, Robertson VJ, Best MO. Work-Related Musculoskeletal Disorders in Physical Therapists: Prevalence, Severity, Risks, and Responses. *Phys Ther* 2000;80:336-51.
38. Shafieezadeh KR. Prevalence of Musculoskeletal Disorders among Paramedics Working in a Large Hospital in Ahwaz, Southwestern Iran. *IJOEM* 2011; 2:3.
39. Karahan A, Kav S, Abbasoglu A, Dogan N. Low back pain: prevalence and associated risk factors among hospital staff. *J Adv Nurs*. 2009; 65(3): 516-524.
40. Carugno M, Pesatori AC, Ferrario MM, Ferrari AL, Silva FJ, Martins AC, et al. Physical and psychosocial risk factors for musculoskeletal disorders in Brazilian and Italian nurses. *Cad Saude Publica* 2012;28:1632-42.
41. 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. *Occup Environ Med* 2000;57:211-6.
42. Kierklo A, Kobus A, Jaworska M, Botuliński B. Work-Related Musculoskeletal Disorders among Dentists - A Questionnaire Survey. *Ann Agric Environ Med* 2011;18:79-84.
43. Campo M, Weiser S, Koenig KL, Nordin M. Work-related musculoskeletal disorders in physical therapists: A prospective cohort study with 1-year follow-up. *Phys Ther* 2008;88:608-19.
44. Passier L, McPhail S. Work related musculoskeletal disorders amongst therapists in physically demanding roles: Qualitative analysis of risk factors and strategies for prevention. *BMC Musculoskelet Disord* 2011;12:24.
45. Kilroy N, Dockrell S. Ergonomic intervention: Its effect on working posture and musculoskeletal symptoms in female biomedical scientists. *Br J Biomed Sci* 2000;57:199-206.

Cite this article as: Yasobant S, Rajkumar P. Work-related musculoskeletal disorders among health care professionals: A cross-sectional assessment of risk factors in a tertiary hospital, India. *Indian J Occup Environ Med* 2014;18:75-81.

Source of Support: Nil, **Conflict of Interest:** None declared.

Staying in touch with the journal

1) Table of Contents (TOC) email alert

Receive an email alert containing the TOC when a new complete issue of the journal is made available online. To register for TOC alerts go to www.ijoem.com/signup.asp.

2) RSS feeds

Really Simple Syndication (RSS) helps you to get alerts on new publication right on your desktop without going to the journal's website. You need a software (e.g. RSSReader, Feed Demon, FeedReader, My Yahoo!, NewsGator and NewzCrawler) to get advantage of this tool. RSS feeds can also be read through FireFox or Microsoft Outlook 2007. Once any of these small (and mostly free) software is installed, add www.ijoem.com/rssfeed.asp as one of the feeds.