**EFFECTS OF PHYSICAL AND PSYCHOSOCIAL WORK ENVIRONMENT FACTORS ON MUSCULOSKELETAL SYMPTOMS AMONG HOSPITAL ORDERLIES AT A TERTIARY CARE HOSPITAL**

**ABSTRACT:**

**Background:** Hospital orderlies perform a wide range of jobs, including prolonged static postures, repetitive tasks, and prolonged periods of exposure to a given task.They also undertake a range of physically and psychosocially demanding tasks that have been linked to the development of work-related musculoskeletal disorders.

**Methods:** The purpose of this cross-sectional study was to determine the effects of physical and psychosocial work environment factors on musculoskeletal symptoms among hospital orderlies at a tertiary care hospital. 129 hospital orderlies participated in this study. A self-reported questionnaire was used to collect data on physical and psychosocial work environment factors.

**Results:** The most common musculoskeletal disorder, during a 12-month period, as reported by 71 percent of participants was lower back pain. Factors significantly associated with musculoskeletal symptoms were years of employment, high physical workload, high quantitative demands, and high emotional demands.

**Conclusions:** The results of the current study indicate that a properly implemented intervention can lead to a decrease in musculoskeletal symptoms and to some extent improve the physical and psychosocial work environment.

**KEYWORDS:** Physical, Psychosocial, Work environment factors, Musculoskeletal symptoms, Thai hospital orderlies

**INTRODUCTION**

Musculoskeletal disorders (MSDs) are often work-related and are a major public health concern. A diverse range of psychosocial hazards, and more widely recognized hazards associated with physically demanding work, affect the prevalence of MSDs [1, 2, 3]. Many studies have shown that work-related musculoskeletal disorders (WMSDs) are a considerable concern for the healthcare workforce. A number of studies over the past decades have indicated that healthcare workers encounter WMSDs, [4, 5] often resulting in pain, lost work time or work restrictions, mental health problems, sickness-related absenteeism, and disability leave [6, 7, 8] .

Physical work factors play a major role in the development of MSDs. These factors include the combination of load and postures [9], heavy weight lifting [10], awkward working postures and high exerted forces [11], prolonged periods of standing or walking [12], long working hours per shift [13], and repetitive movements or monotonous work [14]. Psychological demands and social work factors associated with MSDs include job demands and low social or co-worker support [14, 15, 16], low job satisfaction [15, 17], a low degree of satisfaction with leisure activities [14,15], night shift work [18], high job insecurity [19], and work related stress [20].

Hospital orderlies are at a high risk of developing WMSDs as a result of exposure to risk factors in the work environment. Patient care requires many lifting and transferring tasks that pose a demonstrated risk of injury to orderlies [20]. High rates of back injuries and other MSDs have been well documented among healthcare workers [21,22,23,24].

Numerous studies have been undertaken to determine the prevalence of WMSDs in health care worker from both the developed and the developing countries and these studies have revealed that prevalence ranged from 52% to 91.9% [25, 26-33]. The evidence indicates that WMSDs are an important occupational health issue among hospital orderlies, but there is a dearth of information regarding physical and psychosocial work environment factors and their relation to MSDs among registered hospital orderlies in Thailand. Therefore, this study focused directly on exposure to physical and psychosocial risk factors in the work environment. The purpose of the present study was to determine the effects of physical and psychosocial work environment factors on MSDs among hospital orderlies at a tertiary care hospital.

**MATERIALS AND METHODS**

**Study design and population**

A cross-sectional survey was conducted. The survey consisted of 189 hospital orderlies who worked in a government tertiary care hospital (2,221-bed hospital) in Bangkok, Thailand. The survey was conducted between June and August 2014. Participants had to be male full-time workers that had worked at the selected facility for at least one year. Participants who had any medical history of serious injury, spinal surgery, or severe disability were excluded. Sixty subjects who did not meet qualification requirements or had not completed the physical and psychosocial work environment questionnaires were excluded. The sample group consisted of 129 hospital orderlies.

This study was approved by the Ethics Review Committee of Siriraj Institutional Review Board, Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand(ref: no. 126/2013). Participants received an explanation of the study and signed consent forms before any data were collected.

**Measurements and data collection**

Data on all outcome measures were assessed by self-reported questionnaires. Information on demographic characteristics including, age, gender, educational level, exercise, alcohol consumption, smoking habits, perceived health status, and shift work were obtained by self-reported questionnaires. A panel of specialists in occupational health and safety validated the content of the questionnaires. The panel included two ergonomists, one occupational physician and two nurse professors who specialized in psychosocial work.

 The Nordic Musculoskeletal Questionnaire (NMQ) on physical workload and psychosocial work environment was translated into Thai [8], and its reliability was found to be acceptable. The translation allowed workers to better identify areas of the body undergoing musculoskeletal problems. The content validity index (CVI) was 0.90. The questionnaire was tested with ten orderlies working in the same hospital. The internal reliability coefficient of the questionnaire (Cronbach’s alpha) was 0.80. The physical work environment section was developed based on the physical workload index modified by Hollmann et al. [34]. The psychosocial work environment section was developed based on the Copenhagen Psychosocial Questionnaire (COPSOQ version I and II) modified by Aust et al [35] and Tuomi et al. [36].

 The physical work environment was presented as pictograms and calculated as the weighted sum of the 17-item scores describing the frequency of different work positions combined with the lifting of objects. Participants were asked to record their physical work environment with an average frequency of occurrence of body positions or the handling of loads during ordinary daily work. The total yield score was between 0 (the best physical work environment) and 56.16 (the worst physical work environment). The sum score of all dimensions were used to assess the physical work environment. A score ≤ 22.46 was considered a low physical work environment, a score between 22.47 and 36.37 was considered a moderate physical work environment, and a score **≥ 36.38** was taken as a high physical work environment. The scores were calculated using a binary score.

The psychosocial work environment questionnaire consisted of 57 items with 17 scales covering the three main areas of the psychosocial work environment: demands at work, work organization, and interpersonal relations at work. All scales were transformed to a range from 0 to 100, the weights used were 0, 25, 50, 75, and 100, to make the scoring on the different scales comparable. Directions of the scores follow the label of the scale; a high score on the emotional demand scale indicates high emotional demands, a high score on the predictability scale indicates high predictability, and so on.The subjects were assigned into the group of low and high psychosocial work environment if their score was less than mean score or greater than mean score respectively. The scores were calculated using a binary score.

The standardized NMQ, validated by Kuorinka et al. [37], was used to measure the prevalence of MSD symptoms. Completion is aided by a body map to indicate nine symptom sites: neck, shoulders, upper back, elbows, lower back, wrist/hands, hips/thighs, knees, and ankles/feet. Respondents were asked if they had noticed any musculoskeletal trouble (such as aches, pain, discomfort, or numbness) over the pervious 12-month period.

**Statistical analysis**

Demographic characteristics of study participants were attained using the mean and standard deviation of continuous variables and using the frequency and percentage of categorical variables. An logistic regression was used to estimate the odds ratio (OR) of the physical and psychosocial work environment factors. Data were analyzed using SPSS version 16 for Windows with a level of significance that was set at p < 0.05.

**RESULTS**

**Demographic Characteristics**

The demographic characteristics of the study subjects are shown in Table 1.

Table 1 Demographic characteristics of study subjects (n=129)

|  |  |
| --- | --- |
| Characteristic | n (%) |
| Age (Mean ± SD) years = 35.12 ± 7.81 | 129 (100) |
| BMI (mean ± SD) = 25.11± 5.05 |  |
| Years of working (mean ± SD) = 8.18 ± 7.31 |  |
| Education level |  |
|  < Bachelor’s degree | 121 (93.8%) |
|  ≥ Higher than Bachelor’s degree | 8 (6.2%) |
| Marital status |  |
|  Single | 68 (52.7%) |
|  Married | 55 (42.6%) |
|  Divorced/Separated | 6 (4.7%) |
| Income (Thai Baht, THB\*) |  |
|  ≤10,000 | 40 (31.0%) |
|  >10,001 | 89 (69.0%) |
| Exercise |  |
|  < 3 times/week | 58 (45.0%) |
|  ≥ 3 times/week | 71 (55.0%) |
| Current alcohol consumption |  |
|  No | 36 (27.9%) |
|  Yes | 93 (72.1%) |
| Current smoking |  |
|  No | 44 (34.1 %) |
|  Yes | 85 (65.9%) |
| Perceived health status |  |
|  Good-Very good | 74 (57.4%) |
|  Poor-Fair | 55 (42.6%) |
| Performed Shift work |  |
|  Morning Shift | 80 (62.0) |
|  Afternoon | 34 (26.4) |
|  Night Shift | 15 (11.6) |
| Musculoskeletal symptom |  |
|  Yes | 100 (77.5) |
|  No | 29 (22.5) |

\*1 USD approx. 30 THB

**Physical work environment factors**

The study found that mean scores (±SD) of the physical work environment of the hospital orderlies were those of a highly physical work environment 43.91 (± 10.74).

**Psychosocial work environment factors**

Mean responses to the psychosocial scales are displayed in Table 2.

**Table 2** The mean score of the psychosocial work environment of hospital orderlies (n=129)

|  |  |
| --- | --- |
| **Psychosocial work environment** | Mean(±SD) |
| **Demand at work**   |  |
|  Quantitative demands | 45.32 (±13.29) |
|  Work pace  | 63.91(±29.27) |
|  Cognitive demands | 57.21(±18.43) |
|  Emotional demands | 44.83(±18.29) |
|  Demands for hiding emotions | 53.83(±23.65) |
| **Work organization** |  |
|  Influence at work | 56.20(±24.38) |
|  Possibilities for development | 69.20(±15.60) |
|  Meaning of work | 79.00(±14.33) |
|  Commitment to the workplace | 58.9-(±15.50) |
| **Interpersonal relations at work** |  |
|  Predictability | 67.67(±15.91) |
|  Rewards | 70.58(±17.52) |
|  Role clarity  | 68.88(±14.28) |
|  Role conflicts  | 63.12(±12.64) |
|  Quality of leadership  | 66.68(±12.08) |
|  Social support from supervisor  | 51.88(±14.01) |
|  Social support from colleagues  | 50.87(±15.17) |
|  Social community at work | 60.68(±13.65) |

**MSD symptoms in various body regions of hospital orderlies**

Number of Participants with MSD symptoms %

Figure 1 Percentages of participants reporting MSD symptoms in the past year, by body part. (n = 100)

Figure 1 shows the rate of musculoskeletal disorders on various parts of participants in the last 12 months. Lower back pain was the most common MSD, having been reported by 71 percent of participants. Lower back pain was followed by hips/thighs/buttocks symptoms, reported by 68 percent of participants. Pain in the arms, knees, upper back, and shoulders was infrequent.

The results of the multiple logistic regressions are shown in Table 3. Hospital orderlies that had worked more than 8 years were more likely to have musculoskeletal problems (OR = 3.47, 95% CI = 1.22-9.85). Hospital orderlies that faced a highly physical workload were found at higher risk of musculoskeletal problems than hospital orderlies with lower physical workloads (OR = 2.62, 95% CI =1.12-6.08). Furthermore, analysis of the psychosocial work environment indicated that hospital orderlies with higher quantitative demands were at higher risk of musculoskeletal problems than hospital orderlies with higher quantitative demands (OR = 3.20, 95% CI =1.29-7.92). Hospital orderlies that saw high emotional demands were more likely to have musculoskeletal problems than those who did not (OR = 2.62, 95% CI = 0.16-6.48).

**Table 3** Multivariate logistic regression analysis of self-reported risk factors among hospital orderlies

|  |  |
| --- | --- |
| 12- month prevalence of MSDsn (%) | Multivariate |
| OR | 95% CI | p-value |
| Age (years) |  |  |  |  |
|  Less than 35 | 64 (70.0%) | reference | 0.609-3.211 | 0.564 |
|  35 or more | 36 (75.0%) | 1.398 |  |  |
| Marital Status |  |  |  |  |
|  Single or divorced | 55 (80.9%) | reference | 0.290-1.526 | 0.336 |
|  Married | 45 (73.8%) | 0.665 |  |  |
| Education level |  |  |  |  |
|  Lower than bachelor degree | 93 (93%) | reference | 0.129-2.364 | 0.424 |
|  Bachelor degree or higher | 7 (76.7%) | 0.553 |  |  |
| Nutritional status |  |  |  |  |
|  Non-obese (BMI ≤22.9 kg/m2) | 34 (79.1%) | reference | 0.587-3.196 | 0.466 |
|  Obese (BMI >23kg/m2) | 66 (76.7%) | 1.370 |  |  |
| Current smoking |  |  |  |  |
|  Yes | 68 (80.0%) | reference | 0.651-3.598 | 0.329 |
|  No | 32 (72.7%) | 1.530 |  |  |
| Current alcohol consumption |  |  |  |  |
|  Yes | 73(78.5%) | reference | 0.510-3.146 | 0.610 |
|  No | 27 (72.7%) | 1.267 |  |  |
| Perceived health status |  |  |  |  |
|  Good-Very good | 61 (82.4%) | reference | 0.225-1.197 | 0.124 |
|  Poor-Fair | 39 (70.9%) | 0.519 |  |  |
| Performed Shift work |  |  |  |  |
|  Morning Shift | 69 (86.2%) | reference | 0.857-5.587 | 0.103 |
|  Afternoon | 31 (63.3%) | 2.184 |  |  |
| Exercise |  |  |  |  |
|  < 3 times/week | 44 (75.9%) | reference | 0.519-2.270 | 0.684 |
|  ≥ 3 times/week | 56 (78.9%) | 1.188 |  |  |
| Years employed (years) |  |  |  |  |
|  8 or less | 43 (89.6%) | reference | 1.226-9.855 | 0.019\* |
|  More than 8 | 57 (70.4%) | 3.476 |  |  |
| Physical work load |  |  |  |  |
|  Low | 32 (66.7%) | reference | 1.125-6.082 | 0.026\* |
|  High | 68 (84.0%) | 2.615 |  |  |
| Quantitative demands |  |  |  |  |
|  Low | 49 (75.4%) | reference | 1.298-7.928  | 0.012\*  |
|  High | 51 (79.7%) | 3.208 |  |  |
| Work pace  |  |  |  |  |
|  Low | 41 (73.2%) | reference | 0.672-3.537 | 0.843 |
|  High | 59 (80.8%) | 1.542 |  |  |
| Cognitive demands |  |  |  |  |
|  Low | 49 (69.0%) | reference | 0.731-3.970 | 0.218 |
|  High | 51 (87.9%) | 1.703 |  |  |
| Emotional demands |  |  |  |  |
|  Low | 49 (73.1%) | reference | 0.163-6.481 | 0.036\* |
|  High | 51 (82.3%) | 2.625 |  |  |
| Demands for hiding emotions |  |  |  |  |
|  Low | 57 (82.6%) | reference | 0.230-1.231 | 0.141 |
|  High | 43 (71.7%) | 0.533 |  |  |
| Influence at work |  |  |  |  |
|  Low | 42 (73.7%) | reference | 0.645-3.392 | 0.355 |
|  High | 58 (80.6%) | 1.480 |  |  |
| Possibilities for development |  |  |  |  |
|  Low | 67 (72.0%) | reference | 0.392-2.162 | 0.849 |
|  High | 33 (91.7%) | 0.920 |  |  |
| Meaning of work |  |  |  |  |
|  Low | 17 (77.3%) | reference | 0.340-3.043 | 0.976 |
|  High | 83 (77.6%) | 1.107 |  |  |
| Commitment to the workplace |  |  |  |  |
|  Low | 79 (79.0%) | reference | 0.271-1.797 | 0.456 |
|  High | 21 (72.4%) | 0.698 |  |  |
| Predictability |  |  |  |  |
|  Low | 52 (74.3%) | reference | 0.648-3.552 | 0.340 |
|  High | 48 (81.4%) | 1.510 |  |  |
| Rewards |  |  |  |  |
|  Low | 54 (74.0%) | reference | 0.039-1.940 | 0.692 |
|  High | 46 (82.1%) | 0.846 |  |  |
| Role clarity  |  |  |  |  |
|  Low | 61 (78.2%) | reference | 0.391-2.100 | 0.818 |
|  High | 39 (76.5%) | 0.906 |  |  |
| Role conflicts  |  |  |  |  |
|  Low | 59 (78.7%) | reference | 0.339-2.195 | 0.757 |
|  High | 41 (75.9%) | 0.863 |  |  |
| Quality of leadership  |  |  |  |  |
|  Low | 43 (74.1%) | reference | 0.251-1.403 | 0.235 |
|  High | 57 (80.3%) | 0.594 |  |  |
| Social support from supervisor  |  |  |  |  |
|  Low | 56 (76.7%) | reference | 0.302-1.589 | 0.385 |
|  High | 44 (78.6%) | 0.692 |  |  |
| Social support from colleagues  |  |  |  |  |
|  Low | 62 (78.5%) | reference | 0.344-2.408 | 0.416 |
|  High | 38 (76.0%) | 0.910 |  |  |
| Social community at work |  |  |  |  |
|  Low | 61 (83.6%) | reference | 0.168-1.028 | 0.058 |
|  High | 39 (69.6%) | 0.415 |  |  |

\* Statistical significance at α = 0.05

**DISCUSSION**

This was the first cross-sectional study exploring hospital orderly exposure to physical and psychosocial factors in the workplace and the prevalence of MSDs in a hospital setting. The factors significantly associated with musculoskeletal symptoms were years of employment, physical work environment, quantitative demands, and possibilities for development.

The present study showed that hospital orderlies with more than eight years of work experience were more likely to present MSDs. A possible cause is that more experienced orderlies have many responsibilities beyond patient care, such as supervising junior staff and managing other jobs. In addition, hospital orderlies face physical challenges that do not characterize other healthcare fields [38]. A study of Thai hospital nurses found that poor mental health and MSDs were more likely among nurses with more than 20 years of experience. In 2010, the Health and Safety Laboratory found that older workers’ decreased functional capacity made them more susceptible to MSDs than their younger counterparts. It has been the difference between work demands and individual physical capacity, not age, which has been linked with higher risk of injury.

This study found that MSDs were significantly associated with physical workloads and perceptions of musculoskeletal symptoms. These results are in line with previous studies that have found a relationship between physical workloads and musculoskeletal symptoms in healthcare settings [8]. Several studies have found that factors related to motion and workspace design are linked to MSDs in hospital nurses. Factors such as pulling and pushing motions, transferring patients or materials, and posture are all affected by the design of workstations and tools [8,17,21,24,]. High physical demands (e.g. physical patient handling) may cause overloading of the musculoskeletal system. The effect of overloading can be ‘cumulative trauma,’ resulting in a premature degenerative process [39,40]. Trinkoff et al [41] observed an increased risk of MSDs for individuals in jobs characterized by moderate and high physical demands. In the present study, only physical job demands at high levels were associated with an increased risk of MSDs. This discrepancy may be explained by variations in methodology, as assessed data was self-reported [42]. Differences in methods, including grading of physical job demands, wording of the questions, and differences in case definitions for MSDs must be taken into account [43].

Results regarding the psychosocial work environment in the present study showed that orderlies with high quantitative demands and high emotional demands were more likely to have issues related to MSDs. All in all, high emotional demands are as important a risk factor for hospital orderlies’ well being as other well-established concepts like low job control and high quantitative job demands. Higher quantitative demands require an emphasis on efficiency, being able to perform more work in less time is a priority. High quantitative job demands and a lack of coworker support have been identified as risk factors for neck pain (Ariëns et al. 2001) [44]. Emotional demands and exhaustion must also be considered as they may affect job control. When emotional demands are low workers can go to colleagues for assistance. However, when emotional demands are high, as is the case with facing issues every hour, it becomes less reasonable to rely on coworkers for assistance. The match principle [45-48] addresses this issue by stating that job control, as a resource, does not ‘match’ emotional demands. As a result, job control does not serve as a reduction mechanism of high emotional demands. However, it cannot be overlooked that employees typically benefit from having control at work. This result was similar to previous study that reported the psychosocial loads, was identified as the most important risk factor for musculoskeletal disorders[49]. Singsongsook et al. [49] found low job control statistically associated with persistent shoulder pain in nurses from central Thailand (95% CI: 1.18-5.17, p<0.05). However, this effect was not statistically significant after multiple logistic regression analysis. [40]

**CONCLUSION**

A survey of hospital orderlies at a tertiary care facility was conducted to determine the linkages between physical and psychosocial work environments and MSDs. The study found that musculoskeletal symptoms were most prevalent in the lower back, accounting for 71 percent of reported cases. Years of employment, physical job demands, high quantitative demands, and high emotional demands were found to be significantly associated with musculoskeletal symptoms. Educational materials and programs should be developed to raise awareness of these risk factors and help reduce MSDs among hospital orderlies and improve work environments. Further studies should be undertaken to evaluate the causality of MSDs among hospital orderlies

**Limitations of the study**

 The study had a number of limitations. The respondents were recruited from one hospital of a selected locality; therefore results cannot be generalized with certainty. Moreover, the data are correlational, thus causal relationships between the variables studied cannot be inferred. Furthermore, participants’ responses relied on their memory over the preceding year, making responses potentially subject to recall bias. In addition, there was no measurement scale for measuring the intensity of pain and discomfort reported by respondents. Finally, there was no objective data such as physical exams or injury records with which to compare the subjective questionnaire data.

**ACKNOWLEDGEMENTS**

This study was supported by the 90th Anniversary Fund of Chulalongkorn University (Ratchadaphiseksomphot Endowment Fund). It was conducted as part of a doctoral dissertation at the College of Public Health Sciences, Chulalongkorn University, Thailand. Special thanks are owed to all participants in The Departments of Patient Transfer Service, Faculty of Medicine Siriraj Hospital, Mahidol University, Thailand.

**REFERENCES**

1. Cheng, K.H.Y., Cheng, C.Y., Ju, Y.Y. Work-related musculoskeletal disorders and ergonomic risk factors in early intervention educators. Appl. Ergon. 2013; 44 (1),134-141.

2. Eatough, E., Way, J., Chang, C. Understanding the link between psychosocial work stressors and work-related musculoskeletal complaints. Appl. Ergon. 43(3), 554-563.

3. Marras, W., Cutlip, R., Burt, S., Waters, T. National occupational research agenda (NORA) future directions in occupational musculoskeletal disorder health research. Appl. Ergon.2009; 40 (1), 15-22.

4. Sheikhzadeh A, Gore C, Zukerman JD, Nordin, M. Perioperating nurses and technician’s perceptions of ergonomic risk factors in the surgical environment. Appl Ergon. 2009; 40(5): 833-9.

5. Hubertsson J, Petersson IF, Arvidsson B, Thorstensson CA. Sickness absence in musculoskeletal disorders - patients' experiences of interactions with the social insurance agency and health care: a qualitative study. BMC Public Health. 2011; 11: 107.

6. Tomasson, K., Gunnarsdottir, H., Rafnsdottir, G., Helgadottir, B. Correlates of probable alcohol abuse among women working in nursing homes. Scandinavian Journal of Public Health .2004; 32. (1), 47–52.

7. Birgit Aust, Reiner Rugulies, Janne Skakon, Teresa Scherzer, Chris Jensen. Psychosocial work environment of hospital workers: Validation of a comprehensive assessment scale. International Journal of Nursing Studies. 2007; 44. 814–825.

8. Wanpen Songkham, Wattasit Siriwong, Mark Gregory Robson. Effects of a healthy unit guidance (HUG) program on work environments and health outcomes among nursing personel. J Health Res. 2013; vol.27 no.4 August.

9. Heather, L.B., John,W.K. The effect of loadand posture onload estimations during a simulated lifting task in female workers. Int. J. Ind. Ergonom. 2003; 31 (5), 331-341.

10. Tullar JM, Brewer S, Amick BC, Irvin E, Mahood Q, Pompeii LA, et al. Occupational safety and health interventions to reduce musculoskeletal symptoms in the healthcare sector. J Occup Rehabil. 2010 Jun;20(2):199-219.

11. Skotte JH, Essendrop M, Hansen AF, Schibye B. A dynamic 3D biomechanical evaluation of the load on the low back during different patient-handling tasks. J Biomechanics. 2002;35(10):1357–66. http://dx.doi.org/10.1016/S0021-9290(02)00181-1.

12. Ndetan H, Rupert R, Bae S, Singh P. Epidemiology of musculoskeletal injuries among students entering a chiropractic college. J Manipulative Physiol Ther 2009;32:134–9.

13. Raanaas, R.K., Anderson, D. A questionnaire survey of Norwegian taxi drivers’ musculoskeletal health, and work-related risk factors. Int. J. Ind. Ergonom. 2008; 38 (3-4), 280-290.

14. Thorbjornsson, C.O., Alfredsson, L., Fredriksson, K., Koster, M., Michelsen, H., Vingard, E., Torgen, M., Kilbom, A. Psychosocial and physical risk factors associated with low back pain: a 24 year follow up among women and men in a broad range of occupations. Occup. Environ. Med.1998; 55 (2), 84-90.

15. van den Heuvel, S.G., Ariens, G.A., Boshuizen, H.C., Hoogendoorn, W.E., Bongers, P.M. Prognostic factors related to recurrent low-back pain and sickness absence. Scand. J. Work Environ. Health.2004; 30 (6), 459-467.

16. Larsman, P., Hanse, J.J.. The impact of decision latitude, psychological load and social support at work on the development of neck, shoulder and low back symptoms among female human service organization workers. Int. J. Ind. Ergonom. 2009; 39 (2), 442-446.

17. Hoogendoorn, W.E., Bongers, P.M., de Vet, H.C., Ariens, G.A., van Mechelen, W., Bouter, L.M. High physical work load and low job satisfaction increase the risk of sickness absence due to low back pain: results of a prospective cohort study. Occup. Environ. Med. 2002; 59 (5), 323-328.

18. Eriksen,W., Bruusgaard, D., Knardahl, S.Work factors as predictors of intense or disabling low back pain; a prospective study of nurses’ aides. Occup. Environ. Med. 2004; 61 (5), 398-404.

19. Lee, H., Wilbur, J., Kim, M.J., Miller, A.M. Psychosocial risk factors for work related musculoskeletal disorders of the lower-back among long-haul international female flight attendants. J. Adv. Nurs. 2008; 61 (5), 492-502.

20. Oksuz, E. Prevalence, risk factors, and preference-based health states of low back pain in a Turkish population. Spine. 2006; 31 (25), 968-972.

21. Anis Jellad, Hanene Lajili, Soumaya Boudokhane, Houda Migaou, Sarra Maatallah, Zohra Ben Salah Frih. Musculoskeletal disorders among Tunisian hospital staff: Prevalence and risk factors. The Egyptian Rheumatologist. 2013; Volume 35, Issue 2, Pages 59–63.

22. Mike Fray & Sue Hignett. TROPHI: development of a tool to measure complex, multi-factorial patient handling interventions. Ergonomics, 2013; Vol. 56, No. 8, 1280–1294.

23. Moison S, Calory S, Juret I, Brinon C, Josselin V, Guiho-Bailly MP, et al. Prevention of musculoskeletal disorders in hospital workers: exposure assessment and assistive devices for patients handling. Arch Mal Prof Environ 2009;70:13–27.

24. Dinora Bernal, Javier Campos-Serna, Aurelio Tobias, Sergio Vargas-Prada, Fernando G. Benavides, Consol Serra.,. Work-related psychosocial risk factors and musculoskeletal disorders in hospital nurses and nursing aides A systematic review and meta-analysis. International Journal of Nursing Studies.2015; 52.635–648.

25. Kee D, Seo SR. Musculoskeletal disorders among nursing personal in Korea. Int J Ind Ergon. 2007; 37: 207-12.

26. Choonineh A, Movahed M, Tabatabale SH, Kumashiro M. Perceived demands and musculoskeletal disorders in operating room nurses of Shiraz City Hospital. Ind Health. 2010; 48: 74-84.

27. 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: 82-88.

28. Mehrdad R, Dennerlein JT, Haghight M, Aminian O. Association between psychosocial factors and musculoskeletal symptoms among Iranian Nurses. Am J Ind Med. 2010; 53: 1032-39.

29. Harcombe H, McBride D, Derrett S, Gray A. Prevalence and impact of musculoskeletal disorders in New Zealand nurses, postal workers and office workers. Aus N Z J Public Health. 2009; 33: 437-41.

30. Hou JY, Shiao JSC. Risk factors for musculoskeletal discomfort in nurses. J Nurs Res. 2006; 14(3): 228-35.

31. Smith DR, Kondo N, Tanaka E, Tanaka H, Hirasawa K, Yamagata Z. Musculoskeletal disorders among hospital nurses in rural Japan. Rural Remote Health. 2003; 3(3): 241. 21. Smith

32. Smedley J, Inskip H, Trevely F, Buckle P, Cooper C, Coggon D. Risk factors for incident neck and shoulder pain in hospital. Occup Environ Med. 2003; 60: 864-69.

33. Sha Jin1, Sompong Srisaenpang, Somdej Pinitsoontorn, Wichai Eungpinichpong. Prevalence of work-related musculoskeletal disorders among registered nurses in Srinagarind hospital,Thailamd. J Health Res. 2011; 2: 61-68

34. Hollmann S, Klimmer F, Schmidt K-H, Kylian H. Validation of a questionnaire for assessing physical work load. Scand J Work Environ Health. 1999; 25(2): 105-14.

35. Aust B, Rugulies R, Skakon J, Scherzer T, Jensen C. Psychosocial work environment of hospital workers: validation of a comprehensive assessment scale. Int J Nur Studies. 2007; 44: 814-25.

36. Tuomi K, Ilmarinen J, Jahkola A, Katajarinne L, Tulkki A. Work ability Index. 2nd ed. Helsinki: Finnish Institute of Occupational Health; 1998.

37. Kuorinka I, Jonsson B, Kilbom A et al. Standardized Nordic questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon 1987;18:233–237.

38. Holmström, E.B., Lindell, J., Moritz, U., 1992a. Low back and neck/shoulder pain in construction workers: occupational workload and psychosocial risk factors. Part1: relationship to low back pain. Spine (Phila Pa. 1976 ) ; 17, 663-671.

39. Kumar, S. Theories of musculoskeletal injury causation. Ergonomics.2001; 44, 17-47.

40. Menzel, N.N., Brooks, S.M., Bernard, T.E., Nelson, A. The physical workload of nursing personnel: association with musculoskeletal discomfort. Int. J. Nurs. Stud. 2004; 41, 859-867.

41. Trinkoff, A.M., Lipscomb, J.A., Geiger-Brown, J., Storr, C.L., Brady, B.A. Perceived physical demands and reported musculoskeletal problems in registered nurses. Am. J. Prev. Med. 2003; 24, 270-275.

42. Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., Podsakoff, N.P. Common method biases in behavioral research: a critical review of the literature and recommended remedies. J. Appl. Psychol.2003; 88, 879-903.

43. Punnett, L., Wegman, D.H.,. Work-related musculoskeletal disorders: the epidemiologic evidence and the debate. J. Electromyogr. Kinesiol.2004; 14, 13-23.

44. Evanoff, B.A., Bohr, P.C., Wolf, L.D. Effects of a participatory ergonomics team among hospital orderlies. Am. J. Ind. Med. 1999; 35 (4), 358–365.

45. Ariens GA, van Mechelen W, Bongers PM et al. Psychosocial risk factors for neck pain: a systematic review.Am J Ind Med. 2001;39:180–193.

46. Cohen, S., & Wills, T. A. Stress, social support, and the buffering hypothesis. Psychological Bulletin.1985;9: 310–357.

47. de Jonge, J., & Dormann, C.The DISC model: Demand-induced strain compensationmechanisms in job stress. In M. F. Dollard, H. R. Winefield, & A. H. Winefield (Eds.), Occupational stress in the service professions. 2003;pp. 43–74. London: Taylor & Francis.

48. Frese, M. Social support as a moderator of the relationship between work stressors and psychological dysfunctioning: A longitudinal study with objective measures. Journal of Occupational Healt Psychology. 1999; 4: 179–192.

49. Singsongsook T, Taptagaporn S, Jiamjarasrangsi W. Association of work-related factors and shoulder pain among hospital nursing personnel. Chula Med J. 2005; 49(2): 61-72.