Investigation on the Relationship between Mental Workload and Musculoskeletal Disorders among Nursing Staff

Yousef Mahmoudifar[1], Bayaneh Seyedamini[1]

[1]Department of Nursing, Islamic Azad University, Mahabad, Iran

Abstract

Aims: High prevalence of musculoskeletal disorders owing to the work is one of the popular discomforts between nursing staff. High level of workload is considered as a serious problem and identified as a stressor in the nursing. This study intends to recognize the relationship between musculoskeletal disorders and mental workload in nursing personnel reside at southern part of West Azerbaijan province Iran in 2017. **Materials and Methods:** In this analytical-descriptive study, 100 nurses working in West Azerbaijan hospitals have been randomly selected. Nordic and National Aeronautics and Space Administration-Task Load Index workload questionnaires have been simultaneously utilized as data collection tools. Data analysis has also carried out using SPSS, variance analysis tests, multiple linear regression, and Pearson's correlation coefficient. **Results:** Results suggest that the most frequent complaints of musculoskeletal problems are associated to the back area. Investigation on sextet scales of mental workload indicates that each of the six scales of workload was at the high-risk level and the average of total workload was 72.45 ± 19.45 which confirms a high-risk level. Pearson's correlation coefficient also indicates mental workload elements have a significant relationship with musculoskeletal disorders ($P < 0.05$). **Conclusion:** The results suggest there is a relationship between musculoskeletal disorders and mental workload and the majority of personnel had mental workload with high-risk level. The best way of management planning to mitigate the risk of musculoskeletal disorders arising of mental workload is, therefore, managing-controlling approach such as staff training, job rotation, and time management.

Keywords: Mental workload, musculoskeletal disorders, nursing staff

INTRODUCTION

Nowadays, musculoskeletal disorders owing to the work are one of the biggest occupational safety and health (OSH) problems in industrial and developing countries. The main reason of such problem is not observing the ergonomics while exerting forces (pulling or lifting the objects), repeated movements, and tensional positions of organs and also working in static and unfavorable condition in some jobs. The health-care professions are one of those high-risk jobs which are susceptible to these kinds of disorders.[1] Having the considerable level of physical activity such as stooping, rotating, long-lasting stand up, patient handling, and lifting the heavy objects make the nursing profession, among the other health-care occupations, very exposed to musculoskeletal disservices.[2] Nursing, after industrial jobs, is ranked in the second place with regard to the physical activities.[3] The reviewed conducted on the various occupations indicate that nursing is within top ten heavy jobs in which, job holders

suffer from musculoskeletal disorders.[4] Hedge, in this connection, writes: more than 40% of reported accidents among nurses was due to patient handling tasks, 75.9% of which lead to back injury.[5] De Castro *et al.* are also reported 80% of prevalence on back injury between Philippino nurses in their studies. These researchers believe the increase in back and leg injuries are totally connected to the nursing activities, specifically those related to the patient handling such as putting the patient clothes and changing their postures.[6] Hegarty *et al.* during the ergonomic evaluation in nursing center of acute care in the USA also show that patient handling activities gain the highest grade (grade 10) in Rapid Entire Body Assessment tools which is used for working condition evaluation in healthcare professions such as nursing.[7]

Address for correspondence: Dr. Yousef Mahmoudifar,
Department of Nursing, Mahabad Branch, Islamic Azad University,
Mahabad, Iran.
E-mail: yousef.mahmoudifar@gmail.com

Access this article online

Quick Response Code:

Website:
http://iahs.kaums.ac.ir

DOI:
10.4103/iahs.iahs_33_17

Thus, this activity between nurses recognized risky and the immediate rectification of working positions is necessary accordingly. Several researches confirm the relationship between working condition and musculoskeletal disorders. The studies show the population, physical, and mental factors are effective on musculoskeletal problems.[8] Other researches also regard the work-related musculoskeletal disorders as multicauses problems (including physical, organizational, mental-social, personal, and social-cultural factors). At the same time and apart from the physical requirement, nurses are exposed to other factors such as mental requirements, time pressure, lack of social supports, etc.[9-11] These factors are normally recognized as social mental or mental factors.[12,13] Epidemiologic studies recognized these factors in combination with physical activities as risk factors for musculoskeletal disorders, especially in the neck area.[14,15] Working condition in hospital environments, on the other hand, is in such a way to be open to the combination of mental and physical requirement.[16] Neurocognitive disorders that can be the cause of mental stresses, also increases the biomechanical response to the musculoskeletal system. Such can reduplicate the risk of musculoskeletal problems.[13,17] Hence, the heavy workload is identified as a stressor and an important issue in nursing.[18] The heavy workload is an important factor in exhaustion, lack of proper communication with patient, work-related injuries, and decrease on the productivity among nurses and in principle, is connected with mental abilities of a person.[19] Taking the importance of this subject into account, previously conducted studies are too narrow to reach to an extensive picture of social-mental risk factors related to the musculoskeletal disorders and that the relationship between musculoskeletal disorders and these risk factors need to be deeply studied among nurses.[20,21] This study carried out aiming at the review of relationship between mental workload and musculoskeletal disorders among nursing staff of hospitals located in the southern part of West Azerbaijan province. This research carried out in a hope that its results would make a platform for further studies on different aspects of mental workload among nursing staff to provide the ergonomic intervention in working environment of nurses.

Materials and Methods

This research is of analytical-descriptive and cross-sectional type in the southern part of West Azerbaijan province Iran in 2017 has been studied. In this study, 100 persons from different wards provided that they are qualified to be respondent, have been randomly selected. Having at least an associate degree, a full-time job and expressing their consent to subscribe to the research were the condition of samples. Those nurses who have less than 1 year of work experience or those who have previously musculoskeletal disorders by accidents were deleted from the research. The researcher-made questionnaire for demographic data collection along with Nordic and National Aeronautics and Space Administration-Task Load Index (NASA-TLX) workload questionnaire have

been simultaneously utilized as data collection tools. To determine the prevalence level of musculoskeletal disorders, a questionnaire which has been furnished by Kuorinka et al.[22] in 2008 in OSH center of Scandinavia area were utilized. This document is nowadays named as Nordic questionnaire. Nordic questionnaire is made from two parts, one of which is to do with the demographic data (age, gender, job type, job satisfaction, recruitment type, working scheme, and work experience) and the specific questionnaire which analyses the disorders such as existence of pain, discomfort, and paresthesia over the last 12 months. Validity of this questionnaire in a study is verified by Choobineh et al.[23] and used in the several studies. NASA-TLX is a tool for calculation of mental load that is presented by human factors engineering group of NASA.[24] NASA-TLX model includes three aspects of needs being imposed to the operator during the work (physical, mental, and timing needs) and three agents concerning the results arising of doing the works (personal performance, amount of effort, and hopelessness level). The process of investigation on work mental pressure using NASA-TLX has been carried out in three steps. The first step is the determination of workload weight of each sextet scales. In the second step, each sextet scale will be rated in order calculate the impact of each six factors to produce the mental load. After determination of weight and impact of each load, in the third and last step, impact and weight of each load will be multiplied and total workload of each person will be calculated according to the following formula:

Total mental workload = (load impact × load weight)/15

If the total grade, in this questionnaire falls below 50, risk level is low and above 50 indicates a high-risk level. This index gained an acceptable validity and reliability in scientific groups. According to the study carried out in Isfahan hospitals, the reliability of this questionnaire is 0.83 with Cronbach's alpha factor.[25] Data analysis has been carried out using SPSS-16, variance analysis tests, multiple linear regression, and Pearson's correlation coefficient.

Results

The results suggest the most frequent gender is female by 58 persons (58%) and 64 persons (64%) were married. The majority of educational level was bachelor degree (85%). Average age of participants was 32.3 ± 7 and average working experience was 10.1 ± 5.5. The average body mass index (BMI) was 25.2 ± 4.3. A comprehensive descriptive information related to the demographic variables of respondents mentioned in Table 1. Most participants (85%) state that they had no training for posture and 45% of those were unaware of probable risks arising of the work. Data proved to be normalized using Kolmogorov–Smirnov test. The output of analysis of demographic factors shows that the relationship between educational level and marital status is not statistically significant ($P > 0.05$); however, there is a significant relation with age, working experience, working scheme, BMI, and

gender ($P < 0.05$). A significant relation was also observed between BMI and mental workload/musculoskeletal disorders ($P < 0.05$).

Table 2 shows the nurses' most complaints of musculoskeletal disorders are from back (50%), neck (44%) and knee (40%), and elbow with 8% has less injury. The outcome suggests the most frequent referral to the medical centers was due to the backache (8%) while referral owing to elbow disorders was zero. The most referral to the physiotherapy due to the knee problems (8%) and the most complaints in a week was related to the shoulder (10%).

The information arising of sextet workload scales evaluation in samples shows in Table 3. Each of the six aspects of workload is in high-risk level, and the total average of workload was (72.45 ± 25.4) that confirms a high-risk level. Efforts need was of highest value (80.5 ± 15.1), and timing need was of lowest value (60.5 ± 25.4) compared to the other workload aspects. Above 95% of samples have mental workload with high level of risk and the grades above 60, according to the results.

The result of Pearson's correlation coefficient suggests mental workload elements and musculoskeletal disorders are statistically significant ($P < 0.05$) [Table 4]. Multiple linear regression was also used to investigate further on effect of each mental workload aspects score on musculoskeletal disorder score, and the result indicates the disappointment level, mental load, and level of effort are the most effective factors on the musculoskeletal disorders.

Discussion

The objective of this study was the review of relationship between mental workload and musculoskeletal disorders among nursing staff. The statistical population being studied had an average age of 32.3 ± 7 years with 10.1 ± 5.5 years of average work experience which is considered a relatively young population. The outcome shows personal factors such as

Table 1: The results of demographic variables among the participants

Variable	Frequency (%)	P
Gender		
Male	42	<0.05
Female	58	<0.05
Education level		
Associate degree	13	>0.05
Bachelor degree	85	>0.05
Master degree	2	>0.05
Marital status		
Single	36	>0.05
Married	64	>0.05
Divorced	0	>0.05
Working experience (years)		
1-10	48	<0.05
11-20	31	<0.05
21-30	29	<0.05
Age group (years)		
20-30	24	<0.05
31-40	45	<0.05
41-50	21	<0.05
51-60	10	<0.05
Working scheme type		
Rotational	55	<0.05
Fixed	45	<0.05

Table 3: Average and standard deviation mental workload aspects in samples

Workload area	Average	SD
Mental need	77.3	18.2
Physical need	72.3	20.1
Timing need	60.5	25.4
Performance score	78.5	15.7
Level of effort	80.5	15.1
Disappointment score	65.6	22.2
Total mental workload score	72.45	19.45

SD: Standard deviation

Table 2: Musculoskeletal disorders incident according to the result of Nordic questionnaire, categorized by ennead organs within participant

Body organs	Feeling of pain and discomfort (frequency in recent 12 months), n (%)	Feeling of pain and discomfort (frequency in recent week), n (%)
Neck	44 (22)	4 (8)
Shoulder	30 (15)	5 (10)
elbow	8 (4)	0
Wrist	10 (5)	2 (4)
Upper back	26 (13)	1 (2)
Lower back	50 (25)	2 (4)
Upper leg	22 (11)	2 (4)
Knee	40 (20)	1 (2)
Foot wrist	30 (15)	4 (8)

Table 4: Results of correlation between mental workload aspects and musculoskeletal disorders in respondents

	P	Correlation factor
Mental need and musculoskeletal disorders	0.002	0.33
Physical need and musculoskeletal disorders	0.015	0.28
Timing need and musculoskeletal disorders	0.023	0.22
Performance score and musculoskeletal disorders	0.001	0.35
Level of effort and musculoskeletal disorders	0.002	0.4
Disappointment score and musculoskeletal disorders	0.011	0.45
Total score of mental workload and musculoskeletal disorders	0.001	0.41

age, work experience, work scheme (fixed or rotational), BMI, and gender were effective in musculoskeletal disorders. In this study, the level of musculoskeletal disorders increases as the age does, which is in fact in line with the study conducted by Rowshani et al.[26] The research did not find any relationship between educational level and mental workload. Working experience, age, gender, had however, significant relation with mental workload that is in compliance with Rahimi moghadam and Khanjani research.[27] In this study, BMI average between females was higher than males, and the extra weight can be an important factor in musculoskeletal disorders between nurses and that is compatible with the study result of Saeidi et al.[28] Working scheme is also related to the musculoskeletal disorders. It means rotational shifts had more musculoskeletal injuries compared to the fixed shifts and this is in accordance with the study of Ghasemi et al.[29]

In this study based on Nordic questionnaire, backache with 50% gained the most complaints between the nurses and that is in line with the study of Ford et al.[30] Different studies show that the nursing occupation with the high level of physical activity such as stooping, rotating, long-lasting stand up, patient handling, and lifting the heavy objects are very exposed to the risk of musculoskeletal injuries.[2] In this regards, Hedge believes more than 40% of reported accidents among nurses was due to patient handling activities, 75.9% of which results in back injury.[5] These researchers are of the opinion that the increase in the injuries in back and leg are related to the nature of nursing profession.[7] Nurses are suffering from skeletal injuries in back and leg in their life; hence, their health should be cared. In the current study mental workload within the nursing staff was very high (72.45 ± 19.45) which is in accordance with the study of Taheri et al.[21] According to the obtained results, 95% of the statistical population had mental workload with high-risk level and the score more than 60 and the prevalence of musculoskeletal disorders among those are considerably higher than others and study carried out by Saeidi et al.confirms this matter.[28] Studies and investigations show that there are different factors such as fixed and steady jobs, working duration, job requirements (focusing, accuracy, and effort), tiredness due to the physical pressures, environmental factors (sound and vibrations), person's feedback from work or person-work interaction, overtime or agronomical condition of work plays a role in making and increasing of mental workload, such complies with the study result of Mohammadzadeh et al.[31] Among the sextet scales, Workload index and effort and performance scale gains the highest value, respectively. The sensitivity of the nurses' duties in the work environment might be the reason why workload, performance, and effort amount are more important compared to other factors. It means, any kind of mistake by nurses can have a detrimental effect on the patient, in a way that the patient experiences an indirect negative impact on his or her safety. On the other hand, between sextet factors, disappointment score gains the lowest amount but has the highest effect on creation of musculoskeletal disorders which is in accordance with the study result of Habibi et al.[21,32]

Job stress and the considerable amount of workload would consequently result in physiologic response in the shape of muscular stress and such will end up with the disorder in back area; misbehavior of patients and their families and meeting the critical patient can be reason of this problem.[33] In another study also named "Can depression, anxiety, and weak mental health be a risk factor for musculoskeletal disorders?" Indicates there are firm witness and substantiated evidence, proving that a relation exists between depression and knee pain.[34] The result of the current study shows the relationship between mental workload and musculoskeletal disorders prevalence is statistically significant which, at the same time, complies with the study carried out by Giahi et al. They concluded that the mental workload along with its associated scales have significant relationship with musculoskeletal disorders and also the average of mental workload factor and its associated scales is higher in group with musculoskeletal disorders.[35]

CONCLUSION

A relation between musculoskeletal disorders and mental workload and the majority of the respondents have mental workload with high level of risk. Therefore, ergonomic and managerial measures will be effective in reducing the risk of musculoskeletal disorders in hospital departments, which can include measures such as reducing work hours, interrupting and resting between work, increasing diversity in work situations, training of staff, job rotation, and exposure time management.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Helander M. A Guide to Human Factors and Ergonomics. 2nd ed. Singapore: Taylor and Francis Group, Nanyang Technological University; 2006.
2. Fujishiro K, Weaver JL, Heaney CA, Hamrick CA, Marras WS. The effect of ergonomic interventions in healthcare facilities on musculoskeletal disorders. Am J Ind Med 2005;48:338-47.
3. Engels JA, van der Gulden JW, Senden TF, van't Hof B. Work related risk factors for musculoskeletal complaints in the nursing profession: Results of a questionnaire survey. Occup Environ Med 1996;53:636-41.
4. Smith DR, Ohmura K, Yamagata Z, Minai J. Musculoskeletal disorders among female nurses in a rural Japanese hospital. Nurs Health Sci 2003;5:185-8.
5. Hedge A, Reviewed by Brian R. Subach. Back Care for Nurses. SpineUniverse. Available from: https://www.spineuniverse.com/wellness/ergonomics/back-care-nurses. [Last accessed on 2017 Sep 19].
6. De Castro AB, Cabrera SL, Gee GC, Fujishiro K, Tagalog EA. Occupational health and safety issues among nurses in the Philippines. AAOHN J 2009;57:149-57.

7. Hegarty C, Rosenberg Y, Stecker R. Ergonomic Evaluation Acute Care Nursing Health Center; Cornell University, 2003. Available from: http://www.ergo.human. cornell.edu/AHProjects/Hospital_Ergonomics/Acute _Care_03.pdf.

8. Burdorf A, Sorock G. Positive and negative evidence of risk factors for back disorders. Scand J Work Environ Health 1997;23:243-56.

9. Iizuka Y, Shinozaki T, Kobayashi T, Tsutsumi S, Osawa T, Ara T, et al. Characteristics of neck and shoulder pain (called katakori in Japanese) among members of the nursing staff. J Orthop Sci 2012;17:46-50.

10. Barzideh M, Choobineh AR, Tabatabaee HR. Job stress dimensions and their relationship to musculoskeletal disorders in Iranian nurses. Work 2014;47:423-9.

11. Hoe VC, Kelsall HL, Urquhart DM, Sim MR. Risk factors for musculoskeletal symptoms of the neck or shoulder alone or neck and shoulder among hospital nurses. Occup Environ Med 2012;69:198-204.

12. Bloemsaat JG, Meulenbroek RG, Van Galen GP. Differential effects of mental load on proximal and distal arm muscle activity. Exp Brain Res 2005;167:622-34.

13. Davis KG, Marras WS, Heaney CA, Waters TR, Gupta P. The impact of mental processing and pacing on spine loading: 2002 Volvo award in biomechanics. Spine (Phila Pa 1976) 2002;27:2645-53.

14. Walker-Bone K, Cooper C. Hard work never hurt anyone: Or did it? A review of occupational associations with soft tissue musculoskeletal disorders of the neck and upper limb. Ann Rheum Dis 2005;64:1391-6.

15. Malchaire J, Cock N, Vergracht S. Review of the factors associated with musculoskeletal problems in epidemiological studies. Int Arch Occup Environ Health 2001;74:79-90.

16. Nimbarte AD, Al Hassan MJ, Guffey SE, Myers WR. Influence of psychosocial stress and personality type on the biomechanical loading of neck and shoulder muscles. Int J Ind Ergon 2012;42:397-405.

17. Marras WS, Davis KG, Heaney CA, Maronitis AB, Allread WG. The influence of psychosocial stress, gender, and personality on mechanical loading of the lumbar spine. Spine (Phila Pa 1976) 2000;25:3045-54.

18. Kiekkas P, Sakellaropoulos GC, Brokalaki H, Manolis E, Samios A, Skartsani C, et al. Association between nursing workload and mortality of Intensive Care Unit patients. J Nurs Scholarsh 2008;40:385-90.

19. McManus IC, Keeling A, Paice E. Stress, burnout and doctors' attitudes to work are determined by personality and learning style: A twelve year longitudinal study of UK medical graduates. BMC Med 2004;2:29.

20. Choobineh A, Rajaeefard A, Neghab M. Association between perceived demands and musculoskeletal disorders among hospital nurses of Shiraz University of medical sciences: A questionnaire survey. Int J Occup Saf Ergon 2006;12:409-16.

21. Taheri MR, Habibi E, Hasanzadeh A, Mahdavi Rad M. Relationship mental workload with musculoskeletal disorders among Alzahra hospital nurses by NASA-TLX index and CMDQ. J Health Syst Res 2014;10:775-85.

22. Kuorinka I, Jonsson B, Kilbom A, Vinterberg H, Biering-Sørensen F, Andersson G, et al. Standardised nordic questionnaires for the analysis of musculoskeletal symptoms. Appl Ergon 1987;18:233-7.

23. Choobineh A, Lahmi M, Shahnavaz H, Jazani RK, Hosseini M. Musculoskeletal symptoms as related to ergonomic factors in Iranian hand-woven carpet industry and general guidelines for workstation design. Int J Occup Saf Ergon 2004;10:157-68.

24. Hart SG. NASA-task Load Index (NASA-TLX); 20 Years Later. Proceedings of the Human Factors and Ergonomics Society Annual Meeting. Los Angeles; 2006.

25. Safari S, Mohammadi Bolban Abad H, Kazemi M. Evaluation mental work load in nursing critical care unit with NASA-TLX index. Health Syst Res 2013;9:613-9.

26. Rowshani Z, Mortazavi SB, Khavanin A, Mirzaei R, Mohseni M. Comparing RULA and strain index methods for the assessment of the potential causes of musculoskeletal disorders in the upper extremity in an electronic company in Tehran. Feyz 2013;17:61-70.

27. Rahimi Moghaddam S, Khanjani N. Evaluating risk factors of work-related musculoskeletal disorders in assembly workers of Nishabur, Iran using rapid upper limb assessment. J Health Dev 2012;1:226-37.

28. Saeidi C, Dastaran S, Musavi S. Evaluation of the risk factors of musculoskeletal disorders and its relation to the workload of employees at 118 call center in Sanandaj, Iran. J Health Dev 2016;5:110-21.

29. Ghasemi GA, Rahimi N, Eshaghian M, Aghayari A. The prevalence of low back pain and its correlation with some occupational factors and demographic characteristics of the nurses working in the hospitals affiliated with social security organization in Isfahan, 2011. J Res Dev Nurs Midwifery 2014;20:69-76.

30. Forde MS, Punnett L, Wegman DH. Prevalence of musculoskeletal disorders in union ironworkers. J Occup Environ Hyg 2005;2:203-12.

31. Mohammadzadeh M, Habibi E, Hasanzadeh A. Relationship between work ability and mental workload with musculoskeletal disorders in industrial jobs. J Prev Med 2016;2:29-39.

32. Habibi E, Aa K, Hossini SM. Evaluation of work-related psychosotial and ergonomic factors in relation to low back discomfort in emergency unit nurses. Health Syst Res 2011;6:752-61.

33. Habibi E, Dehghan H, Moghiseh M, Hasanzadeh A. Study of the relationship between the aerobic capacity (VO2 max) and the rating of perceived exertion based on the measurement of heart beat in the metal industries Esfahan. J Educ Health Promot 2014;3:55.

34. Dehghan H, Habibi E, Habibi P, Maracy MR. Validation of a questionnaire for heat strain evaluation in women workers. Int J Prev Med 2013;4:631-40.

35. Giahi O, Darvishi E, Akbarzadeh M, Shahsavari S. Assessment of the relationship of the risk of subjective work load to musculoskeletal disorders in bank staff in Kurdistan Province. Sci J Kurdistan Univ Med Sci 2014;19:36-45.