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

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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]

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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:

\[
\text{Total mental workload} = (\text{load impact} \times \text{load weight})/15
\]

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%).

### 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 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)           |

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 ($72.45 \pm 25.4$) that confirms a high-risk level. Efforts need was of highest value ($80.5 \pm 15.1$), and timing need was of lowest value ($60.5 \pm 25.4$) 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 $32.3 \pm 7$ years with $10.1 \pm 5.5$ years of average work experience which is considered a relatively young population. The outcome shows personal factors such as

### 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 |

### 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.[29] 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.[30] 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.[31]

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.[30] 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.

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**Conflicts of interest**

There are no conflicts of interest.

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