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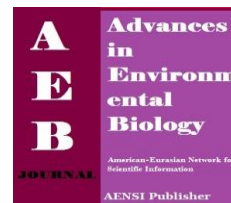
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Evaluation of Ergonomic Factors Associated with Musculoskeletal Disorders in Nurses

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ABSTRACT

Aims: Although musculoskeletal disorders is one of the main problems, costly and serious in nurses as a high risk group, But few studies have been conducted, especially in Iran to understand its causes. This study was conducted to determine the prevalence of musculoskeletal disorders and ergonomic factors associated with nurses. **Methods** In this cross-sectional study were studied 400 nurses by census method from Amol hospitals. In order to collect information and to determine the prevalence of musculoskeletal disorders using the modified Nordic questionnaire and study Yip. **Results** Multivariate logistic regression analysis was performed to determine the respective risk predictors: The risk predictors for knee pain were Not Exercising (OR = 2.4 (95% CI 1.4 – 3.8), p = 0.001) and Help the patient to go to the toilet [OR = 0.85 (95% CI 0.73 – 0.98), p = 0.030]. For wrist pain, walking in section >= 2hrs [OR = 4.5 (95% CI 1.8 – 11.3), p = 0.002]. For neck pain, Female [OR = 3.0 (95% CI 1.6- 5.6), p = 0.001], Exercise [OR = 1.9 (95% CI 1.1 – 3.2), p = 0.014], Move the patient between bed and chair [OR = 0.83 (95% CI 0.73 – 0.95), p = 0.006], Displacing the Section Tools [OR = 1.05 (1.001 – 1.1), p = 0.044], Raise hands above the shoulder [OR = 1.05 (95% CI 1.01 – 1.08), p = 0.009] and Sitting in section ≥ 2 hours [OR = 2.0 (95% CI 1.01 – 3.9), p = 0.048. For shoulder pain, exercise [OR = 1.8 (95% CI 1.1 – 3.1), p = 0.024], Help the patient to go to the bathroom [OR = 0.84 (95% CI 0.71 – 0.98) p = 0.026] and Displacing the Section Tools [OR = 1.1 (95% CI 1.06 – 1.2) p < 0.001] Help the patient to sit down on the bed [OR = 1.1 (95% CI 1.02 – 1.2), p = 0.010] and Lifting more than 5 kg weight [OR = 0.92 (95% CI 0.87 – 0.98), p = 0.005]. **Conclusion** Musculoskeletal disorders is one of the most serious problems in the nursing profession that is associated with several factors such as bending, transfer patients, move the equipment ward, helping patients to the bathroom and pick up Pick up the anything, So it can be effective in reducing complications by modifying risk factors and Educating to the nurses for using the assistive devices in the ward.

INTRODUCTION

Musculoskeletal disorders are inflammatory and degenerative conditions that affect the muscles, tendons, ligaments, joints or peripheral nerves, usually leading to ache, pain or discomfort [1,2] that is one of the most common causes of occupational injury and disability in developing countries [3] and most common cause of job-related disability and makes finance and medical costs [4] or morbidity in health care workers [5]. These disorders among health service providers as the important problems of occupational [5,6]. Many countries of the world are being evaluated the occurrence of musculoskeletal disorders among health care providers. In Italy, has been reported high rate of complaints in various fields of medicine So that this disorder is considered as a problem at the physiotherapists and radiologists [6]. Nurses are the largest group at risk of musculoskeletal disorders [7,8].

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Work related musculoskeletal disorders are highly prevalent among nurses because of the nature of work [3]. A study in England has shown that incidence of back pain were equal nurses with industrial workers. Low back pain after upper respiratory infections is the second most common diagnosis. Studies have reported that 65-80% of people have experienced back pain at least once in lifetime and the incidence of back pain is 5-14 percent in the general population during one year. According to the study Karahan, 85/7% of the subjects were suffering from back pain after a year to start nursing [9]. The annual prevalence of low back pain in nurses has been reported in Germany 73-76% [10], in Italy 86% [11] and Hong Kong 80.9% [12]. Also have reported the prevalence of 62 % [13] and 49% in Iran [14].

Repetitive back pain that is experienced in nursing can cause the mental health problems and reduced occupational performance and it was shown that back pain is the most important factor in the decision to change jobs. A study explains about it that 11% of nurses have resigned from their jobs due to back pain [9].

In addition to LBP, neck pain (30-48%) and shoulder disorder with prevalence of 43-53% are at the next rank. Choobineh, 84/4% of the nurses in this study had experienced musculoskeletal disorders in one or more areas of your body for example neck pain 36.4%, shoulder pain 39.8% and Elbows disorder 17.9% [3]. Research in New York revealed that 84% of nurses working in the surgical ward were suffering back pain, 74% of knee, foot and shoulder pain [15]. 8% of the nurses who were employed a year in Switzerland had lost their workdays due to neck, shoulder, arm, elbow and wrist disorders, in this why Switzerland's economy has lost 1.4 million days, equivalent with $ 185 million in 1996 [16].

Various occupational factors are responsible for these problems. Among these factors can be pointed to increased physical activity, lifting an object [4], Lifting and displace patients to other locations [9,17], also obesity, age and gender [6]. In addition, there is a close relationship between these disorders and the use of improper body mechanics [16]. Factors such as bending and rotation of the neck, sitting [18], standing [9] and manual activities [19] is the most important issues.

Studies in this area have shown that some jobs, such as nursing are directly related musculoskeletal disorders which can be related to the nature of the profession. Special attention is necessary because of the Multiple problems arising from these disorders Such as different degrees of disability, impact on activities of daily living, physical problems, emotional and occupational and Consequently Impose direct and indirect costs. Since the any plan for the prevention, treatment or rehabilitation of individuals requires knowledge of the epidemiology of musculoskeletal disorders and its associated factors in nurses and also Because of few studies with a particular focus have been done on the vulnerable group in Iran. Hence, the present study was conducted to with increasing knowledge of the prevalence and its risk factors to achieve planning and Codification Ergonomic interventions required In order to prevent and reduce complications In the Workplace.

Methods:

This study is a cross-sectional survey in 2009 that were selected 400 subjects Of the 438 nurses working in hospitals of Amol by census method. (Amol, city in Mazandaran province, the north of Iran has the population of 500000 individuals).

Study Exclusion criteria included: history of bone surgery, scoliosis, fractures, pregnancy, osteoporosis, cancer and cardiovascular disease.

Was used to collect data Modified Nordic questionnaire and Yip study, which was composed of two parts. The first part included demographic characteristics that they determined experience musculoskeletal pain in last year and the second part consisted of 17 questions related to conventional activities and practical nursing which Participants reported average number of Specified activities in each shift. In order to determine content validity of the questionnaire, it was given to 10 Rheumatologist and Orthopedics and then, it was judged and evaluated and its reliability was calculated using internal consistency by Cronbach's alpha ($\alpha=0.91$) and also re-test method ($r=0.88$).

For Ethical approvals to Participants will be given ensure their information kept private.

Statistics:

Analyses were performed using SPSS 21.0. The demographical and physical predictors for musculoskeletal disorders were determined using univariate and multivariate logistic regression. An exploratory stepwise logistic regression was also performed. Statistical significance was set at $p < 0.05$.

Results:

Of the 400 nurses sampled, 78.5% were females, mean (sd) age of 32.4 (6.2), range 21 to 54 years old. 67.5% are married and 40.8% had an over-weight BMI. Table 1 shows the prevalence of each of the musculoskeletal disorder with knee pain (63.5%) the most prevalent and wrist pain (29.5%) the least.

Predictors for each Musculoskeletal Disorder:
Wrist Pain:

Univariate predictors were Bending at the edge of the bed to do the procedure [OR = 1.03 (95% CI 1.01 – 1.06), p = 0.015] and walking on section ≥ 2hours [OR = 3.2 (95% CI 1.5 – 6.7), p = 0.002]. Only walking in section >= 2hrs [OR = 4.5 (95% CI 1.8 – 11.3), p = 0.002] remained significant upon multivariate analyses. From the exploratory stepwise logistic regression, both walking in section >= 2hrs [OR = 3.0 (95% CI 1.4 – 6.2), p = 0.004] and Bending at the edge of the bed to do the procedure [OR = 1.03 (95% CI 1.001 – 1.055), p = 0.044] were significant.

Neck Pain:

Both univariate and multivariate showed the following predictors for neck pain (the adjusted Odds ratios are presented). Female [OR = 3.0 (95% CI 1.6- 5.6), p = 0.001], Exercise [OR = 1.9 (95% CI 1.1 – 3.2), p = 0.014], Move the patient between bed and chair [OR = 0.83 (95% CI 0.73 – 0.95), p = 0.006], Displacing the Section Tools [OR = 1.05 (1.001 – 1.1), p = 0.044], Raise hands above the shoulder [OR = 1.05 (95% CI 1.01 – 1.08), p = 0.009] and Sitting in section ≥ 2 hours [OR = 2.0 (95% CI 1.01 – 3.9), p = 0.048]. Upon Stepwise analysis, only Female [OR = 2.6 (95% CI 1.5- 4.4), p = 0.001], Exercise [OR = 2.0 (95% CI 1.2 – 3.2), p = 0.006], Move the patient between bed and chair [OR = 0.87 (95% CI 0.80 – 0.94), p = 0.001] and Displacing the Section Tools [OR = 1.06 (1.02 – 1.1), p = 0.004] remained significant.

Shoulder Pain:

The univariate predictors were age [OR = 1.03 (95% CI 1.001 – 1.07), p = 0.046], exercise [OR = 1.7 (95% CI 1.07 – 2.6), p = 0.027], Help the patient to go to the bathroom [OR = 0.85 (95% CI 0.75 – 0.95) p = 0.006] and Displacing the Section Tools [OR = 1.05 (95% CI 1.01 – 1.08) p = 0.005]. Upon multivariate analyses, exercise [OR = 1.8 (95% CI 1.1 – 3.1), p = 0.024], Help the patient to go to the bathroom [OR = 0.84 (95% CI 0.71 – 0.98) p = 0.026] and Displacing the Section Tools [OR = 1.1 (95% CI 1.06 – 1.2) p < 0.001] remained significant. Age was not a predictor anymore. In addition, 2 more predictors were included form the multivariate analyses: Help the patient to sit down on the bed [OR = 1.1 (95% CI 1.02 – 1.2), p = 0.010] and Lifting more than 5 kg weight [OR = 0.92 (95% CI 0.87 – 0.98), p = 0.005]. Exploratory Stepwise analyses showed exercise [OR = 1.7 (95% CI 1.1 – 2.8), p = 0.022], Help the patient to go to the bathroom [OR = 0.84 (95% CI 0.74 – 0.95) p = 0.006], Displacing the Section Tools [OR = 1.1 (95% CI 1.06 – 1.2) p < 0.001] and Lifting more than 5 kg weight [OR = 0.94 (95% CI 0.90 – 0.98), p = 0.004] were significant

Knee Pain:

Univariate, Multivariate and Stepwise analyses showed that Not Exercising is a risk predictor for knee pain, adjusted OR = 2.4 (95% CI 1.4 – 3.8), p = 0.001. From the multivariate analysis, Help the patient to go to the toilet [OR = 0.85 (95% CI 0.73 – 0.98), p = 0.030] was also a predictor.

Table 1: Prevalences of musculoskeletal disorders.

musculoskeletal disorders	Prevalence (95% CI)
Wrist pain	29.5% (95% CI 25% to 34%)
Neck pain	50% (95% CI 45% to 55%)
Shoulder pain	35.5% (95% CI 31% to 40%)
Knee pain	63.5% (95% CI 58.5 – 68.2)

Discussion:

According to the results, musculoskeletal disorders are common among nurses which were similar to Derek's study results. They were reported prevalence of musculoskeletal disorders 85.5% for a year So that shoulder pain 71.9%, back pain 71.3%, neck pain 54.7%, and pain in the upper back 33.9%, respectively [19] and also in study of Lorusso were reported neck pain 49%, upper limb and lower limb pain 31% and 54% [6]. Pompeii also was expressed One third of the nurses in the study had musculoskeletal disorders which 83% of the damage caused by Nursing care [20].

In this study there was a significant association between female gender and the risk of neck pain and back pain; so that female gender increases the chances of neck pain 122% and low back pain 203%. Many studies have indicated that women are more prone to back pain [13,6]. The high Prevalence of these disorders in women can be dependent on factors such as pregnancy and childbirth that needs further investigation. While the Male nurse using safer techniques when transferring patients from bed to wheelchair [21]. Although there is research that this negates for example Yip did not find a significant relationship between gender and low back pain [22]. Hoogendoorn is also stated that the absence of men nurses is twice more than women nurses due to low back pain [23].

The results are expressed with increasing age increases the chances of shoulder pain. Younger people faster and easier than adults to be compatible with safe techniques for working [21]. Since the full and regular training

is not done about how to use the body mechanics correctly and also forget the academic courses and lack of review can be associated with Increase in age-related musculoskeletal disorders. Of course we should not forget that normal aging is associated with deterioration of motor function and physical capacity that can be makes Poor technique and consequently higher incidence of musculoskeletal disorders [21].

According to results of this study with increasing height and per kg weight Back pain is more likely. These findings are consistence with recent study. In social studies, tall people are more at risk for low back pain and chances of low back pain increased 1.2 per 10 cm [14]. In another study the prevalence of back pain in tall nurses was 1.75 higher [24]. Although Height is a component of non-modifiable risk factors but with prove this point that taller people are at greater risk of musculoskeletal disorders and to prevent this disorder should be given more attention than other risk factor.

The results of the present study showed that with an increase of 1 kg of weight, chance of back pain increased to 40%. Keep of normal body weight reduces pressure on the spine and abdominal Extra weight puts pressure on the lumbar spine which can cause chronic spasms. When the abdominal muscles constricts to keep up the abdomen that Can by the abnormal forces cause progressive erosion of discs and arthritis in lumbar spine [25]. Specifically, High BMI can cause back pain and shoulder pain [3]. Lorusso said "BMI can make a person susceptible to musculoskeletal disorders" [6]. Karahan also showed that obesity is a major cause of back pain and decrease the elasticity the abdominal muscles and increase lumbar lordosis [9]. Evangelos and *et al*. also came to the conclusion that high BMI is significantly associated with chronic low back pain and absence from work due to back pain and shoulder pain [4].

According to results of this study, regular exercise reduces the risk of experiencing low back pain. Several studies show lower back pain occurs in people who exercise regularly. Daily exercise program have been keeping muscles strong so that it can be reconciled with sudden force And therefore frequency and severity of back pain decreases against abnormal forces, abnormal forces [25].

Wide range of risk factors for musculoskeletal disorders in nursing suggests that Causing agents of them are complex and numerous. About occupational risk factor, results has showed as in other studies, factors associated with nursing jobs for example bending, transfer patients, move equipment, raise your hands above shoulder and bathing patients is the most important factor to patients. Other studies have similar results. For example Derek in his study showed that shoulder pain was associated with hard physical work and lifting, also upper back pain is significantly associated with hard physical work and In addition, back pain is significantly associated with low numbers of staff. Overall in the research was conclusion "anywhere in the body" is significantly associated with hard working and lifting [19].

Yip said "back pain is significantly associated with bending to pick up objects from the floor and working in bent position raises risk of back pain 2.76 times, on the other hand helping patients to move has significantly associated with incidence of back pain [22]. Pompeii in in the review of hospital staff demonstrated which had prevented by mobility aids 40% of injuries caused by lifting and moving patients also 32% of the damage caused rotate patients, changes position and Raising them in bed [20]. Of course, Yip stated: pain isn't significantly associated with Transferring patients between bed and wheelchair, changing the patient's position in bed, Helping the patient to go to the toilet and lifting more than 5 pounds [22].

Conclusion:

Overall, results of study showed that Musculoskeletal disorders have high prevalent in nursing and Risk factors are job-related and complex. It is clear that pressure of work imposed on body of the person can be reduced to physical performance in nurses, reduction in patients care and financial, life and economic losses. Therefore, it is recommended that with modify the risk factor, education to nurses, Service training classes about the proper techniques for transfer and use body mechanics correctly and even learn how to do the equipment lifts in hospitals help to reduce the incidence of musculoskeletal disorders. Considering geographical area and difficult conditions of work Generalization capability of the results is top in Hospitals of North Country because the study was conducted with large volume of sample.

Limitations of the study:

The limitations of this study can be noted to the lack of a reliable diagnostic test for the accurate diagnosis of musculoskeletal disorders such as electro diagnosis.

Conflict of interest:

There was no conflict of interest.

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