ISSN: 2476-5279; International Journal of Musculoskeletal Pain Prevention. 2024;9(1): 988-994.

Status of the Musculoskeletal Disorders among Repairmen: Using Quick Exposure Assessment method

ARTICLEINFO

Article Type

Descriptive-analytical Article

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How to cite this article

Salimi F, Mohammadi E, Ahmadi O. Status of the Musculoskeletal Disorders among Repairmen: Using Quick Exposure Assessment method. IJMPP. 2024; 9(1): 988-994.

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Article History
Received: Dec 25, 2023
Accepted: Jan 1, 2024
ePublished: Mar 14, 2024

ABSTRACT

Aims: Pain and discomfort caused by Work related Musculoskeletal Disorders(WMSDs) is one of the most common health problems that is common in almost all jobs worldwide. Considering the importance of early prevention and treatment of these disorders, the purpose of this research is to investigate the prevalence of WMSDs and their risk factors among repair workers through using Quick Exposure Check (QEC).

Method and Materials: In this descriptive-analytical study, 50 auto repairers in Sabzevar city were selected by census method. The Nordic questionnaire was used to determine the prevalence of WMSDS and the QEC posture assessment method was used to determine the risk level of suffering from these disorders.

Findings: According to the results of the Nordic questionnaire, 58% (N=29) of the studied subjects had pain and discomfort in at least one of the nine areas of the musculoskeletal system during the last 12 months. The highest rate was reported in the waist (46%, N=23), knee (34%, N=17) and shoulder (16%, N=8) regions. Furthermore, 84% (N=42) of people were in the 3rd and 4th priority level of corrective action based on the QEC method.

Conclusion: This study showed that skeletal-muscular disorders have the highest prevalence in the waist and knee areas. This means that paying attention to the risk factors of disorders related to these areas and removing them from the work environment can be an effective measure in improving work conditions and preventing these complications.

Keywords: Ergonomics, Musculoskeletal Disorder, Nordic Questionnaire, Repairmen, Quick Exposure Check (QEC)

Introduction

Pain and discomfort caused by Work -related Musculoskeletal Disorders (WMSDs) is one of the common health problems that have become common in almost all jobs and countries[1-5]. These disorders may occur as a result of exposure to several stressful factors related to work, such as repetitive movements, improper posture, excessive pressure, moving heavy loads, working with manual vibrating tools, and local mechanical stresses[6-10]. Musculoskeletal disorders have serious effects on the human body and psychological stressors [11]. In the work environment, anger, anxiety, time pressures, and low social support are related. Excess risk factors for these disorders include individual characteristics such as gender, age, economic and social status, etc., which can cause serious hormonal and cardiovascular responses[12]. Psychological and cause pain, sensitivity, swelling or personal stress factors can also even decrease and loss of function of hands, wrists, elbows, shoulders, neck and back[13].

According to a study conducted in Iran, musculoskeletal problems of lower limbs among Iranian employees, especially back and knee limbs, have a relatively high prevalence compared to other countries[14]. In Iran, one of the main causes of disability and related costs is caused by skeletal-muscular injuries, so that cumulative injuries caused by physical and mechanical factors account for 48% of work-related injuries[15]. Gennady et al. believe that MSDs are the main cause of damage to the human resources of the workforce, reducing productivity and economic losses, and that these disorders are the reason for one-third of compensation claims for work-related problems[16]. Therefore, in order to identify

risk factors and exposed people, different methods are used[17]. Including the direct assessment method[18], self-report method and observation methods.

Direct methods usually require special tools for measurement such as electromyography or motion analysis device, which increase the costs of evaluations. In self-report methods, the results may be influenced by the individual's objective reports[19]. From the point of view of occupational health and safety, it has been important to develop a simple tool for risk assessment and management of musculoskeletal disorders[20]. Therefore, various observational methods are often used to identify the risk factors of musculoskeletal disorders related to work and also to evaluate the effects of ergonomic changes[21]. Rapid exposure assessment is a general observational method was developed between 1996 and 1998 in the UK to assess exposure to WMSDs risk factors affecting the back, shoulder, arm, hand, wrist and neck, as well as the vibration and stresses caused by the work[22]. This method is specifically designed to meet the needs of experts and ergonomists and in scoring the tasks and completing the questionnaire, it involves the opinion of the evaluator and the worker at the same time. This method of exposure levels is used for different body postures, repetition of movements, force/ load and duration. It estimates the performance of the task for different areas of the body. It has also been translated into several languages, but studies have shown that the original English version is practical and reliable in many jobs[23]. Also, in this study, the Nordic standard questionnaire was used to assess the risk of musculoskeletal disorders in nine anatomical areas of the body[24]. Considering the limitations of internal studies in car repair shop workers and considering the importance of early prevention and treatment of MSDs, the aim of this research is to investigate the prevalence of MSDs among Sabzevar car repair shop workers based on the Quick Exposure Check (QEC) method and the Nordic standard questionnaire. Furthermore, due to the high prevalence of MSDs, accurate identification, evaluation and measurement of these risks can be helpful in the implementation of risk assessment programs and especially in ergonomic research.

Method and Materials

The current research is a descriptive-analytical study that was conducted in 2019 on the employees of the car repair shop who were selected by census method. Workers who had at least one year of work experience were included in this study. The exclusion criteria included having congenital MSDs and musculoskeletal disorders caused by accidents and second jobs. The instruments which used were as following: Nordic questionnaire was used to determine the prevalence of MSDs. The QEC posture assessment method was used to determine the risk level of suffering from these disorders. The Nordic Standard Questionnaire has two general and specific sections, in the first section, which aims at a general survey; questions are asked about people's age, height, weight, body mass index, level of education, work history, and marital status. BMI is calculated by dividing weight (kilograms) by the square of height (square meters) and according to the WHO standard, it is divided into four groups: underweight (<18.5), normal weight (18.5-24.9), overweight (25-9.29) and obese 30)[25]. In the specific questions section, information about the work environment, the person's duties and the person's use of tools, as well as questions about the skeletal-muscular problems related to each person have been asked. Questionnaires were filled by the researcher in the form of a face-to-face interview with people and referring to their workplace, and then during work, the posture of the person was assessed. The translation, localization, and reproducibility of this questionnaire have been done by Mokhtari Nia et al. The results of the study showed that the ICC value of the Persian version of the questionnaire is higher than 0.7, the SEM value is between 0.56-1.76, and the range of the Kappa agreement coefficient is between 1. and 0.78 and these results indicate that this questionnaire with acceptable reproducibility can be used with high confidence in examining

Iranian people[26].The desired parameters in QEC method will be recorded in one of the moments when a person has the worst posture. Of course, it should also be considered that this situation is perhaps the worst posture in our opinion and it is in contradiction with the opinion of the worker about the worst posture. For this reason, in this method, a person's mental responses and judgment about the task he performs which are a part of the evaluation process. Rapid exposure assessment questionnaire identifies physical, organizational and psycho-social risk factors. The checklist has 16 items that are placed in two columns. The first column completed by the evaluator includes the assessment of posture and movements of the back, shoulder, arm, wrist, hand and neck areas. The second column is related to the worker's opinions about the maximum weight carried, the number of working hours that a person spends to perform that task during the day, the maximum force applied with one hand, the visual requirement of the task, the number of hours of work, the duration of exposure vibration that is how it matches the work and ultimately how stressful the work is. The obtained score can include the total score and the score obtained from the risk of specific factors. Based on this method, body parts are classified and coded according to the postures they may have. Then, in the next step, each of the given codes is placed in the scoring tables designed for the waist, shoulder, arm, wrist, hand and neck sections. Finally, according to the overall score (total score of the four areas) and the contact percentage of each working posture independently for each body part (E), practical corrective measures and ergonomic intervention were carried out according the following formula.

$$E(\%) = {}^{X}/_{X_{max}} \times 100$$

X: final score obtained for each body area exposure (waist, shoulder/arm, hand/wrist, neck)

X_{max} :The maximum possible score which is for exposure of body areas and is a fixed coefficient, which is equal to 56 for the waist and shoulder/arm area, 46 for the wrist/hand area, and 18 for the neck area.

The final score (percentage of exposure) in the whole body is calculated using the same relationship, in which case.

X: exposure score for the whole body obtained from the sum of the scores of the four body regions.

X_{max} : The maximum possible score is for the whole body and it is a fixed coefficient which is equal to 176 for manual load carrying tasks and 162 for other tasks[27].

This questionnaire was compiled in English in two stages. In the first phase, from 1996 to 1998, Li & Buckle developed it at the Rubens Center at Surrey Guilford University[28] and after the professionals used it for a period, in the second stage its texts were re-examined and confirmed and finally in 2007 David et al. developed this questionnaire[22].

Findings

The present study was conducted with the participation of 50 auto repairers in Sabzevar city of Iran. All participants (100%) were men. The demographic information of the surveyed people is presented in Table 1.

Table 1) Demographic information of the participants in the study

Variables		
Age (Yrs)	Mean ± SD	31.44±9.00
	Minimum-Maximum	17 56
Work Experience	Mean ± SD	12.24±5.13
	Minimum - Maximum	2 25
Weight	Mean ± SD	75.98 ±12.15
	Minimum - Maximum	55 130
Height	Mean ± SD	176.56±6.50
	Minimum-Maximum	160 188
Body Mass Index (BMI)		N (%)
	18.5 -24.9	34 (68%)
	25 - 30	14 (28%)
	More than 30	2 (4%)
Level of Education		N (%)
	High school	27 (54%)
	Diploma	20 (40%)
	Associate degree	2 (4%)
	Bachelor Degree	1 (2%)
Smoking	Non smoker	48 (98%)
	Smoker	2 (4%)
Marital status	Single	15 (30%)
	Married	35 (70%)

As can be seen from Table 1, the age range of people is between 17 and 56 years. It was also found that the majority of participants had a normal BMI, and about 28% of them were overweight, and the percentage of participants with obesity was negligible (less than 4% in total). Meanwhile, the highest frequency in the study population is related to work experience of 8-18 years (72%) and the lowest frequency is related to work experience less than or equal to 4 years (4%). The minimum work experience in the studied community is 2 years and the maximum work experience is 25 years. The rest demographic characteristic is shown in Tale 1.

Table 2) Distribution of prevalence of musculoskeletal disorder symptoms in body parts of repairmen in the last year (n=50)

Body organ	With Disorder		Without Disorder	
	N	%	N	%
Neck	2	4	48	96
Shoulder	8	16	42	84
Elbow	2	4	48	96
Wrists and Hands	6	12	44	88
Back	3	6	47	94
Waist	23	46	27	54
Thigh	3	6	47	94
Knee	17	34	33	66
Leg	6	12	44	88

According to Table 2, based on the results of the Nordic questionnaire, the majority of the studied participants had pain and discomfort in at least one of the nine areas of the musculoskeletal system during the past 12 months, and only 42% had no disorders. The prevalence of MSDs was different in different areas of the body, and the highest and lowest prevalence was related to the waist, elbow and neck area.

Based on the results of QEC, the status of people regarding the level of MSDs risk was determined. The distribution of people in the four levels of risk was shown in Chart 1. Accordingly, none of the studied people, were in no risk of ergonomic factors of MSDs. About 20% of people needed more investigations and ergonomic measures urgently.

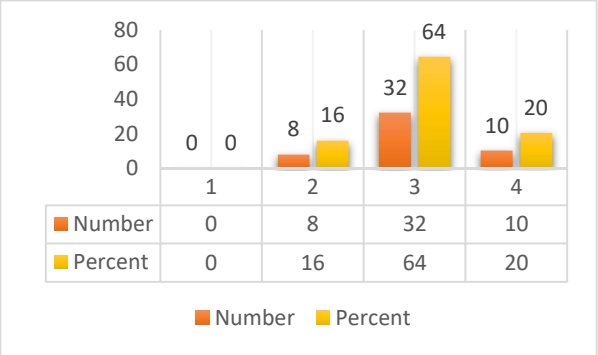

Fig 1) The status of the risk level derived from the Quick Exposure Check method

Discussion

Musculoskeletal disorders are considered to be one of the common diseases in various occupations, and considering the importance of workers' health and its impact on job productivity and society's economy, it is necessary to know the factors affecting it [29-31]. The purpose of this research was to evaluate the ergonomics of the risk of musculoskeletal disorders in repairmen. For this purpose, the prevalence of MSDs was extracted using the QEC method and the Nordic questionnaire. The findings indicate that repairmen are at a high level of risk factors for this problem because 58% of the studied participants had pain and discomfort in at least one of the nine areas of the musculoskeletal system during the past year. The most common symptoms of the disorders are related to the back, knee and shoulder regions. This means that most of the repairmen are in a bent position and a lot of pressure is applied to the upper areas and knees while working. These results are consistent with the previous study, which aimed to investigate MSDs among workers of a cement factory, because the highest prevalence was related to the waist area and the lowest prevalence was related to the elbow area. Therefore it confirms the results of the present study [32]. The high prevalence of skeletal-muscular disorders in the mentioned areas, especially among repair workers, is inevitable. In an existed study, the most common skeletal disorders in assembly workers were in the neck, shoulders, elbows, wrists/hands, and majority of them experienced pain or MSDS symptoms in at least one part of their body [33]. In a conducted

study, the prevalence of disorders among car assembly line workers was 78.2% [34]. In another study in Iran by Ghasemkhani et al. in 2006, the most common musculoskeletal symptoms were in the leg (50%), back (47.4%), wrist/hand (30%), and the 12-month prevalence of skeletal disorders in line workers car assembly was significantly more than MSDs symptoms in office workers in all nine parts of the body based on the Nordic questionnaire[35]. The relationship between demographic variables and the prevalence of MSDs (at least in one of the nine areas of the musculoskeletal system) is given in Table 3.

This study showed that there is a significant relationship between the average age and work experience with the prevalence of musculoskeletal disorders in the studied subjects (P-value<0.05). These findings are consistent with the previous study [36]. The prevalence of these complications increases with age and work experience, because with age, people become physically weaker and also the conditions of the work environment expose people to more injuries. Furthermore, with the increase of work history and long-term work in inappropriate working conditions, the probability of workers suffering from skeletal-muscular injuries increases. Finally, considering that the Nordic questionnaire has been standardized to record and analyze skeletal-muscular symptoms, it can be concluded that this questionnaire was also effective in the present study.

Conclusion

The high prevalence of musculoskeletal disorders among repair workers is inevitable. Based on the findings of this study, it was found that the majority of the subjects of this study experienced musculoskeletal pain in at least one of their organs during the past year. Although various factors may be involved in the occurrence of these pains, according to ergonomists, posture is one of the most important factors in this field. The results of the present study showed that in most workstations, people have to work in such a way that they have an ergonomically inappropriate posture. The results of the evaluations obtained from the QEC method, according to the scores obtained for the whole body, showed the necessity of taking corrective measures in the near future or immediately in this industry. Moreover, skeletal-muscular disorders are most prevalent in the waist and knee areas. This means that paying attention to the risk factors of disorders related to these areas and removing them from the work environment can be an effective measure in improving working conditions and preventing these complications, and any control program should be focused on the risk factors related to these areas.

Acknowledgment

The authors consider it necessary to appreciate and thank all the participants.

Authors' Contribution

FS and FM designed and conducted all stage of the study and wrote the first draft of the manuscript. OA supervised the study and confirmed the manuscript.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript.

Ethical Permission

In this study all ethical principals were considered. Written consent form was completed and signed by the participants.

Funding

This research did not receive any grant from funding agencies.

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