

# Evaluation of Risk Factors Causing Musculoskeletal Disorders Using QEC Method in a Furniture Producing Unite

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## Abstract

The musculoskeletal disorders cover a large percent of occupational diseases; therefore, in order to protect workers from such disorders, there is a need to evaluate workers positions at work in different industries. In a major furniture manufacture located in Tehran, 500 workers were examined. These workers were divided into fourteen working groups, including production lines of water-heater, air condition, electromotor production line, dunnage making hall, plastic hall, smithery, restaurant, store, engineers and supervisors, facilities, transportation, assembly of absorptive refrigerator and drivers. The results from Nordic Questionnaire and performing the evaluation method showed that, there was a significant relevance between outbreak of back pain and workgroups ( $P=0.005$ ) and between the outbreak of pain in neck and workgroup as well. A significant relevance of  $P=0.005$  indicating that, the working in the above mentioned work-place causes pain in both back and neck. Between other parts of the body and workgroup no significant relevance observed. Among workgroups, there was a significant relevance between the water-heater production line ( $P<0.005$ ) and pain in the back, and there was also a significant relevance among the work in air-conditioning production line and the plastic injection ( $P=0.002$ ), causing pain in the neck. The results from Quick Exposure Check (QEC) in one hundred working posture have shown that 10% of them fall into first and second level and 90% of them were categorized in third and forth levels.

**Keywords:** Work-related musculoskeletal disorders, Furniture producing workers, QEC method, *Iran*

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## Introduction

Skeletal disorders-work related muscular are appeared usually due to the long term stress or repetition in soft tissue of the man such as nerves, tendons and the joints. Its side effects at first were described in 19<sup>th</sup> and 20<sup>th</sup> century. Most countries incurred an epidemic disorder, skeletal disorders, and the repetition movements (1). In Japan, more often among the workers, increasing in musculoskeletal disorders between years 1960-1980(1) was engaged typing as an operator and assembly lines and most of them felt uncomfortable in hand, arm, and shoulder in 1980. In Scottish countries these problems were revealed and most part of it were related to the back pain among white collar workers, the discomforts of wrist, the shoulder, with Nordic process-factors in creating pain in neck, and arm leading to a careful

survey (2). Musculoskeletal disorders among 1980-1986 were increased in the United States and the number of sufferers were increased from 50000 people in 1985 to 332000 in 1994 (3). Naturally, the outcome of the disease and musculoskeletal disorders at working-place, its costs and compensation were paid by the owners of the industries and governmental centers (1). With regard to the above cases, the furniture industry is a part of semi heavy industries and often worker's role in production process is unavoidable. Therefore, the hand operations such as moving, pulling, and pressing pieces and working in a static form causes musculoskeletal disorders mainly in back, shoulder, arm, wrist, and the neck. This study was carried out as a last method of evaluation called Quick Exposure Check in the Iranian industries.

*Aims:*

Evaluation of,  
 -musculoskeletal disorders in worker's back,  
 -incidence of the musculoskeletal disorders in shoulder/arm, wrist, and neck),  
 -risk factors related to the musculoskeletal disorders in back shoulder/arm, wrist, and neck,  
 -risk factors related to the unergonomics job,  
 Preference classification of different sections of production lines based on obtained results.

### Materials and Methods

In order to perform this research evaluation tools of the work-condition, method of QEC and Nordic Questionnaire regarding the study of the incidence of musculoskeletal disorders were used (5). Two hundred and twenty Nordic Questionnaire were completed including 50% of workers production lines. Also, for all available workplaces in production lines, 100 workplaces of the physical exercises and the obtained results were analyzed using QEC software and finally the gained information were processed, applying the SPSS/9 software. To evaluate the musculoskeletal disorders resulting from working posture, methods of the observation, OWAS, REBA, PLIBLE, the observation method using video computer URBAN, VIRAR, ROTA, HARBO, direct method, the reporting method, and physiological approach could be pointed out (1).

**QEC method** A quick, comprehensive, and practical method for the musculoskeletal disorders evaluation was developed by Prof. P. Buckle and Dr G. Li in 1999 in the Research Center and Robens Center, Surrey University, in which, action level of the method was proposed by Dr Li colleagues in 2003 (6). This tool evaluates some parts of the body, including the back, shoulder/arm, hand-wrist, neck, and regarding to the observant encounter, the type of the work, and the employed answer, factors are determined and it independently goes to the scores tables (3): The maximum weight of the moving pieces, the duration of the time of doing a work, the maximum applied force by one or two hands, bending or moving mentioned

organs mentioned, conducting repetitious movement, doing a work in a static or dynamic form, the existing vibration and a good eyesight in doing the work. One of the special characteristic is evaluation method of attention to the psychological aspect or stress, resulted from work. Finally the whole points gained from each posture are independently calculated with the following formula exposure level for action level and ergonomic intervention (4):  $E\% = (E/E_{max}) 100$  Where E is referred to as exposure. Action level is divided into four levels, in which, the third and the fourth levels required to the amendment measures considering that, at fourth level these measures must be immediately performed (5).

**Nordic Questionnaire** Since 1987 Nordic Questionnaire was established by Korina and his colleagues in Occupational Health institutes of Scandinavian countries aiming to the determination of the incidence of musculoskeletal disorders resulted from the work (6).

### Results

Results obtained from Nordic Questionnaire are shown in Table 1.

**Table 1:** The incidence of the musculoskeletal disorders

Body part	Incidence
Neck	24%
Arm	17%
Leg	20%
Knee	48%
Up-back	9%
Wrist	23%
Back	50%

As it can be seen, the most incidences were shown in the back with 50% and 24% in the neck. The pain incidence was seen in the back, leg and the knee in the water-heater production line, respectively (1-A to 28-A Table 2), and the pain incidence in the neck was observed in the air-condition production line (1-B to 30-B). Those who were involved guard section, engineering unit, serial production, water-heater assembly, big press process, plastic injection and laboratories, have shown a low incidence in neck and shoulder/arm. Results from perform-

ance of the method QEC evaluation in one hundred work posture have shown the following arrangements:

one percent of workgroup of the production unit at first level of action level, 9% at the second level, 55% at the third level and 35% at fourth level. Based on fourth posture, jobs such as A, C, 1-G, 2-J, 1-K, 1, 2-L with 55% of the whole workgroup were placed at the third level of reformed performance. Jobs such as A, B, C, 1-F, 2-G, 1-H, 2-K, 35% of the whole workgroup were placed at the fourth level of the reformed performance. Jobs such as A-26, B, and C, 1-I, and 1-J, 9% were placed at the second action level (Table 2). The simultaneous survey of obtained results from the method of QEC and Nordic Questionnaire have shown

that, there is a significant relevance between the incidence of the back pain and the workgroup ( $P=0.005$ ). Also, there is a significant relevance between the incidence in the neck of different workgroup ( $P=0.005$ ). These results indicate that, work at the above mentioned workstation causes musculoskeletal disorders in the back and the neck. Regarding to the incidence of the disorders in other parts of the body and workgroup no significant relevance was observed. With the reconsideration among workgroups, it was observed that, the work in water-heater production line has a significant relevance with back pain ( $P<0.005$ ). Working the air-condition production line and plastic injection has a significant relevance with pain in the neck ( $P= 0.002$ ).

**Table 2:** List of tasks used during assessment

Disc press	3-C	Fixing pipe	18-B	Wire incise	3-B	Loading	16-A	Disc incise	1-A
Wire curl	4-C	Card cutting	19-B	Electric	4-B	Painting effective	17-A		2-A
Fixing disc	5-C	Foundry	20-B	Band incise	5-B	Welding bottom	18-A	Incise of coil	3-A
Fixing head	6-C	Fixing cooler	21-B	Banding	6-B	Tank test	19-A	Big press	4-A
Varnishing	7-C	Fixing pholy	22-B	Tank handling	7-B	Welding	20-A	Small press	5-A
Fixing of mini-pipe	8-C	Fixing roller	23-B	Tank unloading	8-B	Welding bent	21-A	Holler	6-A
Wire control	9-C	Motor test	24-B	Spiral handling	9-B	Welding of tank	22-A	Point welding	7-A
Polyester	10-C	Fixing door	25-B	Fixing spiral	10-B	Grip of edge	23-A	Tank fixer ac	8-A
Holing of cable	11-C	Fixing dunn age mauing	26-B	Fixing pine	11-B	Pipe welding	24-A	Tank fixer	9-A
Fixing of center pipe	12-C	Fixing package	27-B	Contort	12-B	Washing	25-A	Painting unloading	10-A
Fixing of pine	13-C	Packaging	28-B	Motor handling	13-B	Manual handling	26-A	Painting loading	11-A
Abrasive	14-C	Pumping packaging	29-B	Fixing roller	14-B	Mini montage	27-A	Painting spray	12-A
Electric test	15-C	Fixing regulation	30-B	Fixing motor	15-B	Bending of pipe	28-A	Furnace handling	13-A
Fan cutting	16-C	Holing of motor center	1-C	Fixing cable	16-B	Packaging of pump	1-B	Bending	14-A
Rotor abrasive	17-C	Manual abrasive	2-C	Fixing bail	17-B	Cable press	2-B	Montage Motor	15-A
Auto mechanic	1-L	Storage	1-H	Piping	2-E	Dunn age device	2-D	balancing	18-C
Oil changing	2-L	Protection	1-I	Water piping	3-E	Dunn age handling	3-D	Fixing pine over	19-C
Refrigerator montage	1-M	Engineering	1-J	Smothery	1-F	Dunn age heading	4-D	Foundry	20-C
Drivers	1-N	Electric facility	1-K	Washing	1-G	Dunn aging	5-D	Fixing pine over motor	21-C
		Machine mechanic	2-K	Cooking	2-G	Injection device	1-E	Dunn age incise	1-D

## Discussion

Study of the psychological stress resulted from work in one hundred work stations by the method of QEC showed that, the most stress from the gained points is equivalent to 34 (maximum possible points) belong to electrical facilities unit. Jobs such as A, B, C, 1-D and 1-N by gaining points between 14 to 21 have relatively more psychological stress (Table 2) (7).

The following recommendations are suggested:

-Since most work in this factory have been allocated based on the physical ability to the young individuals, (for example in most work stations in water-heater production line has been engaged to the young individuals), the role of anthropometry principle in designing tools and work station could be prevented from the musculoskeletal disorders (6).

-With rotating the jobs, workers who are doing the repetitious works in a static positions have an opportunity in making movements and in the gathering of lactic acid too much in muscular and tiredness could be prevented (6).

-By designing the chair, the work-table, the proportion of the work type to its height, and the ergonomic intervention in some jobs embarking on transportation by hand, will considerably be reduced the incidence of musculoskeletal disorders (8).

-The rectification of the work-shift program at the factory and a proper planning according to the human physiology system (in a weekly work-shift, i.e. morning, evening, and night respectively) will effectively be deducted in mental and physiological stress resulted from the works (8).

- A periodic educational program as well as daily body practice can play a main role in reducing the musculoskeletal disorders resulted from the work position and postures.

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## References

1. Hasanzadeh M (2002). Assessment of work-related musculoskeletal disorders in shipping and porting in Iran. MSPH thesis, School of Public Health and Institute of Public Health Research, TUMS.
2. Proceeding of the first ergonomic conference, Malek Ashtar University, Tehran, Iran, 2002.
3. Health and safety executive information service-safety engineering laboratory, Broad Lane Sheffield S3 7 HD.
4. Guangyan Li, Buckle, P (1999). Evaluation change in exposure to risk for musculoskeletal disorders a practical tool. HSE Contract Report 251/1999, HSE Books ISBN 07176 1722 X.
5. Brown R, Guangyan, Li (2003). The Development of Action Levels for the "Quick Exposure Check "(QEC) System. In: *Contemporary Ergonomics*, (Ed. P.T. McCabe), London: Taylor & Francis, 41-46.
6. Karwowski, Maras (1999). Hand book of Occupational Ergonomics. Amazon Press.
7. Mirmohamadi M (2003). The survey of risk factors causes musculoskeletal worker disorders in one of the producers of home appliances, using QEC in Iran. MSPH thesis, School of Public Health and Institute of Public Health Research, TUMS
8. Pheasant S (1995). *Body space "anthropometry, ergonomics and design of work"*. Amazon Press.