

Comparative survey of work related musculoskeletal disorders (WRMDs) prevalence and related factors in Iranian welders

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ABSTRACT

Objective: To determine the prevalence and risk factors for work related musculoskeletal disorders among welders.

Methodology: All 160 welders who work at a petrochemical complex in south of Iran were included in this study. The Nordic musculoskeletal questionnaire (NMQ) was used to study prevalence of work related musculoskeletal disorders (WMSDs).

Results: Most welders (88.3%) suffered from some kind of MSDs symptoms. Arc welders had significantly more musculoskeletal problems in the neck and wrists/hands regions than gas welders. Analysis showed that duration of employment as a welder was significantly associated with a work related musculoskeletal disorder of the shoulder (OR 3.2, 95% CI 1.1 to 8.9), lower back, neck (OR 3.1, 95% CI 1.1 to 8.4), and knee (OR 3.5, 95% CI 1.3 to 9.2).

Conclusion: WMSDs had occurred with a high rate among Iranian welders. This study supports the need for vigilant ergonomic intervention at welding.

KEY WORDS: Work related musculoskeletal disorders, Nordic Musculoskeletal Questionnaire (NMQ), Risk factors of disorders, welders.

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INTRODUCTION

Musculoskeletal disorders have been an important cause of morbidity and disability in many occupational populations during the past few decades.^{1,2} At present, MSDs are one of the most important problems ergonomists encounter in the workplace around

the world.³ The economic loss due to those disorders affects not only the individual but also the organization and the society as a whole.⁴ Estimates of the costs are limited and where data exists, i.e. in the Nordic countries and The Netherlands, the costs have been estimated between 0.5% and 2% of the GNP.⁵

The European Agency for Safety and Health at Work in Bilbao, Spain, report has also pointed out the need of specific and sensitive diagnostic criteria for work-related musculoskeletal disorders.⁶ In many countries, preventing work-related musculoskeletal disorders (WMSDs) is considered a national priority.⁷

Risk factors of WMSDs include workplace activities such as heavy load lifting, repetitive tasks, and awkward working postures.^{8,9} Demographic characteristics and psychosocial factors are also known to be important predictive variables.¹⁰⁻¹² Welding comes with the risk of musculoskeletal disorders (MSDs). Alex Burdorf et al reported 51% of welders attributed at least one period of sickness absence to musculoskeletal complaints which accounted for 44% of all Work days lost.¹³ Other studies¹⁴ on this topic have found

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that the main contributing factors to MSDs come from work conditions such as: awkward postures such as squatting, kneeling, or stooping due to the confined or tight locations, lifting heavy equipment or materials, keeping neck bent or keeping shoulders raised for a long time, stress on neck from supporting the heavy weight of hard hat and welding mask.

Therefore, the objectives of this study were to find out the prevalence of musculoskeletal problems among Iranian welders. It is believed that the results of this study can be used to establish preventive strategies to decrease the prevalence of work related musculoskeletal disorders among welders.

METHODOLOGY

This analytical cross sectional study was carried out in a petrochemical company complex in south of Iran. Subjects included all welders that are working in 6 petrochemicals companies (n=157). Ethical approval for access to research subject was taken from research vice-chancellor of Tehran medical university and informed consent taken from all participants. They were subdivided into two groups, arc welders (n=75) and gas welders (n=85). Welders with background diseases or accidents affecting their musculoskeletal system were excluded from this study.

Data was collected through anonymous questionnaires, which covered (a) personal details (including age, weight, height, job tenure, education, health, and medical background); and (b) musculoskeletal problems in different body regions. The general Nordic questionnaire of musculoskeletal symptoms¹⁵ was used to examine reported cases of MSDs among the study population. All 154 welders employed in their present job for at least 12 months were invited to participate in the study. All workshops were visited; the questionnaires were completed on the basis of an interview with each worker.

After completion of the field survey, data was transferred into a computer for statistical analyses (SPSS version 13). Independent 't' test and multivariate logistic regression were used to assess the relationship between personal and work variables with reported MSDs symptoms. Significant level kept at 0.05.

Table-I: Personal characteristics of the workers (n = 116). Mean (SD).

Characteristics	Arc welders (n=75)	Gas welders (n=85)
Age (years)	40.1 (9.70)	39.2(8.6)
Weight (kg)	69.3 (10.29)	70.0(11.0)
Height (cm)	170.6 (11.30)	172.0(10.3)
Tenure(years)	10.4 (5.47)	9.3(5.2)

RESULTS

Ten percent of workers who participated in the study were illiterate, and 50.5% had primary and secondary education. They were all males aged 17-60 years. Mean (SD) duration of employment as a welder was 11.5 (6.3) years. Table-I summarizes other personal details. Gas Welders and arc welders did not differ for individual characteristics and distributions of duration of employment in current jobs.

Musculoskeletal problems experienced during work after starting the current job were fairly common among the two group welders. As Table-II shows, the most commonly affected regions among the arc welders were neck (82.0%), knees (59.0%), lower back (72.2%), elbows (72.2%), and among gas welders are neck (64.7%), shoulders (66.7%), knees (67.1%), lower back (66.7%) and upper back (64.75). Gas welders had significantly more musculoskeletal problems than the arc welders in the upper back, wrist/hands and shoulder regions, and arc welders had significantly more musculoskeletal problems than the arc welders.

Table-III shows the relationship between demographic variables and reported MSD problems in at least one region. The mean age and job tenure among welders who reported MSDs symptoms were significantly higher than those workers without any symptoms ($P < 0.05$), as such increasing job tenures the prevalence rate of problems in this region increased. No association was found between weight and height and prevalence rate of reported problems in different regions of musculoskeletal system ($p > 0.05$).

Another analysis was a multivariate logistic regression model examining five main effects by body area including age, duration as welder, smoking status, feeling exhausted at end of the day, and having had a previous illness (Table-IV). Duration of employment as a welder for e^{15} years was significantly associated with a work related musculoskeletal disorder of the shoulder (OR 3.2, 95% CI 1.1 to 8.9), lower back,

Table-II: Prevalence of musculoskeletal complaints in the past 12 months

Body Regions	Arc welders (n=75)	Gas welders (n=85)
	No. (%)	No. (%)
Neck	61(82.0)	55(64.7)
Shoulders	28(41.0)	56(66.7)
Elbows	55(72.2)	62(73.0)
Wrists/hands	21(27.3)	31(36.5)
Upper back	21(27.3)	55(64.7)
Lower back	55(72.2)	56(66.7)
Thighs	27(36.4)	34(40.0)
Knees	44(59.0)	57(67.1)
Legs/feet	17(22.7)	36(42.4)

neck (OR 3.1, 95% CI 1.3 to 8.2), and knee (OR 3.5, 95% CI 1.3 to 9.2) and age for e"35 years was significantly associated with a WMSDs of the neck (OR 2.2, 95% CI 1.5 to 4. 2) and lower back (OR 3.0, 95% CI 1.1 to 8.4). Also, feeling exhausted at the end of the day was significant for work related musculoskeletal disorders of the neck, and lower back. (Table-IV).

DISCUSSION

The questionnaire showed that MSD symptoms were common among both welder groups. Most of the study population (88.3%) had experienced some form of MDS symptoms during the 12 months prior to the study. The prevalence were four to six times higher than the prevalence of musculoskeletal disorders among general Iranian male population.¹⁶ This indicated that the problem of MSDs in welders was serious and required due attention. Symptoms from the neck, lower back, elbows and knees among arc welders, and symptoms from the neck, shoulders, upper back, lower back and knees among gas welders were found to be the most prevalent problems. This could be attributable to awkward postures such as squatting, kneeling, or stooping due to the confined or tight locations, lifting heavy equipment or materials, keeping neck bent or keeping shoulders raised for a long time, the stress on neck from supporting the heavy weight of the hard hat and welding mask, which were common in almost all workstations and job activities observed. Because heavy material handling is characteristic of welding, a higher prevalence of work related musculoskeletal disorders of the back was expected.

The results also indicated that age and job tenure was significantly associated with MSDs symptoms in different body regions. This is in agreement with the findings of other researchers.¹⁷⁻²¹ No association

Table-III: Relation of some demographic variables and Musculoskeletal Disorder (MSD) problems among the workers (n = 160).

Variables	Musculoskeletal Disorder				P-value
	Reported		Not reported		
	M	SD	M	SD	
Age (years)	31.61	7.80	27.50	5.70	<0.01
Weight (kg)	72.50	9.40	72.00	9.70	0.812
Height (cm)	175.00	10.48	173.34	7.47	0.850
Tenure(years)	8.53	6.50	4.64	3.90	<0.001

was found between weight, height, education, and MSDs prevalence rate in this population. Although it is an agreement with the results of other studies,²²⁻²⁵ but many studies have showed association between weight, height and musculoskeletal symptoms.²⁶

Multivariate logistic regression model indicated, for most other body areas, however, as duration of employment in welding and age increased there was an increase in work related musculoskeletal disorders. This is in line with the findings of similar studies,²⁷ and indicated that the problem of WMSDs is cumulative trauma disorders. Feeling exhausted at the end of the day was significant for work related musculoskeletal disorders of the neck and shoulders. Workers feeling exhausted at the end of the day was significant with knee pain,²⁸. This could be related to long awkward posture of this region and lack of enough breaks at the day.

Following corrective measures were recommended to reduce MSDs among welders consider the following:

- Position the work at a height between waist and shoulder.
- Using lifting and turning tables with wheels.
- Using welding guns which have swivels and can be used in either hand.

Table-IV: Logistic regression analysis of associated risk factors of work related musculoskeletal disorders by body region (Adjusted OR (95% CIs).

Body region	5 and <15**	<15	Current smoker	Exhausted end of day Previous	health condition
Neck	0.9 (0.4 to 2.5)	3.1 (1.1 to 8.9)	1.0 (0.5 to 2.0)	1.1 (0.6 to 2.2)	1.6 (0.7 to 3.7)
Shoulders	2.3 (1.02 to 5.4)	3.2 (1.1 to 8.9)	1.0 (0.6 to 1.7)	1.5 (0.9 to 2.4)	0.8 (0.4 to 1.6)
Elbows	1.7 (0.8 to 3.3)	1.7 (0.7 to 4.0)	1.7 (1.0 to 2.6)	1.4 (0.9 to 2.2)	1.2 (0.6 to 2.3)
Wrists/hands	2.4 (1.1 to 5.3)	2.8 (1.1 to 8.4)	1.1 (0.7 to 1.7)	1.5 (0.9 to 2.5)	1.8 (1.0 to 3.4)
Upper back	1.5 (0.8 to 3.1)	1.9 (0.8 to 4.6)	1.3 (0.8 to 2.2)	1.3 (0.8 to 2.1)	1.0 (0.5 to 2.0)
Lower back	1.9 (0.5 to 6.6)	3.1 (1.1 to 8.4)	1.1 (0.6 to 2.4)	1.4 (0.7 to 3.0)	2.5 (1.1 to 5.9)
Thighs	1.9 (0.9 to 4.1)	3.5 (1.3 to 9.2)	1.5 (0.9 to 2.6)	1.8 (1.1 to 3.1)	1.7 (0.9 to 3.5)
Knees	0.4 (0.1 to 1.8)	1.1 (0.2 to 6.7)	1.0 (0.4 to 2.5)	0.7 (0.3 to 1.9)	2.7 (0.8 to 8.7)
Legs/feet	1.5 (0.9 to 2.6)	1.8 (1.1 to 3.1)	1.1 (0.7 to 1.7)	0.6 (0.2 to 1.8)	1.0 (0.5 to 2.0)

* Model included age which was significant with neck and lower back; ORs ranged from 1.5 to 4. 2 and 1.3 to 8.2 respectively.

** Comparison group is <5year duration (n=25)

- Sitting on a work stool when the work is at low level.
- Using a work table or work bench instead of bending over to work on the ground.
- Using a rotating clamp for pipe.
- Putting welding leads on pulleys.
- Taking stretch breaks throughout the day to relieve discomfort and get the muscles moving.
- Training of the workers in ergonomic principles & proper working postures would also be helpful

CONCLUSION

Our results have shown that musculoskeletal problems are a common complaint among welders. Taking corrective measures for reduction the prevalence of WMSDs seemed essential. Training of the workers in ergonomic principles, taking stretch breaks throughout the day and avoiding of awkward posture would be helpful. In this respect, assess physical exposure to WMSDs should be studied in the same occupational populations.

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Authors Contribution:

Ebrahimi Hossein: Main advisor of the research and contributed with other authors in data collection and translation of the article into English.

Kazemi Reza: Co-author in designing and data collection. Writing of the final manuscript.

Mohammadbeigi Abolfazl: Statistical co author, assisted in data analysis & its interpretation.