

MUSCULOSKELETAL DISORDERS AMONG MUNICIPAL SOLID WASTE WORKERS

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Abstract- Waste collection is a necessary activity all around the world and the removal of municipal solid waste is a job associated with a variety of biological, chemical, mechanical, physical, and psychosocial hazards. In our country, like many developing countries, municipal solid waste is collected manually and collection of household waste is also a job which requires repeated heavy physical activity such as lifting, carrying, pulling, and pushing. We performed this study to evaluate musculoskeletal disorders among municipal solid waste workers. We designed a cross sectional study. Our survey instrument for measurement of musculoskeletal symptoms was adapted from the Standardized Nordic Questionnaire that translated into Farsi language. A total of 65% (n=142) of participants reported that they had been troubled with musculoskeletal symptoms in one or more of the 9 defined body regions during the last 12 months. Prevalence of symptoms in low back, knees, shoulders, upper back and neck were 45, 29, 24, 23 and 22% respectively. Foreign workers reported more musculoskeletal symptoms in all body parts than Iranian workers. The differences between prevalence of symptoms between two groups were significant in all parts of body except knees. The study found that solid waste workers have more musculoskeletal disorders than general population. Meanwhile these symptoms were more common among foreign workers. The risk of disease was increased with the increasing years of working as solid waste worker and smoking. We didn't find relationship between musculoskeletal disorders and education or marriage status of workers.

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INTRODUCTION

Waste collection is a necessary activity all around the world and the removal of municipal solid waste is a job associated with a variety of biological, chemical, mechanical, physical, and psychosocial hazards (1). In many countries municipal solid waste is collected manually, and municipal solid waste collection has been found to be among the highest-risk occupations in the United States (2).

Municipal workers are at risk for a variety of occupational diseases as a result of daily exposure to work-related hazards. The socioeconomic status of waste workers is low and their working conditions are unfavorable. In addition, this population of workers has not been well studied, so the actual risk may be substantially underreported (3). Musculoskeletal problems are also common among waste collectors (4) and in this work group non-fatal injuries are mainly musculoskeletal (1).

Musculoskeletal disorders (MSDs) represent one of the leading causes of occupational injury, illness and disability within many countries and different occupations (5-9). Association between working environment and musculoskeletal symptoms has been widely reported. Workplace activities such as

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heavy lifting, manual handling, prolonged sitting and standing, bending and repetitive tasks are known as risk factors for MSDs (10-13). In our country, like many developing countries, municipal solid waste is collected manually and collection of household waste is also a job which requires repeated heavy physical activity such as lifting, carrying, pulling, and pushing (14) so musculoskeletal problems are common among waste collectors. Although musculoskeletal disorders represent a significant occupational issue for municipal solid waste workers worldwide, a few epidemiological studies have investigated musculoskeletal complaints among Iranian workers.

The aim of this study was to determine the prevalence of musculoskeletal symptoms in a group of municipal solid waste workers in Tehran and to test the relationship between musculoskeletal complaint and work by using the duration of employment as a measure of exposure. Another objective of the study was to compare the injuries sustained by foreign and local workers.

MATERIALS AND METHODS

The study design was cross sectional and study population consisted of the municipal solid waste workers who had been employed in their current job for at least two years. Seven zones in Tehran (capital of Iran) were selected by simple random sampling and all workers in each zone were asked to participate in the study. We met them before starting to work and explained them the main objective of study. The participation in study was voluntary and we were careful to highlight the voluntary nature of participation. Patients were enrolled in this study after obtaining written informed consents.

Our survey instrument for measurement of musculoskeletal symptoms was adapted from the Standardized Nordic Questionnaire and translated into Farsi language. An anatomical diagram with labels and arrows clearly indicating differently shaded body sites was used for the assessment of musculoskeletal symptoms. Presence of musculoskeletal symptoms defined as ache, pain or discomfort in one of the nine body regions (neck, shoulders, elbows, wrists or hands, upper back, low

back, hips or thighs, knees and ankles or feet) during past 12 months.

All our study participants were asked to complete a questionnaire collecting information on employment and job history and individual characteristics. Individual characteristics and work history included questions on age, marriage status, family situation, nationality, level of education, duration of employment and previous jobs. A trained person helped the participants in completing the questionnaire when they had any question or they had not enough skill for reading or writing.

The results summarized in descriptive statistics. One year prevalence of musculoskeletal symptoms was calculated for the total group and for the Iranian and foreign subgroups. Differences in prevalence of symptoms between Iranian and foreign subgroups were tested by Chi square test. Then the relations between musculoskeletal symptoms in each body region and risk factors were analyzed, using multiple logistic regression analysis with adjustment for age.

Data analyzed using the statistical package SPSS V 11.5. *P* values below 0.05 were considered statistically significant throughout the analysis.

RESULTS

A total of 235 questionnaires were distributed to workers, from whom 217 workers replied the questionnaire (92% response rate). All respondents were male workers with more than two years experience in this job as a solid waste worker. Mean age was 30.3 years (SD = 12.2 years). Twenty-one workers (10%) were under 18 and 6 workers (3%) were under 15 years old. The youngest worker was a 13 years old child. Mean period of employment as solid waste worker was 5.5 years (SD = 6.2 years). The main proportion of participants (53%) consisted of not educated workers. Of all participants, 153 (55%) were married and 64 (45%) were single. 69 of participant (32%) were smoker.

A total of 65% (n = 142) of respondents reported that they had been troubled with musculoskeletal symptoms in one or more of the nine defined body regions during the last 12 months. One-year prevalence of musculoskeletal symptoms by body part showed different prevalence for different body parts (Table 1).

Table 1. Relations between nationality and one year prevalence of musculoskeletal symptoms by body part*

Body part	Total	Iranian workers	Foreign workers	OR (95% CI)	P Value
	(n= 217)	(n=106)	(n = 111)		
Neck	48 (22.1)	15 (14.2)	33 (29.7)	2.56 (1.29-5.07)	0.006†
Shoulders	52 (24)	19 (17.9)	33 (29.7)	1.93 (1.02-3.68)	0.042‡
Elbow	33 (15.2)	8 (7.5)	25 (22.5)	3.56 (1.52-8.30)	0.002†
Wrists/Hands	39 (18)	8 (7.5)	31 (27.9)	4.74 (2.06-10.9)	0.000§
Upper back	50 (23)	17 (16)	33 (29.7)	2.21 (1.14-4.28)	0.017‡
Low back	99 (45.6)	39 (36.8)	60 (54.1)	2.02 (1.17-3.48)	0.011‡
Hips/Thighs	30 (13.8)	5 (4.7)	25 (22.5)	5.87 (2.15-15.9)	0.000§
Knees	64 (29.5)	28 (26.4)	36 (32.4)	1.33 (0.74-2.40)	0.331
Ankles/Feet	30 (13.8)	8 (7.5)	22 (19.8)	3.03 (1.28-7.14)	0.009†
Any complaint ¶	142 (65.4)	59 (55.7)	83 (74.8)	2.36 (1.33-4.19)	0.003†

*Data are given as number (percent).

† $P < 0.01$, ‡ $P < 0.05$, § $P < 0.001$

¶ Either neck, shoulder, elbow, wrist or hand, upper back, low back, hip or thighs, knee, ankle or foot.

23% (n = 50) of participant had complaint in one part of their bodies during last year, 17% (n = 36) in two parts, 6% (n = 13) in three parts, 4% (n = 9) in four parts, 4% (n = 8) in five parts, 1% (n = 2) in six parts, 2% (n = 5) in seven parts, 5% (n = 10) in eight parts and 4% (n = 9) in all nine parts.

Prevalence of musculoskeletal symptoms by body part varied between the Iranian and foreign subgroups of workers (Table 1). Foreign workers reported more musculoskeletal symptoms than Iranian workers in all body parts. The differences between prevalence of symptoms between two groups were statistically significant in all parts of body except knees.

Multiple logistic regression analysis was performed separately for each part of the body, with

the MSDs as a dependent variable and age, duration of employment, smoking, marriage, education and nationality as independent variables.

The results of analysis for some parts of the body are shown in table 2. As the table 2 shows, the relationship between nationality and neck, shoulder, upper back and any part of body complaint was statistically significant. Our results show a relationship between smoking and neck pain, low back pain and any part of body symptom. We didn't find any statistical significant relationship between marital status of workers and the musculoskeletal symptoms in any part of body based on our data. Relationship between duration of employment and shoulder pain and pain in one part of body were statistically significant.

Table 2. Correlation between musculoskeletal symptoms and demographic characteristics in solid waste workers (n= 217)

Risk factors	Neck		Shoulders		Upper back		Low back		Any complaint ^a	
	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)	OR	(95% CI)
Nationality	6.46	(2.15-19.4)**	2.96	(1.08-8.07)*	3.25	(1.19-8.85)*	1.77	(0.77-4.04)	3.94	(1.98-7.85)**
Smoking	3.71	(1.74-7.90)**	1.69	(0.83-3.47)	1.47	(0.71-3.05)	1.92	(1.03-3.59)*	2.03	(1.02-4.07)*
marriage	2.17	(0.69-6.76)	1.44	(0.51-4.12)	0.91	(0.32-2.53)	1.58	(0.66-3.79)	1.19	(0.47-3.05)
education	0.59	(0.26-1.32)	0.46	(0.21-1.01)	0.51	(0.23-1.11)	1.06	(0.55-2.04)	1.23	(0.60-2.50)
Duration of employment	1.06	(0.98-1.14)	1.08	(1.01-1.17)*	1.03	(0.95-1.12)	1.02	(0.95-1.08)	1.09	(1.02-1.16)**

^a Either neck, shoulder, elbow, wrist or hand, upper back, low back, hip or thighs, knee, ankle or foot

^b OR and (95%)CI adjusted for age

* $P < 0.05$ ** $P < 0.01$

DISCUSSION

The response rate in our study was 92% that seems suitable and similar to or better than previous questionnaire studies, *e.g.* 70% in Hussain (15), 86% in Smith *et al.* (16) and 88% in Alexopoulos *et al.* (17). In this group of municipal solid waste workers 65 percent reported complaint in one or more parts of body in the last 12 months. Previous studies using the Nordic Questionnaire in a variety of jobs have reported 1 year prevalence rates of musculoskeletal symptoms of 37, 70 and 79% in nursing students (16), nurses (18) and truck assembly workers (15), respectively.

This study did not evaluate non work risk factors for musculoskeletal disorders. Based on our knowledge risk factors other than workplace could have been responsible for a proportion of the reported symptoms but the aim of this study was to assess the prevalence of musculoskeletal symptoms in this group of workers in our country.

The commonest reported symptom was low back pain. Low back pain represents one of the most common forms of occupational MSDs. Approximately 85-90% of the population will experience low back pain in their life time. In our study low back pain is followed by knee, shoulder, upper back and neck pain. Prevalence of symptoms in neck, low back and hip were 22, 45 and 14 percent, respectively. We compared the prevalence of MSDs in municipal solid waste workers with Iranian general population. Based on information from Iranian National Health Survey 2001, prevalence of complaints in neck, low back and hip among Iranian people were 7, 18 and 4 percent, respectively. It means prevalence of MSDs in municipal solid waste workers is about three fold more than general population.

Children and teenagers labor under age 15 is illegal in our country. Nevertheless 10% of participants were under 18 years old and 3% were under 15. All of them were foreign workers. Maybe they have not been protected by any regulations. Hazards in the workplace are more dangerous for younger workers and children. So they need more attention and protection. Working at a young age can

have a long negative impact on health, and it may result in lifelong exposure to hazards (19).

In our country, several municipalities are transforming waste collection management services from a public service publicly provided into a public service privately contracted. Private systems prefer to use foreign and younger workers because the payment to these groups is less than Iranian or adult workers. Foreign workers work informally, without regulation or occupational control. Their living conditions are also very poor, thus further increasing the risk of disease. In our study the proportion of foreign workers that reported having developed symptoms was significantly higher than Iranian workers.

In industrialized countries, the standards and norms for handling municipal solid wastes have reduced occupational diseases and injuries. In developing countries, solid wastes have not received sufficient attention. Even the minimal regulatory framework which exists in most of these countries for environmental protection and occupational health and safety is not enforced. In developing countries, public health attention is focused on urgent health problems such as infectious diseases, malnutrition, and infant mortality. As a country develops and gains economic resources, more attention is directed to health concerns related to hazardous wastes (20, 21). Our country as a developing country needs more information about prevalence of diseases for prevention, control and management of diseases. Managers in Ministry of Health and Education need this information for planning for the future. Just like many developing countries in the world, there isn't enough information about occupationally induced injuries and illnesses in Iran. We know musculoskeletal disorders are prevalent in different kinds of jobs in our country but as a matter of fact we don't know the exact magnitude of problem. Such information about prevalence of diseases even may make a change in the medical education curriculum in our country. Medical students in Iran know a little about occupational diseases and it means they probably miss these diseases in practice. Many of them don't ask any questions about their patient's job. They may treat patients without

considering their job and the relationship between symptoms and their work.

Logistic regression analysis revealed that duration of employment; smoking and nationality were significantly associated with musculoskeletal disorders among solid waste workers, even after adjustment for age. The relationship between heavy work and musculoskeletal symptoms has been studied in many different countries and jobs. The results of our study are compatible with other studies. Heavy work increases the incidence and prevalence of musculoskeletal disorders in workers and manual collection of solid wastes without appropriate tools and machines as a heavy work leads to musculoskeletal complaints. So the high prevalence of musculoskeletal disorders in this group of workers is expectable considering the work situation. The relationship between smoking and musculoskeletal symptoms especially low back pain has shown in many studies. In our study the prevalence of complaint among smokers was more than non smokers. As mentioned before, higher prevalence of symptoms among foreign workers maybe suggests more attention to this special group as a minority.

The cross-sectional design of this study does not permit causal inference from the observed associations. But the observed relationships give valuable evidence for further researches. In conclusion, the study found that solid waste workers have more MSDs than general population. Meanwhile these symptoms are more common among foreign workers in comparison with Iranian workers. The risk of pain in some part of body increases with the increasing years of working as solid waste worker and smoking.

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Conflict of interests

We have no competing interests.

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