

Prevalence of Respiratory Symptoms among Workers in Industries of South Tehran, Iran

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Received February 17, 2005 and accepted October 28, 2005

Abstract: **Objective:** The aim of the present study was to determine the prevalence of respiratory symptoms from occupational lung hazards among workers in industries of south Tehran, IRAN. **Methodology:** This was a cross-sectional study in which by multistage random sampling items on demographic characteristics, cigarette smoking, occupational history and respiratory symptoms were collected of workers. **Results:** The mean age of the workers was 38.5 (SD = 10.2) yr: age ranged from 19 to 70 yr. Of 880 workers under study, 252 (28.7%) were smoking. Also, it has been observed that workers exposed in the workplace with occupational chemical exposures such as dust, gas and fume pollutants. The prevalence of respiratory symptoms was cough (20.7%), phlegm (41.6%), dyspnea (41.7%), feel tightness (27.4%) and nose irritation (23.5%). **Conclusions:** Occupational exposures among workers in industries of south Tehran may cause respiratory symptoms and respiratory disorders, engineering controls and industrial hygiene is recommended.

Key words: Occupational lung hazards, Respiratory symptoms, Prevalence, Smoking, Demographic factors, Duration of employment, Industry

Introduction

Air pollution is a very important occupational problem in a various industries. Increasing amounts of potentially harmful gases and particles are being emitted into the workplace atmospheric, resulting in damage to human health. Inhalation is probably the most important route of exposure in the workplace and is an inescapable route of exposure to toxins in the general environment as well^{1,2}. Occupational pulmonary contaminants come in many forms. Some can be seen, smelled, or felt as irritants in the nose or throat. But others can only be detected with special equipment. Short-term exposure to many toxicants can cause immediate, acute damage. However, most contaminants take repeated or constant exposure

over months or years to cause disease or permanent harm. The impact of pulmonary hazards is also influenced by air pollution in general, age, smoking history, nutritional status, and other less well understood factors such as genetics and stress. Many work processes generate several contaminants at the same time. The health consequences of these hazards can simply be additive or, worse, they can be synergistic. Thus it is essential to know what materials and processes are used on the job to be able to evaluate, monitor, and control potential pulmonary hazards. However it should be noted that most occupational exposures to airborne hazards can be greatly reduced or eliminated through engineering controls, such as improving ventilation; good work practices; and the use of personal protective equipment, such as properly selected and maintained respirators. Two approaches are commonly used to categorize occupational lung hazards. The

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first approach uses a medical framework to classify hazards by their impact on the respiratory tract. Thus, hazards causing similar health effects are grouped together, whether or not the hazards themselves share similar properties (for example, irritants, asphyxiants, fibrosis producers, allergens and carcinogens). In the second approach, an industrial hygiene framework is used to group hazards by their common properties and the methods by which they are generated. Although some contaminants may not adversely affect the lungs, the lungs provide the means through which they enter the bloodstream and harm other organs or impair the blood's oxygen carrying capacity. However, the hazards that cause them are included to show the range of ways in which repairable contaminants damage the body^{3, 4}.

Respiratory symptoms and defect in pulmonary function are major causes of occupational exposures. Intensity of exposure, age, duration of employment and various non-occupational factors, such as cigarette smoking, life-long smoking habits, air pollution, ethnic background, lifestyle and diet, may be assessed for respiratory symptoms²⁻⁶. Occasionally, it is possible to reconstruct past exposure, from work histories and to derive a dose-response relationship. Usually, however, the occupational lung hazards data depend on so many intangibles and assumptions that accurate inferences cannot be drawn. Diseases of the lung caused by workplace exposures have been recognized for centuries^{2, 5-10}. Employment settings where workers use or are potentially exposed to pulmonary hazards should have a respiratory surveillance program. Although lung diseases are not the most common occupational diseases, they are the most significant due to their severity⁴.

It is widely accepted that workers are exposed to pulmonary hazards produce a variety of symptoms including cough, dyspnea and phlegm¹¹. Respiratory symptoms among industries workers have been reported by several authors. A number of studies have reported that workers in industries are exposed to relatively high levels of pulmonary contaminants in their working environment¹². Chemical agents are the commonest reported cause of respiratory irritants, sensitizers and occupational asthma in the United Kingdom¹³. Although some studies failed to find respiratory symptoms in workers¹⁴. Investigations by Valic and Beritic found a significantly increased prevalence of asthma symptoms in tobacco workers compared to that in control subjects. Smokers had higher prevalence for all respiratory symptoms compared to non-smokers, but the differences were not statistically significant¹⁵.

The purpose of the present study was to estimate the prevalence of respiratory symptoms among workers in south Tehran industries, IRAN. The results could pro-

vide information on respiratory health risks due to occupational lung hazards and finally these data can be used for industrial hygienists.

Methods

This was a cross-sectional study in which by multistage random sampling, 880 workers in industries of south Tehran, IRAN, in 2003 were studied. The data were collected by a modified questionnaire of medical research council (MRC) of Great Britain^{4, 7}. The MRC questionnaire has been tested in a variety of different conditions and has been shown to be a reproducible and accurate way of collecting such information. Questionnaires were administered face-to-face and consisted of three parts, including: (i) personal and work characteristics, (ii) respiratory health symptoms, which included items, symptoms of dyspnea, cough, phlegm, eye symptoms, time of onset of symptoms, duration of symptoms, relation of symptoms to work, i.e. whether they were worse at work or at home or whether they only arose exclusively at work, whether treatment had been received for the symptoms (iii) smoking habits. A trained interviewer interviewed each worker during working time.

Definitions of respiratory symptoms:

- Chest tightness: tightness or constriction of the chest occurring any time during the work shift and on any workday, without being worse.
- Chronic phlegm: sputum production occurring on most (5) days a week for a minimum of three months a year for at least two consecutive years.
- Chronic cough: cough without sputum occurring on most (5) days a week for a minimum of three months a year for at least two consecutive years.
- Dyspnea (2+): having to walk slower than a person of the same age at an ordinary pace on level ground because of breathlessness¹⁶.

In recent study chemical industry consists of petroleum, plastic and rubber industries, construction industry consists of cement, gypsum and brick manufactures and metal industry consists of tools, machinery and electrical industries.

All data recorded in a uniform format, collated in a computerized database and transferred to the SPSS (ver.9) statistical package (SPSS, Chicago, IL, USA) for analysis.

The prevalence odds ratio (OR) was then calculated, for each respiratory symptoms, and respiratory disorders and chi-square test were used in this study to compare between the distribution of personal characteristics and respiratory symptoms.

Results

Demographic factors relating to the study population, including age, duration of employment, marital status, education status, cigarette smoke, duration of smoking in smokers and type of industries, are given in Table 1. The mean age of the workers was 38.5 (SD = 10.2) yr: age ranged from 19 to 70 yr, the mean years employment was 14.2 (SD = 9.17) and the mean years of smoking 14.6 (SD = 9.39). Respiratory symptoms of prevalence were shown the age, duration of employment range, type of industry, exposure with harmful materials and major subgroups in industry in tables 2–4 and 5–7, respectively. The prevalence of respiratory symptoms increased with age and employment years and there were found significantly between age and employment years with cough, phlegm, tightness, dyspnea and eye burning ($P < 0.0001$, 0.05, 0.0001, 0.0001 and 0.02, respectively). There were found significantly relation between respiratory symptoms and type of industry (of $P < 0.0001$ to $P < 0.035$). The greatest of the respiratory symptoms were shown, dyspnea (41.7%) and phlegm (41.6%). Feel tightness has become the third prevalent respiratory symptoms in the workers (27.4%). Also, our study was shown no significant difference between other characteristics (marital status and education status) and respiratory symptoms (except dyspnea).

Respiratory symptoms were significantly ($P < 0.0001$) higher in workers with a duration of employment longer than 20 yr, when compared with the other groups (adjusted for age, smoking). Whereas workers with a work history ranged from 10–19 yr in the industries, appeared to be less symptomatic compared with the other groups.

Table 5 shows the odds ratios for respiratory symptoms associated with respiratory disorders. Respiratory symptoms and respiratory disorders were significantly in subjects ($P < 0.0001$) after adjusting for age and smoking. Increased risks for respiratory disorders were observed for the cough (OR = 3.43; 95% CI 1.86–6.34), phlegm (OR = 2.08; 95% CI 1.24–3.47), dyspnea (OR = 12.86; 95%CI 6.05–27.34). The tightness and nose irritation were also weakly associated with respiratory disorders (OR = 0.22; 95%CI 0.13–0.38 and OR = 0.8; 95%CI 0.45–1.45, respectively).

As it is clear in Table 6, the highest percent of respiratory symptoms prevalence, cough, phlegm, chest tightness, dyspnea and nose irritation with 32.6, 56.6, 34.6, 50.4, and 29.2, respectively were in the employees who had an exposure with harmful material, as discrepancy of this group with the others was significantly and the lowest prevalence of respiratory symptoms was in a group of workers who had no exposure with the harmful material.

At last, Table 7 shows that respiratory symptoms

Table 1. Characteristics of the study population (Continue)

	No. Subjects (%) n=880
Age (yr)	$\bar{X}=38.5$ (SD \pm 10.2)
<30	204 (23.2)
30-39	245 (27.8)
40-49	300 (34.1)
≥ 50	131 (14.9)
Duration of employment (yr)	$\bar{X}=14.2$ (SD \pm 9.17)
<10	298 (33.9)
10-19	261 (29.7)
≥ 20	321 (36.5)
Marital status	
Single	105 (11.9)
Married	775 (88.1)
Educational status	
Illiterate	40 (4.5)
Primary	289 (32.8)
Junior high school	195 (22.2)
High school	51 (5.8)
Diploma	270 (30.7)
Diploma+	35 (4)
Cigarette smoke	
Smoke	252 (28.7)
No smoke	612 (69.6)
Before smoke	15 (1.7)
Duration of Smoking in smokers (yr)	$\bar{X}=14.6$ (SD \pm 9.39)
<5	59 (22.3)
5-15	91 (34.5)
15-25	86 (32.6)
≥ 25	28 (10.6)
Type of Industry	
Food, Drink and Tobacco (7*)	201 (22.8)
Textile (3)	40 (4.5)
Chemical (6)	110 (12.5)
Construction (7)	169 (19.2)
Metal (7)	320 (36.4)
Miscellaneous (5)	40 (4.5)
Exposure with harmful material	
Dust	242 (27.5)
Fume	15 (1.7)
Gas	139 (15.8)
Dust & Gas	273 (30.9)
Dust & Fume	113 (12.8)
Fume & Gas	55 (6.3)
None	44 (5.0)

*Number of enterprises.

among the main group in each industry. In Food, Drink, and Tobacco industry, the highest prevalence of respiratory symptoms- phlegm, chest tightness, and dyspnea was in tobacco subgroup (with 47.5, 36.7, and 68.3%, respectively), while the highest prevalence of the respiratory symptoms, cough and nose irritation was in Drink sub-

Table 2. Distribution of respiratory symptoms in the study population by age

Symptoms	age (yr)				P value
	<30	30-39	40-49	>50	
Cough	26 (17.7)*	29 (19.7)	55 (37.4)	37 (34.6)	<0.0001
Phlegm	85 (23.4)	90 (24.8)	129 (35.5)	59 (16.3)	<0.05
Tightness	41 (17.1)	49 (20.4)	104 (43.3)	46 (19.2)	<0.0001
Dyspnea	47 (12.8)	89 (24.3)	153 (41.7)	78 (21.3)	<0.0001
Eye burning	108 (31.3)	83 (24.1)	109 (31.6)	45 (13.0)	<0.02

*Number (Percentage).

Table 3. Distribution of respiratory symptoms in the study population by duration of employment

Symptoms	Duration of employment (yr)			P value
	<10	10-19	>20	
Cough	35 (23.8)*	35 (17.8)	77 (52.4)	<0.0001
Phlegm	110 (31.1)	104(28.7)	146 (40.2)	<0.05
Tightness	64 (26.7)	63 (26.3)	113 (47.1)	<0.0001
Dyspnea	76 (20.7)	113 (30.8)	178 (48.5)	<0.0001
Eye burning	143 (41.4)	84 (24.3)	118 (34.2)	<0.02

*Number (Percentage).

Table 4. Distribution of respiratory symptoms in the study population by industries

Symptoms	Food, Drink and Tobacco	Textile	Chemicals	Construction	Metal	Miscellaneous	n*	P value
Cough	26 (14.9)#	12 (30.8)	18 (18.9)	39 (28.5)	44 (19.0)	8 (25.0)	147 (20.7)	<0.035
Phlegm	68 (34.7)	21 (53.8)	33 (30.0)	72 (43.1)	148 (46.3)	21 (52.5)	363 (41.6)	<0.004
Tightness	42 (20.9)	13 (32.5)	25 (22.7)	63 (37.5)	84 (26.4)	13 (32.5)	240 (27.4)	<0.009
Dyspnea	89 (44.3)	26 (65.0)	41 (37.3)	79 (46.7)	112 (35.0)	20 (50.0)	367 (41.7)	<0.002
Nose irritation	35 (17.4)	5 (12.5)	16 (14.5)	52 (30.8)	89 (27.8)	10 (25.0)	207 (23.5)	<0.0001

#Number (Percentage).

*Total number.

Table 5. Relationships between respiratory symptoms and respiratory disorders in the study population

Symptoms	No. (%)	P value	OR (95%CI)
Cough	147 (20.7)	<0.0001	3.43 (1.86–6.34)
Phlegm	363 (41.6)	<0.004	2.08 (1.24–3.47)
Tightness	240 (27.4)	<0.0001	0.22 (0.13–.38)
Dyspnea	367 (41.7)	<0.0001	12.86 (6.05–27.34)
Nose irritation	207 (23.5)	0.4	0.8 (0.45–1.45)

OR, Odds ratio, Confidence Interval.

group with 28.6 and 35.0%. In Construction group, the highest prevalence of these symptoms, phlegm, and dyspnea with 66.7, and 60% was in Gypsum subgroup; likewise, in cement group, phlegm and dyspnea with 49.5 and 46.0% was found as the highest number of prevalence among employees.

Discussion

The relationships between occupation and occupational pulmonary contaminants and respiratory symptoms in community-based studies have been studied since the late 1970s. In many of these general population studies, an association with exposure to dust, gases and fumes has been found with odds ratios ranging from 1.3 to 2.5 for exposed versus non-exposed workers¹⁷.

Results in this study showed that prevalence of respiratory symptoms were such as cough in 147 workers (20.9%), phlegm in 363 workers (41.6%), tightness in 240 workers (27.4%), dyspnea in 367 workers (41.7%) and nose irritation in 207 workers (23.5%). In our study we found a significantly higher prevalence of respiratory symptoms related to duration of employment such as cough, phlegm, tightness, dyspnea and eye burning in workers upper than 20 yr, (52.4%, 40.2%, 47.1%, 48.5%

Table 6. Distribution of respiratory symptoms in the study population by exposure with harmful materials

Symptoms	Dust	Fume	Gas	Dust & Fume	Dust & Gas	Fume & Gas	None	P value
Cough	42 (21.1) [#]	1 (7.7)	18 (14.8)	22 (28.6)	48 (22.2)	14 (32.6)	2 (5.1)	<0.01
Phlegm	85 (35.3)	3 (20.0)	42 (30.4)	64 (56.6)	143 (53.4)	20 (37.7)	6 (13.6)	<0.0001
Tightness	64 (26.7)	2 (13.3)	21 (15.1)	37 (32.7)	91 (33.6)	18 (32.7)	7 (15.9)	<0.001
Dyspnea	93 (38.4)	2 (13.3)	51 (36.7)	52 (46.0)	137 (50.4)	25 (45.5)	7 (15.9)	<0.0001
Nose irritation	55 (22.7)	4 (26.7)	27 (19.4)	33 (29.2)	72 (26.5)	14 (25.5)	2 (4.5)	<0.0001

[#]Number (Percentage).

Table 7. Distribution of respiratory symptoms in the study population by major subgroup industries

Symptoms	Food, Drink and Tobacco			Textile	Chemicals			P value
	Food	Drink	Tobacco		Petroleum+Gas	Plastic	Rubber	
Cough	9 (8.1) [#]	4 (28.6)	13 (26.0)	12 (30.8)	12 (30.8)	1 (10.0)	5 (10.9)	
Phlegm	32 (27.4)	8 (40.0)	28 (47.5)	21 (53.8)	16 (32.0)	2 (20.0)	15 (30.0)	
Tightness	14 (11.6)	6 (30.0)	22 (36.7)	13 (32.5)	11 (22.0)	2 (20.0)	12 (24.0)	
Dyspnea	40 (33.1)	8 (40.0)	41 (68.3)	26 (65.0)	17 (34.0)	5 (50.0)	19 (38.0)	
Nose irritation	17 (14.0)	7 (35.0)	11 (18.3)	5 (12.5)	8 (16.0)	2 (20.0)	6 (12.0)	

Symptoms	Construction			Metal	Miscellaneous			P value	
	Cement	Gypsum	Brick		Foundry	Machinery	Electrical		Paper
Cough	26 (31.7)	2 (25.0)	11 (23.4)	5 (18.5)	37 (21.5)	2 (6.3)	1 (6.7)	7 (28.0)	<0.002
Phlegm	49 (49.5)	6 (66.7)	17 (28.8)	23 (46.0)	111 (48.5)	14 (35.0)	5 (50.0)	16 (53.3)	<0.001
Tightness	39 (39.4)	5 (50.0)	19 (32.0)	12 (24.0)	62 (27.3)	9 (22.5)	2 (20.0)	11 (36.7)	<0.002
Dyspnea	46 (46.0)	6 (60.0)	27 (45.8)	19 (38.0)	82 (35.8)	10 (25.0)	3 (30.0)	17 (56.7)	<0.0001
Nose irritation	35 (35.0)	2 (20.0)	15 (25.4)	23 (46.0)	60 (26.2)	5 (12.5)	3 (30.0)	7 (23.3)	<0.0001

[#]Number (Percentage).

and 34.2%, respectively). In study similar of respiratory symptoms among workers at a cement factory in a rapidly developing country reported recurrent cough (30%), phlegm (25%), dyspnea (21%)^{18–20}. In other study, 86 workers (79.6%) had been working for less than 10 yr and 22 workers (20.4%) had been working for more than 10 yr, no differences were found between these two groups in the work related respiratory symptoms, that called this finding a “healthy worker effect”²¹. Also, our findings showed no significant difference between smokers and nonsmokers in the prevalence respiratory symptoms. One explanation for the lack of a smoking effect in workers may be due to difference in frequency smokers and nonsmokers (28.7% and 71.3%, respectively) whereas; cigarette smoking has been identified as the most important cause of pulmonary diseases. Smokers have an increased frequency of cough, sputum production²².

Sharp and co-workers, in a follow up study of 1,263 persons over a seven-year period (1961–1968), recorded respiratory symptoms. At the end of the follow-up period, the respiratory symptoms (cough, phlegm, dyspnea, and wheeze) were less prevalent than at the beginning of

the study. This reduction was attributed to the decline in the smoking rate from 52% to 35% in 1968. However, the incidence of new symptoms was less in non-smokers and ex-smokers than in those who continued to smoke²³.

In our study we found a significantly higher prevalence of respiratory symptoms related to textile industries workers such as cough, phlegm and dyspnea, (30.8%, 53.8% and 65%, respectively), and construction industries workers, such as tightness and nose irritation (37.5% and 30.8%, respectively). The textile industries in this study are one of the oldest of industries, also the construction industries are known as the most polluted workplaces. The prevalence of respiratory symptoms was found significant between industries workers. This may be due to differential nature of occupational chemical exposure or exposure levels in industries.

This study identified several industrial groups that were associated with work related respiratory symptoms. An increased prevalence of respiratory symptoms was found in textile and construction industry. Working in the in textile and construction industry is associated with numerous occupational health hazards. These industrial groups

with potential exposures to various respiratory symptoms including numerous organic chemicals—for example, solvents, dust and various other chemicals. Previous studies show that the workers with a more exposure with harmful material, as the likely occurrence of their health risks has increasingly went up; the prevalence percent of respiratory symptoms has also grown up. On contrary, among the workers with no exposure with harmful material, this percent was in its lowest level and symptoms differences between these two groups are mostly significant, showing the influence of harmful material in the prevalence of respiratory symptoms. Distribution of respiratory symptoms in industrial subgroups was equal to the distribution in industries, as in the subgroup of construction (cement and gypsum) and textile group it was found the highest prevalence of respiratory symptoms, showing existence of harmful material in these two industrial groups.

Construction is one of the largest industries in the IRAN. Workers in the construction industry may be exposed to increased concentrations of construction dust, wood dust, various paints, asphalt, and dust from concrete and masonry, as well as gases and vapors. Other population-based studies have previously reported similar associations a significant between working in the industries and the occurrence of respiratory symptoms¹⁸). In the United States Workers in the construction industry, exposure to wood dust has been reported to be associated with increased prevalence of respiratory symptoms. They did not find any association with work related asthma. This could partly be due to the healthy worker effect. An increased prevalence of respiratory symptoms was found in textile, workers in a textile industry are potentially exposed to cotton and other fiber dusts, textile dyes, and fabric printing and treatment chemicals²⁴).

Numerous studies have investigated the respiratory health effects of exposure to cotton dust in textile industries. Exposure to cotton dust has been reported to be associated with cough and dyspnea¹⁶).

In a follow-up study of Portland cement industry workers were found, to have an excess risk of developing dyspnea compared with non-exposed controls²³).

Fell *et al.* found no significant differences in prevalence of respiratory symptoms between cement workers and controls²⁵).

Using logistic regression, the risk of respiratory disorders for dyspnea was highest (12.86 times greater risk), cough (3.43 times greater risk), phlegm (2.08 times greater risk) and tightness (0.22 times greater risk). Risk factors for the occurrence of respiratory disorders in industries workers have not been identified clearly. Specifically, the relation between occupational lung hazards and respiratory disorders outcomes has been a con-

troversial issue. Some studied reported high-risk industries were the construction, metal industry. The construction industry was found mainly to be associated with respiratory symptoms; working in the metal industries was positively associated with the occurrence of respiratory disorders^{17, 26, 27}).

In conclusion, age and duration of employment of workers and type of industry can be the cause of respiratory symptoms and are related to the prevalence of respiratory symptoms. The risk of respiratory disorders for dyspnea was highest in our study. The results of indicate that occupational lung hazards among workers in industries may be due to respiratory symptoms. Further study is required to identify the factors that determine the consistent presence of occupational lung hazards related respiratory symptoms. These hazards are significant causes of morbidity, disability, early retirement, and death. They are entirely preventable once their causes are recognized. Therefore, recognition of the hazards associated with occupational lung disease and prevention of exposure must be a high priority.

Acknowledgements

The authors are grateful to A Afaghi H Mahmodi, E Haji Azimi, H Gorgizadeh, R Asgarian and F Shadravan for their valuable cooperations in this study.

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