



**PREVALENCE AND RISK FACTORS OF RESPIRATORY TRACT INFECTIONS  
AMONG PETROLEUM WORKERS IN KUWAIT**

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**ABSTRACT**

The aim of this study, was to estimate the prevalence and risk factors of respiratory tract infections among workers in the Kuwait Oil Company. In order to improve the health of the petroleum oil refinery workers.

While the objectives behind this study were to estimate the prevalence of respiratory tract infections among petroleum workers in Kuwait and to relate the risk factors of respiratory tract infections with the frequency of respiratory diseases among petroleum workers in Kuwait.

The study was conducted in a form of a cross-sectional study that compares the respiratory infections of blue-collar workers in the oil refinery fields and white-collar workers in Kuwait Oil Company (KOC). The main instrument used was a questionnaire that was distributed to workers and it included simple data as Demographic data, Diagnosed diseases, Respiratory symptoms, Questions on risk factors and some other questions. Around half of the sample, 243 (47.2%), was between the age group of 21-30; of them, 87 (56.1%) were office workers. Males represented 97% of the cohort, 208 (40.4%) employees suffered from respiratory infections, 145 (40.3%) and 63 (40.6%) were field and office workers. Preventive measures and management plans are highly recommended.

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**INTRODUCTION**

A respiratory tract infection is any infection relating to the sinuses, throat, airways or lungs, and is mainly caused by viruses and bacteria (3). Acute respiratory infections such as pneumonia, influenza, and respiratory syncytial virus are responsible for 4.25 million deaths worldwide each year (4). It was observed that respiratory infections were prevalent among petroleum workers: workers who had been working for more than 5 years had an obvious increase in prevalence, those who had been working for 6-10 years had a 15% increase in their prevalence, and lastly, the prevalence in those who had spent 11-15 years working was increased by 20.5% (5).

There are several symptoms and signs that can be recognized in people with respiratory tract infections; however, they all depend on the exposure, age, sex and many other factors that affect the severity of the symptoms. The spectrum can range from barely noticed irritation to choking dyspnea and severe chest pain. Rashes, tremors, rhinorrhea, narcosis, fever and nasal congestion can also be expected in any case of respiratory infection.

The list may also include paralysis and episodes of headache if the degree of infection is high (8,14-15).

Studies regarding oil and pollutants show that oil refineries are the largest source of air pollution with large amount of emissions including: heavy metals and dust particles gases like sulfur dioxide, nitrogen oxide, carbon dioxide and benzene(6).Respiratory impairment is evident as the workers have a prevalence of 33.7% (7). As for benzene exposure and its relation with respiratory infections, a study in the U.S. showed that there is a no significant relationship between benzene exposure and infections; however, a different study showed that exposure to hydrogen sulfide, one of the main gas streams exiting the refinery process exposure, is a cause of 15% of hospital visits for respiratory diseases (8-9).

A study in Sicily showed calculations of the standardized mortality ratio (multiplied by 100) due to respiratory diseases in petrochemical employees of a polluted site was 72%. The same study stated that the odds ratio of acute respiratory infections that caused hospitalizations in the blue workers was 1.26 (10).

Respiratory impairment has been observed in both smoking and non-smoking oil refinery workers, (11).

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Oil fields are heavily contaminated by hydrocarbons and silica; two pollutants found in oil. Along with other risk factors such as: tobacco use, allergens, unhealthy diet and physical inactivity, they contribute to respiratory tract infections (12). The burden of this problem can be viewed in multiple aspects, including financially, socially, and by their work productivity. Studies have shown that the annual cost of lost productivity due to absenteeism in the manufacturing and production industry is 2.8 billion dollars (13).

**Study Aim**

To estimate the prevalence and risk factors of respiratory infections among workers in the Kuwait Oil Company. In order to improve the health of the petroleum oil refinery workers.

**Study objectives**

1. To estimate the prevalence of respiratory tract infections among petroleum workers in Kuwait.
2. To relate the risk factors of respiratory tract infections with the frequency of respiratory diseases among petroleum workers in Kuwait.

**MATERIALS AND METHOD**

**Type of Study**

The study is a cross-sectional study that compares the respiratory infections of blue-collar workers in the oil refinery fields and white-collar workers in Kuwait Oil Company (KOC).

**Data Sources**

The data was collected from the KOC blue collar workers, who are individuals that work in the oil fields. In addition, we also collected information from the white collar workers, who are individuals that work in the offices.

**Study Population**

There are five oil companies in Kuwait: Kuwait Foreign Petroleum Exploration Company (KFPEC), Kuwait National Petroleum Company (KNPC), Kuwait Oil Company (KOC), Kuwait Petroleum Corporation (KPC), and Kuwait Petroleum International (KPI). In this study the population of interest was that of KOC which has a total of 7,094 employees (16).

There are three major oil fields: the North field, the West field and the South-Eastern field. The study was conducted on the South-Eastern field, the Burgan field, which has approximately 1,500 field workers. It was the field of choice because it is the largest oil field that is under the company's name; thus, having the largest number of workers.

**Sample Size**

After calculations were made, we concluded that the study would revolve around a sample size of 250 field workers out of the 1,500 workers in Burgan.

$$N = \frac{(Z^2) \times P(1 - P)}{D^2}$$

N= Sample size

Z= Standard normal deviate for desired level of confidence

P= Assumed proportion expressed as a decimal percentage

D= Maximum error allowed expressed as a decimal percentage

$$\frac{(1.96^2) \times (0.205 \times (1 - 0.205))}{0.05^2} = 250.433904$$

**Study Instrument**

Our study's main instrument was the questionnaire that was distributed to workers. The questionnaire's questions includes the following:

1. Demographic data
2. Diagnosed diseases
3. Diagnosed diseases in the upper respiratory tract
4. Diagnosed diseases in the lower respiratory tract
5. Questions about respiratory infections
6. Questions on absenteeism
7. Respiratory symptoms
8. Questions on risk factors

In addition to the questionnaire, we were present to observe and provide them with help, if needed.

**Inclusion and Exclusion Criteria**

**The subjects that took this questionnaire should have fit with the criteria below**

1. Those who are working in the Burgan field.
2. Those who have been working in the company for the past two years at least.

**The exclusion criteria included**

1. Workers who are busy.
2. Workers who refuse to participate in the study.
3. Workers that have been working at the company for less than two years.

**Procedure**

The first step that was obtaining permission from the university, the ministry, and the KOC to be able to conduct the research. A group of the research members interviewed the selected candidates during the period of this study.

**Ethical Considerations**

A proposal letter was sent to the university's dean, attached with the protocol, requesting a formal consent from the Kuwaiti cultural office in Bahrain. They contacted the Kuwait Oil Company for permission to enter the fields and gather information. After the approval, we met with the chairman and managing director of the Kuwait Oil Company, where he escorted us to Burgan field to distribute the questionnaires.

We also obtained consent from the workers that were surveyed. We explained to them the process and let them know that their personal information will not be used for any purpose other than this research, and that their names or other identifiers will not be recorded or published.

**Statistical Analysis**

IBM SPSS version.21 was used to enter and analyze our data. The data included the worker's age, height and weight, which were ported as means and standard deviations. Other data representing the worker's life style, for example; smoking, obesity and physical activity, was also analyzed. Lastly, data regarding the worker's position, hours of work and their frequency of respiratory infections was included as well.

**RESULTS**

Five hundred and fifteen were included in our study of Kuwait Oil Company employees. The cohort was divided into office and field employees. Around half of the sample, 243 (47.2%), was between the age group of 21-30; of them, 87 (56.1%) were office workers. Males represented 97% of the cohort. (Table I)

**Table I** Demographic Data of Oil Company Workers in Kuwait

Demographic Data	Type of Worker		Total	
	Field Worker	Office Worker		
Age	21-30	156 (43.3%)	87 (56.1%)	243 (47.2%)
	31-40	104 (28.9%)	47 (30.3%)	151 (29.3%)
	41-50	65 (18.1%)	21 (13.5%)	86 (16.7%)
	>51	35 (9.7%)	0 (0%)	35 (6.8%)
Gender	Male	360 (100%)	140 (90.3%)	500 (97.1%)
	Female	0 (0%)	15 (9.7%)	15 (2.9%)
Governorate	Al Ahmadi	70 (19.4%)	25 (16.1%)	95 (18.4%)
	Al Asimah	40 (11.1%)	30 (19.4%)	70 (13.6%)
	Al Farwaniya	30 (8.3%)	10 (6.5%)	40 (7.8%)
	Al Jahraa	15 (4.2%)	5 (3.2%)	20 (3.9%)
Hospital	Hawalli	135 (37.5%)	35 (22.6%)	170 (33%)
	Mubarak Al Kabeer	70 (19.4%)	50 (32.3%)	120 (23.3%)
	Al Ahmadi	95 (26.4%)	55 (35.5%)	150 (29.1%)
	Al Ameerii	50 (13.9%)	20 (12.9%)	70 (13.6%)
Private Sectors	Mubarak	85 (23.6%)	20 (12.9%)	105 (20.4%)
	Private	90 (25%)	45 (29%)	135 (26.2%)
	Others	40 (11.1%)	15 (9.7%)	55 (10.7%)

Cardiovascular diseases affected 20 (3.9%) employees, 5 (1.4%) and 15 (9.7%) were field and office employees, respectively. Respiratory diseases affected 175 (33.9%) employees; with asthma having a total of 120 (23.3%); 75 (20.8%) were field workers and 45 (29%) were office workers. Moreover, 50 workers (9.7%) had pneumonia; 40 (11.4%) were field workers, and 10 (6.5%) were office workers. History of allergies existed in 150 (29.1%) employees. (Table II)

**Table II** History of Chronic Diseases (% to who said yes) of Oil Company Workers in Kuwait

Disease	Type of Worker		Total	
	Field Worker	Office Worker		
Cardiovascular	5 (1.4%)	15 (9.7%)	20 (3.9%)	
Gastrointestinal	70 (19.4%)	20 (12.9%)	90 (17.5%)	
Nervous	20 (5.6%)	5 (3.2%)	25 (4.9%)	
	Asthma	75 (20.8%)	45 (29%)	120 (23.3%)
Respiratory	COPD	5 (1.4%)	0 (0%)	5 (1%)
	Pneumonia	40 (11.1%)	10 (6.5%)	50 (9.7%)
Allergies	110 (30.6%)	40 (25.8%)	150 (29.1%)	
Diabetes	4 (1.1%)	0 (0%)	4 (0.8%)	
	Disc	4 (1.1%)	0 (0%)	4 (0.8%)
Other Systems	G6PD	1 (0.3%)	0 (0%)	1 (0.2%)
	Hypercholestrolemia	2 (0.6%)	1 (0.6%)	3 (0.6%)
Hyperthyroidism	0 (0%)	3 (1.9%)	3 (0.6%)	
IGA	0 (0%)	1 (0.6%)	1 (0.2%)	

\*\* Emphysema, cystic fibrosis, tuberculosis and lung cancer had no outcomes (all 0%)

208 (40.4%) employees suffered from respiratory infections, 145 (40.3%) and 63 (40.6%) were field and office workers, respectively. Of the 208 employees who suffered respiratory infections, 136 (65.3%) had 4-6 attacks of respiratory infections since they joined work and the majority of them (108, (79.4%)) were field workers. Our data showed that

342(66.4%) never missed the work because of the infection whereas 43(8.3%), the majority being field workers 32(8.9%), missed the work once due to the infection and 50(9.7%) missed work twice because of the infection. (Table III)

**Table III** History of Respiratory Infection of Oil Company Workers in Kuwait

	Type of Worker		Total
	Field Worker	Office Worker	
History of Respiratory Infections since joining the company	185 (51.04%)	89 (57.4%)	208 (40.4%)
Were they working the last time they had an infection	57 (15.8%)	30 (19.4%)	87 (16.9%)
Respiratory infection since they started working	0 (48.6%)	66 (42.6%)	241 (46.8%)
	1-3 (14.7%)	47 (30.3%)	100 (19.4%)
	4-6 (30%)	28 (18.1%)	136 (26.4%)
	>7 (6.7%)	14 (9%)	38 (7.4%)
Missed Work because of the infection	Never (68.1%)	97 (62.6%)	342 (66.4%)
	1 (8.9%)	11 (7.1%)	43 (8.3%)
	2 (6.9%)	25 (16.1%)	50 (9.7%)
	3 (4.2%)	3 (1.9%)	18 (3.5%)
	4 (3.6%)	10 (6.5%)	23 (4.5%)
	>5 (8.3%)	9 (5.8%)	39 (7.6%)

As shown in table 4, the respiratory symptoms that existed included chronic rhinorrhea (%), sore throat (%), dry cough (%), cough with mucus (%) and cough with blood (%). Flu-like symptoms dominated, with 415(80.6%) worker, most of which are field worker 280(77.8%). Additionally, 380 workers (73.8%) suffered from sore throat, the majority being field workers 245(68.1%). Thirdly comes chronic rhinorrhea, 365 workers (70.9%), constituted mainly of field workers 235(65.3%). (Table IV)

**Table IV** Respiratory Symptoms (% to who said yes) of Oil Company Workers in Kuwait

Symptom	Type of Worker		Total
	Field Worker	Office Worker	
Chronic Rhinorrhea	235 (65.3%)	130 (83.9%)	365 (70.9%)
Sore Throat	245 (68.1%)	135 (87.1%)	380 (73.8%)
Dry Cough	185 (51.4%)	90 (58.1%)	275 (53.4%)
Cough + Mucus	225 (62.5%)	120 (77.4%)	345 (67%)
Cough + Blood	10 (2.8%)	0 (0%)	10 (1.9%)
Flu like symptoms	280 (77.8%)	135 (87.1%)	415 (80.6%)
Fever	195 (54.2%)	110 (71%)	305 (59.2%)

As illustrated in table 5, 264 (51.3%) employees smoked cigarettes, 209 (79.1%) of them were field employees while 55 (20.9%) of them were office employees. Field employees wore protective wears more often than office employees, 355(89.9%) wore helmets, 325 (91.5%) field workers. In total, 265(64.6%) workers wore protective gloves with field workers being 250(69.4%). Protections for respiratory system in particular, were worn in 225 (53.6%) of the workers, most of them, 205(58.6%), were field workers. (Table V)

**Table V** Protective Wear/Risk Factors (% to who said yes) of Oil Company Workers in Kuwait

	Type of Worker		Total
	Field Worker	Office Worker	
Protection for Respiratory System	205 (58.6%)	20 (28.6%)	225 (53.6%)
Protective Gloves	250 (69.4%)	15 (30%)	265 (64.6%)
	Helmet	325 (91.5%)	30 (75%)
Smoking	209 (58.1%)	55 (35.5%)	264 (51.3%)

Crosstab

		Respiratory Infection		P Value
		Yes	No	
Type or worker	Field Office	145 (40.3%) 63 (40.6%)	215 (59.7%) 92 (59.3%)	0.507

	Type of Work	Field Worker		Office Worker		P Value
		Respiratory Infection Yes	No	Yes	No	
Age	21-30	70 (48.3%)	86 (40%)	25 (39.7%)	62 (67.4%)	0.792
	31-40	38 (26.2%)	66 (30.7%)	28 (44.4%)	19 (20.7%)	
	41-50	24 (16.6%)	41 (19.1%)	10 (15.9%)	11 (12%)	
	>51	13 (9%)	22 (10.2%)	0 (0%)	0 (0%)	
Asthma	Yes	55 (37.9%)	20 (9.3%)	20 (31.7%)	25 (27.2%)	0.000
	No	90 (62.1%)	195 (90.7%)	67 (72.8%)	43 (68.3%)	
Allergies	Yes	58 (40%)	52 (24.2%)	15 (23.8%)	25 (27.2%)	0.014
	No	87 (60%)	163 (75.8%)	48 (76.2%)	67 (72.8%)	
Smoking	Yes	101 (69.7%)	108 (50.2%)	20 (31.7%)	35 (38%)	0.010
	No	44 (30.3%)	107 (49.8%)	43 (68.3%)	57 (62%)	
Respiratory wear	Yes	92 (63.4%)	113 (55.1%)	10 (25%)	10 (33.3%)	0.569
	No	53 (36.6%)	92 (44.9%)	30 (75%)	20 (66.7%)	
Protective wear	Gloves	102 (70.3%)	148 (68.8%)	5 (20%)	10 (40%)	0.546
	No	43 (29.7%)	67 (31.2%)	20 (80%)	15 (60%)	
Helmet	Yes	126 (90%)	199 (92.6%)	15 (60%)	15 (100%)	0.014
	No	14 (10%)	16 (7.4%)	10 (40%)	0 (0%)	

## DISCUSSION

Our project studied a cohort of Kuwait Oil Company (KOC) employees from two different work environments; field and office environments. We looked at several diseases affecting this cohort to find out if work environments influence the type of diseases the employees suffer from.

It is evident that our hypothesis, that field workers would have more infections than office workers, was not proven. A recent study in Iraq (2010) showed a directly proportional relationship between numbers of years worked and respiratory infections among field workers (6). Another recent study showed that respiratory impairment has evident among field workers, with a prevalence of (33.7%).

As seen in previous tables, the p-value of the difference between field and office workers respiratory infections among field and office workers was not significant. This indicates that there is not much difference between field workers and office workers when it comes to respiratory infections. Such results might be due to interference of some risk factors like smoking, asthma and allergies. Smoking, for example, has the potential to dramatically change the outcome of the results. A study revealed that "smoking has adverse health effects on the entire lung-affecting every aspect of lung structure and function-including impairing lung defenses against infection and causing the sustained lung injury that leads to chronic obstructive pulmonary disease." (17). When observing the workers who wore respiratory wears and those who didn't, the results showed that those who wore protective equipment had similar outcomes to workers who did not. This contraindicates studies that revealed how effective protective wear is in preventing respiratory infections. The limitation to studies and bias might be a cause to such results.

## CONCLUSION

Our results showed almost equal results between the office and field workers of Kuwait Oil Company regarding respiratory infections, unlike the expected results that field workers would have more infections than office workers.

## References

1. Kuwait Petroleum Corporation (2009) *Kuwait Oil History* <http://www.kpc.com.kw/InformationCentre/KuwaitOilHistory/default.aspx>[Accessed: 2014 Jan12].

2. Rosenberg M. About (2013) <http://geography.about.com/library/cia/blekuwait.htm> [Accessed: 2014 Jan 13].
3. Medical encyclopedia (c2008-2009) <<http://www.nhsdirect.wales.nhs.uk/encyclopaedia/article/respiratorytractinfection/>>[Accessed: 2014 Jan 14].
4. Mayor S. Acute respiratory infections are world's third leading cause of death. *BMJ* 2010; 341:c6360. <<http://www.bmj.com/content/341/bmj.c6360>>[Accessed: 2014 Jan 10].
5. Al-jebouri M. A study on respiratory infections among oil refineries workers of Iraq. *International Society for Infectious Disease* (2001-2010); 1(6): 489.
6. Al-jebouri M, Younis A. Incidence of aminoglycosides-resistant rothia mucilagenosa causing respiratory infections in workers of al-baiji oil refinery iraq. *JPSI* 2012; 1(6):54-56.
7. Minov J, Karadzinska-Bislimovska J, Vasilevska K, Trajceva L, Risteska-Kuc S, Stoleski S, *et al.* Respiratory and nasal symptoms, immunological changes and lung function among petroleum refinery workers. *Med Lav*; 101(5); 364-74
8. Speight JG. Refinery Wastes. *The Chemistry and Technology of Petroleum*. 4<sup>th</sup> edition. CRS Press; 2006.
9. Campagna D, Kathman S, Pierson R, Inserra S, Phifer B, *et al.* Ambient hydrogen sulfide, total reduced sulfur, and hospital visit for respiratory disease in northeast Nebraska. *Journal of Exposure Analysis and Environmental Epidemiology* (2004); 14(1): 180-187
10. Pasetto R, Zona A, Pirastu R, Cernigliaro A, Dardanoni G, Addario SP, *et al.* Mortality and Morbidity Study of Petrochemical Employees in a Polluted Site. *Environmental Health*. 2012. 11:34. 5-7. <http://www.ehjournal.net/content/11/1/34> [Accessed 2014 Jan 14].
11. Balmes JB, Speizer F. Access Medicine <<http://accessmedicine.mhmedical.com/content.aspx?bookid=331&ionid=40727039>> [Accessed: 2014 Jan 16].
12. Ud Din S, Al Dousari A, Literathy P. Evidence of Hydrocarbon Contamination from Burgan Oil Field, Kuwait-- Interpretations from Thermal Remote Sensing Data. *Journal of Environmental Management* (2007); 86:605-615.
13. Investopedia. Forbes (2013) <<http://www.forbes.com/sites/investopedia/2013/07/10/the-causes-and-costs-of-absenteeism-in-the-workplace/>>[Accessed: 2014 Jan 11].
14. Meo SA, Al-Drees A, Rasheed S. Effect of Duration of Exposure to Polluted Air Environment on Lung Function in Subjects Exposed to Crude Oil Spill into Sea Water. *International Journal of Occupational Medicine and Environmental Health* 2009; 22(1):35-41.
15. Nhs. NHS choices. <http://www.nhs.uk/conditions/respiratory-tract-infection/pages/introduction.aspx> [Accessed: 2014 Jan 13].
16. Al-Rushaid SF, Hussain M, Al-Khashti B, Bu Hamra W, Al-Noori J, *et al.* Kuwait Oil Company Annual Report. KOC. 2010-2011 <http://www.kockw.com/sites/EN/Pages/Media%20Center/Publications/AnnualReport.aspx> [Accessed 2014 April 7].