Shiraz E-Med J. 2016 June; 17(6):e38237. doi: 10.17795/semj38237.

Published online 2016 June 25. **Research Article**

Lung Cancer Incidence Trends in Iran and in Six Geographical Regions of the Country (2000 - 2005)

Sattar Bab,[1] Edris Abdifard,[1,2] Yousef Moradi,[3] Azadeh Faraj,[2] and Mohammad Heidari[4,*]

[1]Students Research Committee, Kermanshah University of Medical Sciences, Kermanshah, IR Iran
[2]Department of Nursing, School of Nursing and Midwifery, Iran University of Medical Sciences, Tehran, IR Iran
[3]Pars Advanced and Minimally Invasive Manners Research Center, Pars Hospital, Iran University of Medical Sciences Tehran, IR Iran
[4]Department of Epidemiology, Kermanshah University of Medical Sciences, Kermanshah, IR Iran

[*]*Corresponding author*: Mohammad Heidari, Department of Epidemiology, Kermanshah University of Medical Sciences, Kermanshah, IR Iran. E-mail: Heidari_m@kmu.ac.ir

Received 2016 April 05; **Revised** 2016 May 23; **Accepted** 2016 June 18.

Abstract

Background: Lung cancer, the most common type of cancer in humans, is the leading cause of cancer deaths globally, accounting for 1.38 million deaths per year (18.2% of all cancer deaths). Lung cancer is the third most common type of cancer in Iran.
Objectives: The present study investigated the incidence of lung cancer in six geographical regions of Iran.
Materials and Methods: Data for annual cases of lung cancer were obtained from the national cancer registry during the years 2000 - 2005. The rates of incidence were standardized using world health organization (WHO) population data, and confidence intervals were calculated at 95%. Iran was divided into six areas according to geographical differences. The Poisson regression model was used to test the significance of changes in the incidence rates during the study period
Results: The age-standardized rates of lung cancer for men and women increased from 0.8 and 0.3 per 100,000 people in 2000 to 4 and 1.5 in 2005, respectively. The highest rate of lung cancer was observed in the mountainous region, and the lowest rate occurred in the western provinces of the Caspian sea region. Despite the difference in the slope of changes, there is an increasing trend in the incidence of lung cancer in all geographical areas.
Conclusions: The current incidence rates of lung cancer in all the geographical areas examined are generally increasing. Unfortunately, the rates of urbanization, environmental pollution, and smoking tendency are also increasing in Iran; to control these trends and adjust these risk factors, officials should help more with public-program planning.

Keywords: Lung Cancer, Incidence, Trend, Geographical Regions, Iran

1. Background

Lung cancer is one of the world's most common cancers. For every 10.9 million cancer cases, 1.35 million are related to lung cancer, and for every 6.7 million cancer deaths, 1.18 million result from lung cancer (1). In the United States, 220,000 people with lung cancer are diagnosed each year, and more than 157,000 of them will succumb to the disease (2). In Britain, the prevalence of lung cancer is also an increasing issue, with a total incidence rate of 4.41 for every 100,000 individuals, and it is considered to be the main cause of death in that country (3). In countries such as the United States and Canada, the total number of people who die of lung cancer is greater than the number of deaths caused by breast, colon, and prostate cancer combined (4, 5). According to a report issued by the world health organization (WHO) in 2002, lung cancer was the ninth leading cause of death and was responsible for 2% of the total number of deaths. It is predicted that in 2030, lung cancer will be the seventh leading cause of death and will be responsible for 3% of all deaths (6). Lung cancer is classified into two main types: non-microscopic lung cancer (NSCLC) and microscopic lung cancer (SCLC). Comprising 85% of all lung cancers, microscopic lung cancer is the more common of the two (7). There are three forms of non-microscopic lung cancers, which are labeled based on the type of cellular involvement: carcinomas of squamous cells, adenocarcinoma, and carcinomas of large cells. In total, 17.3% of people who suffer from this cancer live for five years (7). It is worth noting that non-microscopic types of lung cancer are treated through surgery if diagnosed at the primary stage (8). About half the known cases occur in developing countries, with the highest rate of lung cancer prevalence reported in North America and Europe. The average increases have been seen in Australia, New Zealand, and East Asia (primarily in China and Japan) (9). Today, the rate of lung cancer is relatively low in Iran (9).

Lung cancer is more prevalent among men than women, with 71% of all cases diagnosed in the male population. The highest rates among men are reported in Europe (especially Eastern Europe) and North America, while the

highest rates among women are reported in North America and North Western Europe (Britain, Iceland, and Denmark) (9). In recent decades, the incidence of lung cancer has decreased in conjunction with a reduced smoking prevalence, the result of anti-smoking activities and increased public awareness in these countries (10). A society's lung cancer prevalence increases with the number of its individuals who smoke (11, 12). In developing countries, such as Southeast Asia and the Indian peninsula, that have high rates of cigarette smoking, lung cancer is currently the deadliest form of cancer (13, 14). In Iran, lung cancer cases among men and women number 10.5 and 5.1 in 100,000, respectively. For example, from 1950 to 1980, the rate of lung cancer deaths among Taiwanese women increased from 0.9 to 8.5 per 100,000; in Japan, it increased from 3 to 11.5 per 100,000; and in Hong Kong, it increased from 11.4 to 28.5 per 100,000 (15). From 1980 to 1980, South Korea's death rate due to lung cancer grew from 1.4 to 7, and from 1980 to 2004, it grew ten-fold (16). Among Chinese women, this rate increased by approximately +153% in 2005 compared to the 1991 rate (17).

Smoking is the main risk factor for lung cancer (18). Today, smoking is an important health issue: More than 4 million people throughout the world die as the result of smoking. It is predicted that the number of smoking deaths will reach to ten million annually within the next 25 years (19). A 2001 study on the incidence of smoking revealed that the rate was 3.6% for Iranian women over the age of 16 and 26% for men (20). Considering the high prevalence of cigarette smoking among the Iranian male population, the incidence of lung cancer is less than the expected rate. This cancer is the fifth most prevalent cancer in Iran, a low rate that may be the result of under-reporting and diagnosis. However, several recent studies have shown gradual increases in the incidence of lung cancer (21, 22). Other risk factors include air pollution and secondary contact with cigarette smoke, as well as occupational and environmental exposure to radon and asbestos, specific metals (especially chromium, cadmium, and arsenic), and some organic chemical or radioactive materials; coal smoke and the spread of other fuels in the household are additional risk factors. Among young people who are diagnosed with lung cancer, in particular, genetic aptness contributes to an increased risk (23, 24).

2. Objectives

In light of the limited number of studies on changes in the incidence rate of lung cancer in Iran, the present study investigated the country's lung-cancer trend during the years 2000 - 2005. The results are important for identifying the risk of lung cancer and for predicting its incidence trend, which can be of great benefit to health policy makers.

3. Materials and Methods

In this population-based study, data were obtained from the national cancer registry at the centre for disease control of the Iranian ministry of health. Each year, cancer data are collected from all pathology departments across the country; the extracted data are then monitored for errors in coding, demographic information, duplicates, and missing identities. It should be noted that, in the Islamic Republic of Iran, it has been mandatory since 1984 to record and to report cases of cancer; the first report was published in 1986. The Iranian national cancer registry was improved with the development of Pars software in 2000. Types of cancer are classified according to the International Classification of Disease (ICD-10), second revision. For purposes of this study, we used ICD-10 categories C33 and C34 for lung cancer. The country was divided into six geographical areas: the central and western Caspian sea region (Gilan and Mazandaran provinces), the eastern Caspian sea region (Golestan province), the flat region (Tehran, Qom, Qazvin, Zanjan, East Azerbaijan, West Azerbaijan, and Ardebil provinces), the mountainous region (Kermanshah, Kurdestan, Hamedan, Ilam, Chaharmahal va Bakhtiari, and Kohkiluye va Buyerahmad provinces), the desert region (Fars, Kerman, Sistan va Baluchistan, Yazd, Semnan, Khorasan, Birjand, and Isfahan provinces), and the Persian gulf region (Khuzestan, Bushehr, and Hormozgan provinces). Cases with no information on residential provinces were considered in the calculation of the overall national incidence rate and not in calculations for the different geographical regions. For incidence standardization, the results of the national population consensus of 2006 were used. Considering the annual population growth rate of 1.01%, the population of different geographical regions was determined for 2000, 2001, 2002, 2003, 2004, and 2005. Standard population data from WHO was used as the reference population. Using direct methods and STATA software, version 11, age sex incidence rates and a 95% confidence interval (CI) for the whole country and for the six geographical regions were calculated. The significance of incidence trends was tested via the use of a Poisson regression model. All graphs were drawn using Microsoft Excel 2007.

4. Results

During the 5-year study, an overall number of 2,268 cases of lung cancer were recorded in Iran; the number

of cases ranged from 397 in 2000 to 1,871 in 2005, with a female to-male ratio of 2.99. The subjects' mean age was 62.72 years (SD = 13.04). The women's mean age was 59.87 years (SD = 14.29), and the men's mean age was 63.67 years (SD = 12.46). The standard incidence rate of breast cancer is increasing in Iran: Overall, among both genders, it has increased from 0.5 cases per 100,000 in 2000 to 2.8 cases per 100,000 in 2005.The incidence-rate standard age among men was significantly higher than that for women. The rate for men increased from 0.8 cases per 100,000 in 2000 to 4.00 cases per 100,000 in 2005, while the rate for women increased from 0.3 in 2000 to 1.5 cases per 100,000 in 2005 (Table 1).

4.1. Eastern Caspian Sea Region

By ranking all regions, it is obvious that the rate of lung cancer in this area was lower than the country's average during the study and had the lowest incidence rate of the six geographical areas studied. The general rate of lung cancer in the region on the eastern border of the Caspian sea region decreased during the first two years of the study; beginning in 2002, the incidence rate showed an increasing trend. The incidence trend among both genders saw many fluctuations from 2000 to 2005. Among men, the rate increased from 0.00 cases per 100,000 in 2000 to 1.3 cases in 2005; among women, it increased from 0.000 cases per 100,000 in 2000 to 0.8 in 2005. Generally, the rate was more severe among men. The incidence trend for this type of cancer in the eastern border of the Caspian Sea region increased for both genders from 2000 to 2001. In 2002, the incidence rate among males decreased, and in 2003 it increased. Following the study, the rate increased from 0.3 cases per 100,000 in 2003 to 0.8 cases in 2004; during the same time frame, the incidence rate among women decreased from 0.4 to 0.3 cases per 100,000. Both genders experienced increased rates in 2005, with 1.3 cases for men per 100,000 and 0.8 cases for women, which were the highest incidence rates for both genders during the study.

4.2. Central and Western Caspian Sea region

This region was ranked as having the fourth highest incidence rate of lung cancer of the geographic areas examined. In this area, the rate of lung cancer was lower than the country average. During the first two years of the study, the rate increased and then decreased. Like the Eastern border of the Caspian sea region, the rate of cancer increased from the 2002 rate. In general, the rate increased for both genders, with 0.6 cases per 100,000 men in 2000, reaching 3.2 in 2005, and with 0.2 cases per 100,000 women in 2000, reaching 1.1 in 2005. The lung cancer rate among the men in this region decreased from 2000 to 2001; the trend then continued to increase until the end of the study. In 2005, the rate reached 3.2 cases per 100,000. During the period 2000 - 2001, the rate among women remained unchanged, then increased, with a constant slope in 2002 and 2003 compared to the first two years of the study; it then decreased in 2004 and reached its peak in 2005.

4.3. Desert Region

After the Persian gulf border area, the desert region ranked second as the riskiest geographic area in Iran. The rate of lung cancer in the first two years of the study was the same; from 2003, the rate of this cancer among men continued to increase until the end of study, reaching its highest level in 2005 (2.7 cases per 100,000) compared to the year 2000 (0.8 cases per 100,000). Among women, the rate also increased, from 0.4 cases per 100,000 in 2000 to 1.4 in 2005. Generally, the rate was higher for men than women. The lung cancer trend varied with respect to gender. The rate fluctuated for men and in 2005 reached its highest level. In women, the trend had a constant slope during the first three years, and, suddenly, in 2003, it significantly decreased; beginning in 2003, the trend again increased until 2005, when it reached its highest level.

4.4. Flat Region

The flat region ranked fifth among the six geographic areas of the study. This area had the lowest rate of lung cancer compared to the country's average rate. In the first two years of the study, the rate increased and then suddenly decreased. Beginning in 2002, the cancer rate increased and in 2005 reached its highest level. The rate among men increased from 0.6 cases per 100,000 in 2000 to 5.3 in 2005; among women, the rate increased from 0.2 cases per 100,000 in 2000 to 1.8 in 2005. The rate generally increased among both genders. For men, the rate increased from 2000 to 2001; in 2002, it suddenly decreased, and beginning in 2002 and through the end of the study, it continued to increase with a high slope. Among women, the range of variation constantly increased.

4.5. Mountainous Region

In this area, the rate was lower than the country's average rate. It ranked third after the border of the Persian gulf and desert areas. The rate in this area generally increased during the first two years of the study, remained constant during the next two years, and increased to a rate higher than that of the first two years of the study; it finally was fixed at a rate that was higher than that during the first four years of the study. Among the men in this area, the rate increased from 0.7 cases per 100,000 in 2000 to 2.4 in 2005; among women, the rate increased from 0.2 cases per

Table 1. Trend of Changes in the Age-Standardized Incidence Rate (Per 100,000 Persons) of Lung Cancer in Six Geographical Areas in Iran during 2000 - 2005

	79	80	81	82	83	84	Slope/P Value
Center and western border of Caspian sea region							
Male	0.6 (.03 - 0.9)	0.01 (0 - 0.3)	0.9 (0.5 - 1.4)	1.8 (1.2 - 2.3)	2.3 (1.7 - 2.9)	3.2 (2.5 - 03.9)	-0.13 (0.5)
Female	0.2 (0.0 - 0.4)	0.2 (0.0 - 0.4)	0.5 (0.2 - 0.8)	0.5(0.2 - 0.8)	0.4 (0.2 - 0.7)	1.1 (0.7 - 1.5)	-0.38 (0.9)
Total	0.3 (0.2 - 0.5)	0.1 (0.0 - 0.2)	0.7 (0.5 - 1.0)	1.1 (0.8 - 1.4)	1.3 (0.9 - 1.6)	2.1 (1.7 - 2.6)	0.12 (0.6)
Eastern border of Caspian sea region							
Male	0.0 (0.0 - 0.0)	1.4 (0.3 - 2.6)	0.0 (0.0 - 0.0)	0.3 (0.0–0.8)	0.8 (0.0 - 1.6)	1.3 (0.3 - 2.3)	-0.1 (0.7)
Female	0.0 (0.0 - 0.0)	1.0 (0.0 – 2.0)	0.0(0.0 - 0.0)	0.4 (0.0 - 0.9)	0.3 (0.0 - 0.8)	0.8 (0.0 - 1.6)	-0.17 (0.7)
Total	0.0 (0.0 - 0.0)	1.2 (0.5 - 2.0)	0.0 (0.0 - 0.0)	0.3 (0.0 - 0.7)	0.6 (0.1 - 1.0)	1.1 (0.4 - 1.7)	-0.12 (0.7)
Desert region							
Male	0.8 (05 - 1.0)	0.07 (0.5 - 01)	0.9 (0.7 - 1.1)	0.6 (0.4 - 0.8)	1.3(1.0 - 1.6)	2.7 (2.3 - 3.1)	-0.01 (0.7)
Female	0.4 (0.2 - 0.5)	0.4 (.02 - 0.5)	0.4 (0.2- .06)	0.1 (0.1 - 0.2)	0.4 (0.2 - 0.6)	1.4 (1.1- 1.7)	-0.24 (0.6)
Total	0.6 (0.4 - 0.07)	0.6 (0.4 - 0.7)	0.7 (0.5 - 0.8)	0.4 (0.3 - 0.5)	0.9 (0.7 - 1.0)	2.1 (1.8 - 2.3)	-0.12 (0.6)
Flat region							
Male	0.6 (0.5 - 0.8)	0.9 (0.6 - 1.1)	0.6 (0.4 - 0.8)	1.7 (1.3–2)	3.5 (3 - 3.9)	5.3 (4.7 - 5.9)	0.14 (0.5)
Female	0.2 (0.1 - 0.3)	0.3 (0.2–0.5)	0.3 (0.1 - 0.4)	0.3 (0.2 - 0.5)	0.9 (0.6 - 1.1)	1.8 (1.4 - 2.1)	0.68 (0.8)
Total	0.4 (0.3 - 0.5)	0.6 (0.5 - 0.7)	0.5 (0.3 - 0.6)	1.0 (0.8 - 1.2)	2.2 (1.9 - 2.5)	3.6 (3.2 - 3.9)	0.12 (0.6)
Mountainous region							
Male	0.7 (0.0 –)	1.4 (1.0 - 1.8)	1.8 (1.4 - 2.2)	1.8 (1.4 - 2.2)	2.6 (2.1 - 3.1)	2.4 (2.0 - 2.9)	0.02 (0.9)
Female	0.2 (0.1 - 0.4)	0.6 (0.3 - 0.8)	0.5 (0.3 - 0.7)	0.5 (0.3 - 0.7)	0.6 (0.4 - 0.8)	0.8 (0.5 - 1.0)	-0.71 (0. 8)
Total	0.5 (0.3 - 0.6)	1.0 (0.8 - 1.2)	1.2 (0.9 - 1.4)	1.2 (0.9 - 1.4)	1.6 (1.4 - 1.9)	1.6 (1.4 - 1.9)	-0.21 (0.9)
The border of Fars gulf region							
Male	1.1 (0.5 - 1.6)	2.4 (1.7 - 3.2)	1.5 (0.9 - 2.1)	2.1 (1.4 - 2.8)	3.5 (2.6 - 4.4)	5.2 (4.1 - 6.2)	-0.25 (0.8)
Female	0.3 (0.1 - 0.6)	1.1 (0.6 - 1.6)	0.6 (0.2 - 1.0)	0.8 (0.4 - 1.2)	0.8 (0.4 - 1.2)	1.5 (0.9 - 2.1)	-0.01 (0.7)
Total	0.7 (0.4 - 1.0)	1.8 (1.3 - 2.2)	1.1 (0.7 - 1.4)	1.5 (1.1 - 1.9)	2.2 (1.7 - 2.7)	3.4 (2.8 - 4.0)	-0.44 (0.8)
Iran							
Male	0.8 (0.7 - 0.9)	0.9 (0.8 - 1.1)	1.8 (0.17 - 2.0)	2.9 (2.7 - 3.1)	3.6 (3.4 - 3.8)	4.0 (3.8 - 4.2)	0.89 (0.6)
Female	0.3 (0.2 - 0.3)	0.4 (0.3 - 0.4)	0.6 (0.5 - 0.7)	0.9 (0.8 - 1.0)	1.0 (0.9 - 1.2)	1.5 (1.3 - 1.6)	0.32 (0.9)
Total	0.5 (0.5 - 0.6)	0.7 (0.6 - 0.7)	1.2 (1.1 - 1.3)	1.9 (1.8 - 2.0)	2.3 (2.2 - 2.5)	2.8 (2.6 -2.9)	0.07 (0.7)

100,000 in 2000 to 0.8 in 2005. The rate for men was higher than that for women; among men, the rate continued to increase until 2004 and reached its highest level in 2005.

4.6. Persian Gulf Border Region

This area had the highest rate, which was higher than the country's average. The lung cancer trend in this area generally increased during the first two years and suddenly dropped; beginning in 2002, it increased and reached its highest level in 2005. The rate for men increased from 1.1 cases per 100,000 in 2000 to 5.2 in 2005. Among women, the rate increased from 0.3 cases per 100,000 in 2000 to 1.5 in 2005. Like the other areas, the rate was higher for men than women. For men, the rate increased with high slopes and reached its highest level in 2005. The rate for women fluctuated: During the first two years, it increased, and in 2002, it suddenly decreased before reaching its highest level in 2005.

5. Discussion

Despite the increasing variation rates in all geographic areas of the country, the slope of the variations were different: The highest increase occurred in the flat region,

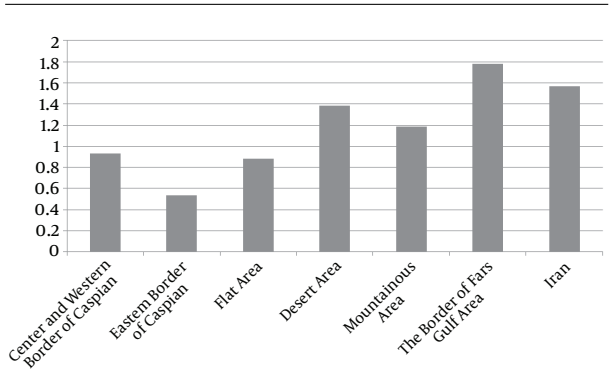

Figure 1. Average of Age-Standardized Rate of Lung Cancer in Six Geographical Areas in Iran, 2000 - 2005

and the lowest increase occurred in the central and western border regions of the Caspian sea. In general, however, the flat areas had the highest risk, and the western Caspian sea region had the lowest risk. The rate of cancer was high for men in all areas. Moreover, the incidence rate corresponded with age: In individuals aged 60 - 69 years, the rate reached the highest level and then decreased. Variations in rates among the younger age groups were low, while they were was high among the older age groups. Variations in cigarette smoking should be considered in terms of the primary risk when interpreting increases in lung cancer rates. In Iran, cigarette smoking is the main risk factor for lung cancer (21). Based on the statistics, the smoking prevalence in Iranian society is increasing. For instance, during 1994 - 2000, the rate among men increased from 2.6% to 2.9%, and among women, from 4.1% to 4.5%, especially among the younger groups (25, 26). Therefore, it can be concluded that the increase of lung cancer is consistent with the increase of smoking in Iran. Studies conducted in Iran have reported different estimations of smoking prevalence. According to a ministry of health and medical education report, in 1990, only 10.7% of individuals aged 15 - 24 years smoked, while in 2000, 17.1% of that population smoked (27). According to statistical reports by the deputy of health, 15% of the Iranian population of 11 million smoke, and 75,000 die each year as the result of smoking (28). According to surveys conducted by the Tehran lipid and glucose institution, the rate of smoking in Iran is 10.6%, with 22% for men and 1.2% for women (29). To determine the cause of the high lung cancer rate in the Persian gulf region, for example, the patterns of smoking among the area's men and women should be considered. For instance, in Shiraz, the rate of smoking among men and women is 26% and 3.6%, respectively (20), and in Bandar Abbas, the smoking rate is 11.7%, with 22.7% and 0.9% for men and women, respectively (30). Therefore, it could be argued that due to free commercial markets with Persian gulf regional countries and ease of access, the rate of smoking is higher than that of other areas of the country. In 2005, Bushehr and Sistan Baluchistan had the highest rates, with 30.6 and 25.5%, respectively; Ilam and Yazd had the lowest rates, with 10% and 10.8%, respectively (31). These percentages are consistent with the present research study in explaining the high rate of lung cancer in the Persian gulf border and desert areas.

On the other hand, nutrition patterns are involved in the increases of all cancers, especially lung cancer. In Iran, consistent with global trends, nutrition is shifting from vegetables, fruits, and low-calorie foods to high-fat and high-calorie foods. Studies have also revealed increases in risk factors for cancer in Iran (32). Other studies conducted in Iran also suggest that, with respect to nutrition, families are substituting undesirable and low-value foods for more nutritious, high-value foods (33). One of the factors involved in the consumption of low-value foods in Iranian society is the economic condition. High-income households experiencing appropriate economic conditions have more choices in terms of healthful foods (34).

According to previous research studies in Iran, food-insecure individuals have lower incomes (35, 36). Another factor in Iran is related to inadequate knowledge and awareness in terms of how to make appropriate food choices for the household. For instance, during the years 2005 - 2007, a study was conducted on 2,500 citizens of Tehran to investigate the dimensions of lifestyle in terms of cancer prevention. The study revealed that, with respect to nutrition habits, 61.3% of the respondents had relatively desirable incomes, and yet none had nutritious diets. The researchers therefore emphasized the importance of nutrition education in cancer prevention (37).

Air pollution from factories, machines, and dust-storm particles is another factor in the prevalence of lung cancer. The development of urbanization, the expansion of cities, accelerating population increases, the growth of industrial activities, and an inordinate consumption of fuels have led to significant amounts of pollution, leading to respiratory and cardiovascular diseases among urban populations, as well as intensifying climate changes, climate fluctuations, and ecological impacts (38). Pollution levels vary among the different areas of Iran and, consequently, cause different rates of lung cancer. For instance, in a study by Jonaidi-Jafari and colleagues, the level of suspended particles in Tehran was calculated at about 34.11 g/m^3 in 2005, leading to 5,388 deaths in the city and encompassing 39.9% of all cardiovascular deaths (39). Another study in Isfahan estimated the level of pollutants from motor vehicles at about 1586921.6 Kg per day in 2010 (40), accounting for increases in the lung cancer rate in such areas and Iran. In

addition to air pollution from industries, the air pollution resulting from dust storms could also be considered. The frequency of dust storms in dry and semi-dry regions is significantly higher, which affects the lives of people who reside in these areas (41, 42). Iran is a large country with many provinces in desert areas. In the present study, the highest rate of lung cancer was seen in the Persian gulf border and desert areas, and the lowest rate was seen in the northern areas, which could be due to climate patterns and dust storms. In recent years, a number of studies have been conducted on the issue, including a study on dust storms and wind erosion in Khuzestan, which suggested that the currents related to storms in Arabia and Iraq comprise the main cause of dust storms in this province and that wind erosion constitutes the country's main domestic factor (42) in terms of lung cancer. In another study, the patterns of dust-producing winds in Fars were analyzed during the years 1993 - 2002. The findings revealed that at sea level, the existence of low-pressure fronts on Arabia and Iraq as a result of the lack of moisture and strong winds and, at 500 hp, the position in front with an east-west arrangement as a result of variation of dry air, causes the transfer of dust particles to Iran; the position in front of the high pressure front leads to the presence of dust particles in the atmosphere (43). Another study on the occurrence of dust storms in the western areas of Iran during 2005 - 2009 revealed that a low-pressure system in the Middle East and the progression of transient conditions at desert levels, in addition to the effects of a low-pressure dynamic wave in the atmosphere, provide conditions conducive to the transfer of dust particles (44).

Moreover, in 2008, a statistical analysis of dust storms in Khorasan-e-Razavi during 1993 - 2005 revealed that dust storms are common in this province and increase as they move from north to south; additionally, most of them occur after 12:00 (45). In light of the above studies, the distribution of lung cancer could be justified. In recent years, the levels of dust particles in the western, southwestern, and southern provinces have increased; at times, they have reached the central parts of the country, which may lead to many more cases of lung cancer if stakeholders do not address the issue in the near future. While discussing the increase of lung cancer in Iran, it is worth noting that the level of public awareness about cancers, as well as their symptoms and effects, have increased in recent years; for example, Montazeri et al. investigated cancer patients and found that 95% of the study respondents were eager to know more about cancer (46). Moreover, the health system in Iran has been developing significantly, and diagnostic and care services are improving (47), which, as the result of a greater number of diagnoses, could account for the increasing rate of lung cancer in Iran. The phenomenon of an aging population could be another factor, since, according to a study on the indicators of the health perspective in Iran, the country's mean lifespan is increasing (47). Increasing lifespans in many developed countries have caused a shift in focus to older adults (48).

The speed at which demographic variations occur in developing countries is more phenomenal (49). According to some studies, life expectancy in Iran in 1986 was 66 and 69 for men and women, respectively (50), while in 1996 this index was 70.7 and 73.4 for men and women, respectively, indicating a 4.5% increase (51). According to WHO, in 2005, 6.4% of the Iranian population were over age 60, and it is predicted that 25.6% of both men and women will reach this age group in 2050; if other variables are kept constant, the per capita should be 2.5-fold until 2050 (52). Although an increased life expectancy is good news, it is usually associated with a reduction in physical and physiologic ability, as well as an increased risk for chronic mental and physical diseases.

The most important factor in interpreting the results of the study and in explaining the increasing lung cancer rate in Iran is consideration of the quality of the Iranian cancer records system. The Iranian national cancer records system, established in 1984 under the supervision of the medical university of Tehran, published the recorded data from 1999 (53). Recently, this system has shown increasing rates (53). According to the Ministry of Health, the level of records has increased from 18% in 1999 to 80% in 2005 (54), which may indicate the high level of cancers, and especially lung cancer, in Iran. Therefore, it is necessary to pay attention to the evolving trend of the cancer records system as had been mentioned in other cancer studies in Iran (55-60). Though how much of the increase and what geographic areas are related to this issue should be investigated in future studies which normally is common in many countries by and large.

References

1. Bahader Y, Jazieh AR. Epidemiology of lung cancer. *Ann Thorac Med.* 2008;**3**:65.
2. American Cancer Society . Cancer Facts and Figures 2011. USA: Atlanta American Cancer Society; 2011.
3. Iyen-Omofoman B, Hubbard RB, Smith CJ, Sparks E, Bradley E, Bourke A, et al. The distribution of lung cancer across sectors of society in the United Kingdom: a study using national primary care data. *BMC Public Health.* 2011;**11**:857. doi: 10.1186/1471-2458-11-857. [PubMed: 22074413].
4. Dubey S, Powell CA. Update in lung cancer 2006. *Am J Respir Crit Care Med.* 2007;**175**(9):868–74. doi: 10.1164/rccm.200702-190UP. [PubMed: 17446343].
5. Shaipanich T, McWilliams A, Lam S. Early detection and chemoprevention of lung cancer. *Respirology.* 2006;**11**(4):366–72. doi: 10.1111/j.1440-1843.2006.00860.x. [PubMed: 16771906].
6. World Health Organization . Injuries violence and disabilities biennial report 2004-2005. Switzerland: WHO; 2006.

7. U.S. National Institutes of Health . SEER Cancer Statistics Review 1973-2006. US: National Cancer Institute; 2006.
8. Free CM, Ellis M, Beggs L, Beggs D, Morgan SA, Baldwin DR. Lung cancer outcomes at a UK cancer unit between 1998-2001. *Lung Cancer.* 2007;**57**(2):222–8. doi: 10.1016/j.lungcan.2007.03.006. [PubMed: 17442450].
9. Ferlay J, Bray F, Pisani P, Parkin DM. Cancer Incidence, Mortality and Prevalence Worldwide. Lyon, France: IARC Press; 2004.
10. Ferlay J, Shin HR, Bray F, Forman D, Mathers C, Parkin DM. Estimates of worldwide burden of cancer in 2008: GLOBOCAN 2008. *Int J Cancer.* 2010;**127**(12):2893–917. doi: 10.1002/ijc.25516. [PubMed: 21351269].
11. Mosavi-Jarrahi A, Mohagheghi M, Yazdizadeh B, Kolahi AA, Tahmasebi S, Sharifi S. Analysis of smoking behaviour among Iranian population: a cohort and period analysis. *Asian Pac J Cancer Prev.* 2004;**5**(1):66–9. [PubMed: 15075008].
12. Mohagheghi MA, Mosavi-Jarrahi A, Malekzadeh R, Parkin M. Cancer incidence in Tehran metropolis: the first report from the Tehran Population-based Cancer Registry, 1998-2001. *Arch Iran Med.* 2009;**12**(1):15–23. [PubMed: 19111024].
13. Bray F, Sankila R, Ferlay J, Parkin DM. Estimates of cancer incidence and mortality in Europe in 1995. *Eur J Cancer.* 2002;**38**(1):99–166. [PubMed: 11750846].
14. Pisani P, Bray F, Parkin DM. Estimates of the world-wide prevalence of cancer for 25 sites in the adult population. *Int J Cancer.* 2002;**97**(1):72–81. [PubMed: 11774246].
15. Lam WK. Lung cancer in Asian women-the environment and genes. *Respirology.* 2005;**10**(4):408–17. doi: 10.1111/j.1440-1843.2005.00723.x. [PubMed: 16135162].
16. Jee SH, Kim IS, Suh I, Shin D, Appel LJ. Projected mortality from lung cancer in South Korea, 1980-2004. *Int J Epidemiol.* 1998;**27**(3):365–9. [PubMed: 9698121].
17. Yang L, Parkin DM, Li LD, Chen YD, Bray F. Estimation and projection of the national profile of cancer mortality in China: 1991-2005. *Br J Cancer.* 2004;**90**(11):2157–66. doi: 10.1038/sj.bjc.6601813. [PubMed: 15150609].
18. Mackay J, Jemal A, Lee NC, Parkin DM. The Cancer Atlas. Atlanta: American Cancer Society; 2006.
19. Grohalm B. Leave the pack blind, some facts on global tobacco use. Geneva: WHO; 1999. pp. 10–1.
20. Ahmadi J, Khalili H, Jooybar R, Namazi N, Mohammadagaei P. Prevalence of cigarette smoking in Iran. *Psychol Rep.* 2001;**89**(2):339–41. doi: 10.2466/pr0.2001.89.2.339. [PubMed: 11783559].
21. Hosseini M, Naghan PA, Karimi S, SeyedAlinaghi S, Bahadori M, Khodadad K, et al. Environmental risk factors for lung cancer in Iran: a case-control study. *Int J Epidemiol.* 2009;**38**(4):989–96. doi: 10.1093/ije/dyp218. [PubMed: 19589809].
22. Hung RJ, Boffetta P, Brockmoller J, Butkiewicz D, Cascorbi I, Clapper ML, et al. CYP1A1 and GSTM1 genetic polymorphisms and lung cancer risk in Caucasian non-smokers: a pooled analysis. *Carcinogenesis.* 2003;**24**(5):875–82. [PubMed: 12771031].
23. Li X, Hemminki K. Inherited predisposition to early onset lung cancer according to histological type. *Int J Cancer.* 2004;**112**(3):451–7. doi: 10.1002/ijc.20436. [PubMed: 15382071].
24. Matakidou A, Eisen T, Houlston RS. Systematic review of the relationship between family history and lung cancer risk. *Br J Cancer.* 2005;**93**(7):825–33. doi: 10.1038/sj.bjc.6602769. [PubMed: 16160696].
25. Department of Tobacco Control . Annual report on tobacco smoking. Isfahan: Isfahan Cardiovascular Research Center; 2001.
26. Boshtam M, Rafiei M, Asgary S, Khalili A. Smoking prevalence and its combination with some cardiovascular risk factors. *Acta Medica Iranica.* 2000;**38**(2):115–20.
27. Majidpour A, Hamidzadeh Arbabi Y, Gholizadeh A, Nategh Salehi E. prevalence and causes of the Cigarette smoking in students of medical university of Ardabil [In Persian]. *J med univ Ardabil.* 2005;**5**(3):266–70.
28. Emamghoreishi M, Bokaee HR, Keshavarz M. CYP2A6 genetic polymorphism and its relation to risk of smoking dependence in male Iranians. *Physio and Pharma.* 2009;**12**(4):296–306.
29. Azizi F, Rahmani M, Emami H, Mirmiran P, Hajipour R, Madjid M, et al. Cardiovascular risk factors in an Iranian urban population: Tehran lipid and glucose study (phase 1). *Soz Praventivmed.* 2002;**47**(6):408–26. [PubMed: 12643001].
30. Aghamolaei T, Zare S. Pattern of cigarette and hookah smoking in the population above 15 years of Bandar Abbas, a population-based study [in Persian]. *Hormozgan Med J.* 2007;**11**(2):241–5.
31. Delavari AR, Alikhani S, Aladdini F. Report on the status of risk factors for non-communicable diseases in Iran [in Persian]. Tehran: Disease Management Center, Ministry of Health, Treatment and Medical Education, Sadra Pub; 2005. pp. 30–5.
32. Johnson JR, Delavari P, O'Bryan TT, Smith KE, Tatini S. Contamination of retail foods, particularly turkey, from community markets (Minnesota, 1999-2000) with antimicrobial-resistant and extraintestinal pathogenic Escherichia coli [in Persian]. *Foodborne Pathog Dis.* 2005;**2**(1):38–49. doi: 10.1089/fpd.2005.2.38. [PubMed: 15992297].
33. Farivar F, Heshmat R, Azemati B. Understanding Knowledge, Attitude and Practice of urban families about nutrition principles [in Persian]. *Iran J Epidemiol.* 2009;**5**(2):11–8.
34. Rose D, Gundersen C, Oliveira V. Socio-economic determinants of food insecurity in the United States: Evidence from the SIPP and CSFII datasets. US: US Department of Agriculture,; 1998.
35. Dastgiri S, Mahboub SA, Totonchi H, Ostadrahimi AR. Influencing factors on food insecurity: A Cross Sectional Study in Tabriz Years 2004-2005 [in Persian]. *J Ardabil Univ Med Sci.* 2006;**3**:233–9.
36. Ghassemi H, Kimiagar M, Koupahi M. Food and nutrition security in Tehran province [in Persian]. *National Nutrition and Food Tech Res Ins.* 1996.
37. Parsa Y, Zoualfaghari M, Kazemnejad A, Monjamed Z. Assessing food habits for cancer prevention among tehran citizens [in Persian]. *Nurs Res J.* 2010;**5**(18):27.
38. Ren W, Tian H, Chen G, Liu M, Zhang C, Chappelka AH, et al. Influence of ozone pollution and climate variability on net primary productivity and carbon storage in China's grassland ecosystems from 1961 to 2000. *Environ Pollut.* 2007;**149**(3):327–35. doi: 10.1016/j.envpol.2007.05.029. [PubMed: 17618716].
39. Joneidi jafari A, Zohor A. Estimation of hearty and respiration dead by air pollution of Tehran city based on particulate matter [in Persian]. *Teb and tazkie journal.* 2010;**17**(74-75):37–47.
40. Zarabi A, Mohamadi J, Abdolahi AA. Investigation and assessment of stable and mobile resources at the air pollution of Esfahan city [in Persian]. *Geographic j.* 2010;**8**(26).
41. Xiao J, Chang C. Dust storm and its causes in northern China. 1. China: IEEE; 2008.
42. Tahmasbi Byrgany A, Abdinejad GH, Nushafarin V. Investigate dust storms and wind erosion in Khuzestan province and its solutions [in Persian]. *Forest and rangeland Quarterly.* 2008;**81**:21–5.
43. Dehdarzadeh M, Salahi B. statistical analysis of synoptic patterns of dust-producing in Fars province during (1993-2000) Proceedings of the Second National Conference of wind erosion and dust storms [In Persian]. ; 2010.
44. Zolfaghari H . Survey synoptic storms of dust in western Iran during 2005-2009 (Case study: wave pervasive July 2009) [in Persian]. *J geograph and environ plan.* 2009;**3**(43):17–34.
45. Lashgari H, Keikhosravi GH. Synoptic analysis of dust storms in Khorasan Razavi province (1993 to 2005) [in Persian]. *Natural Geographical Research.* 2005;**65**:17–33.
46. Montazeri A, Vahdani M, Haji-Mahmoodi M, Jarvandi S, Ebrahimi M. Cancer patient education in Iran: a descriptive study. *Support Care Cancer.* 2002;**10**(2):169–73. doi: 10.1007/s00520-001-0315-2. [PubMed: 11862507].
47. Khosravi A, Najafi F, Rahbar M. The indicators of heath feature in Iran [in Persian]. Tehran: Ministry of Health; 2010.

48. Wu ZH, Rudkin L. Social contact, socioeconomic status, and the health status of older Malaysians. *Gerontologist.* 2000;**40**(2):228–34. [PubMed: 10820926].
49. Hafez G, Bagchi K, Mahaini R. Caring for the elderly: a report on the status of care for the elderly in the Eastern Mediterranean Region. *East Mediterr Health J.* 2000;**6**(4):636–43. [PubMed: 11794069].
50. Malek Afzali H, Pile-Rudy S, Rezai P. Life expectancy for men and women in rural Iran. *Drugs and treatment.* [in Persian]. 1987;**3**(33):58–62.
51. Malek Afzali H. Life expectancy for men and women in 1997. *Hakim Res J.* 1997;**1**(2):107–10.
52. Abbasimoghadam MA, Dabiran S, Safdari R, Djafarian K. Quality of life and its relation to sociodemographic factors among elderly people living in Tehran. *Geriatr Gerontol Int.* 2009;**9**(3):270–5. doi: 10.1111/j.1447-0594.2009.00532.x. [PubMed: 19702937].
53. Etemadi A, Sadjadi A, Semnani S, Nouraie SM, Khademi H, Bahadori M. Cancer registry in Iran: a brief overview. *Arch Iran Med.* 2008;**11**(5):577–80. [PubMed: 18759534].
54. Center for Disease Control and Prevention NDCO . Iranian Annual National Cancer Registration Report 2005 -2006 [In Persian]. Tehran: Ministry of Health and Medical Education; 2007.
55. Abdifard E, Ghaderi S, Hosseini S, Heidari M. Incidence trends of colorectal cancer in the West of Iran during 2000-2005. *Asian Pac J Cancer Prev.* 2013;**14**(3):1807–11. [PubMed: 23679278].
56. Haidari M, Nikbakht MR, Pasdar Y, Najafi F. Trend analysis of gastric cancer incidence in Iran and its six geographical areas during 2000-2005. *Asian Pac J Cancer Prev.* ;**13**(7):3335–3341. doi: 10.7314/APJCP.2012.13.7.3335.
57. Rahimi F, Heidari M. Time trend analysis of stomach cancer incidence in the west of Iran. *J of Health and Development.* [in Persian]. 2012;**1**(2):100–11.
58. Heidari M, Najafi F. Trends of skin cancer incidence in 6 geographical regions of the Islamic Republic of Iran, 2000-2005. *Eastern Mediterranean Health Journal.* 2013 Jan 1;**19**(1):59–65.
59. Abdifard E, Amini S, Bab S, Masroor N, Khachian A, Heidari M. Incidence trends of colorectal cancer in Iran during 2000-2009: A population-based study. *Med J Islam Repub Iran.* 2016 Jan 15;**30**(1):580–6.
60. Jafari M, Moradi Y, Khodadost M, Sekhavati E, Anabad HA, Mansori K, Moradpour F, Rajabi A. Trend of the esophageal cancer incidence in Iran. *Int J Travel Med Glob Health.* 2015;**3**(2):127–31. doi: 10.20286/ijtmgh-0303131.