Middle East Special Report
Middle East Journal of Cancer; October 2017; 8(4): 223-228

Epidemiology of Lung Cancer in Iran: Sex Difference and Geographical Distribution

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Abstract

Background: Lung cancer is one of the most common cancers and most frequent cause of cancer-related death worldwide. In Iran, this cancer ranks second in cancer-related deaths for men and third for women. The aim of this study is to discover the geographic distribution of the age-standardized incidence rate for lung cancer in both genders in Iran.

Methods: This ecological study used re-analysis medical records aggregated to provinces from the National Registry of Cancer and Disease Control and Prevention Report of the Ministry of Health and Medical Education for lung cancer in 2008. For each province, we calculated the average annual age-standardized incidence rate.

Results: Our study showed that squamous cell carcinoma and adenocarcinoma were the most common histological types of lung cancer in males (28.6%) and females (28.8%). The central and southern Iranian provinces had the highest age-standardized incidence rates for lung cancer. The highest age-standardized incidence rates in both genders related to the 80-84 year age group for both males (131.51) and females (38.82).

Conclusion: The central and southern Iranian provinces are lung cancer hot zones. Thus, implementation of prevention programs and increased access to screening services should be considered.

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Keywords: Lung cancer, Epidemiology, Incidence rate

Received: January 29, 2017; Accepted: May 9, 2017

Introduction

Lung cancer (LC) is the leading cause of cancer-related deaths worldwide.[1] Globally, LC is the most common cancer in men and the fourth most frequent cancer in women.[2] Lung cancer has caused an estimated 160,000 deaths in the United States in 2012, which potentially accounted for 28% of all cancer deaths in this country.[3] Additionally, LC is the most common cause of cancer deaths, with 1.38 million deaths in 2008.[2]

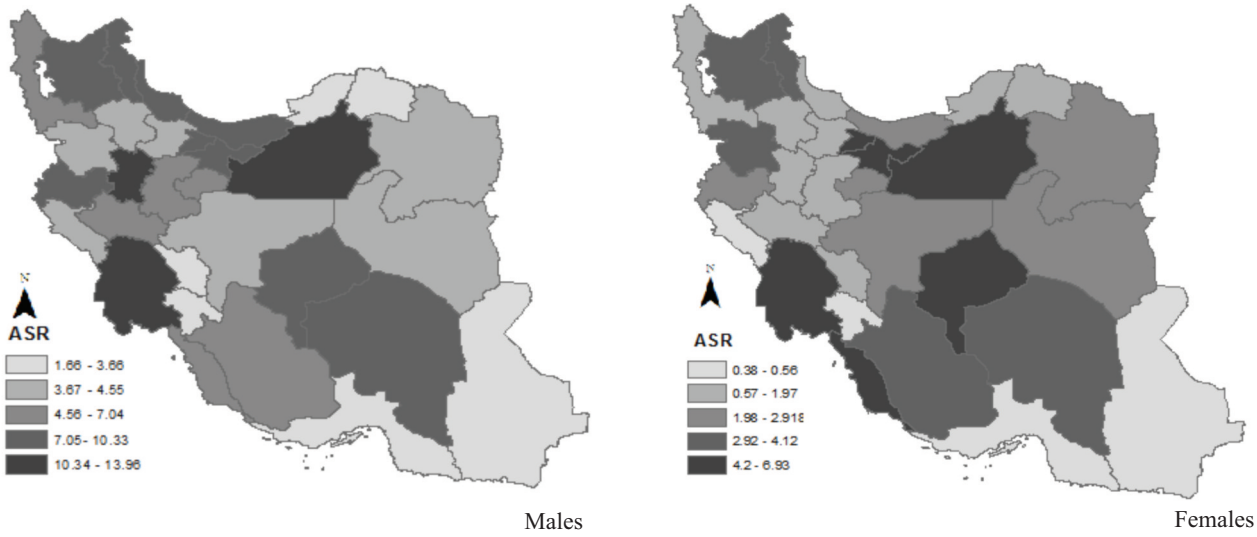
In Iran, LC rank among cancers is 7 in men and beyond 10 in women.[4] However its rank for cancer-related deaths in Iran for males is 2, and for females the rate is 3.[4] Few studies that have been conducted in some parts of Iran report a lower survival in Iranian LC patients compared to other countries, which indicates insufficiency in screening or treatment.[3,5]

The most important risk factor for LC is smoking. Smokers have a 15- to 30-fold increased risk of developing LC compared with nonsmokers.[6] Smoking accounts for 80% of the worldwide LC burden in men and at least 50% of the burden in women.[6] Exposure to indoor radon; air pollution; lung diseases such as tuberculosis; radiation exposure; indoor pollution; and exposures to carcinogens such as asbestos, silica, and arsenic are associated with an increased risk of developing LC.[7-9]

The American Cancer Society (ACS) considered elimination of disparities in the burden of cancer is one of the element of eliminating health disparities goal in nations.[10] Iran has several geographic, climatic, ethnic, racial, and cultural classifications that cause exposure to different risk factors in each part of the country. According to the multifactorial causes of LC, disparity for the incidence of LC in different provinces should be reviewed. Limited studies associated with LC have been conducted at the large areas in Iran.[11,12] Investigations of the geographical and epidemiological characteristics of LC are the first essential steps in achieving a clear and accurate picture of cancer in Iran. Therefore, the present study attempts to discover the geographic distribution for the age-standardized incidence rate (ASR) of LC in both genders in Iran.

Materials and Methods

This ecological study has used re-analysis medical records aggregated to provinces from the National Registry of Cancer (NCR) and Disease Control and Prevention Report of the Ministry of Health and Medical Education for LC in 2008. Data collection by the Iranian Cancer Registry is active, pathology-based, and covers the entire country's pathology laboratories. Hospital-based and death certificate–based data have not been included. We cleaned data from the province after deleting for repeated cases transmitted to the



Males Females

Figure 1. The geographic distribution for age-standardized incidence rate (ASR) of lung cancer in Iran by gender.

Table 1. Incidence of common morphologies of lung cancer (LC) in Iran by gender in 2008.

	Adenocarcinoma NOS N (%)	Malignant neoplasm N (%)	Squamous cell carcinoma NOS N (%)	Carcinoma NOS N (%)	Small cell carcinoma NOS N (%)	Non-small cell carcinoma N (%)
Males	402 (18.4%)	328 (15%)	627 (28.6%)	131 (6%)	255 (11.6%)	107 (4.9%)
Females	239 (28.8%)	149 (18%)	134 (16.1%)	58 (7%)	51 (6.1%)	42 (5.1%)

NOS: not otherwise specified

Ministry of Health every 3 months. We classified the registered data into three parts: 1) patient identification characteristics that included age, gender, race, and residence; 2) patient's clinical history; and 3) preclinical findings. Data on primary location of tumor, date of cancer diagnosis, morphology, histology, and diagnosis method was registered.

Statistical analysis

For each province, we calculated the average annual ASR per 100,000 person-years by the direct method according to the World Standard Population.[13] The data were presented using MS Excel 2010 and GIS version 10.3.

Results

Figure 1 shows the geographic ASR distribution for LC in Iran according to gender. The central and southern Iranian provinces had the highest ASR for LC. These areas were hot zones for LC in Iran. Table 1 shows the morphological subtype of LC by gender in 2008. Squamous cell carcinoma and adenocarcinoma comprised the most common histological types of LC in males (28.6%) and females (28.8%).

Figure 2 shows the LC incidence by age group and gender in 2008. The population pyramid in Iran indicated that the highest ASR for both genders was related to individuals 80-84 years of age, with 131.51 per 100,000 for males and 38.82 per 100,000 for females. Statistics for LC according to gender and province are shown in Table 2. Males had the highest ASR in Hamadan, Semnan, Khuzestan, Kurdistan, Tehran, Ardebil, and East Azarbayejan Provinces, whereas females had the highest ASR in Semnan, Chaharmahal and Bakhtiari, Khuzestan, Tehran, and Ardebil Provinces. In males, LC ranked less than 10 in all provinces except for Chaharmahal and Bakhtiari, and North Khorasan. However, for women, LC ranked less than 10 in Semnan, Kurdistan, Yazd, Khuzestan, Qom, Ardebil, Kerman, and South Khorasan Provinces.

Discussion

Our study showed that the central and southern Iranian provinces had the highest ASR for LC. Several studies have reported the differences in incidence rates among various geographical regions.[14] The Iranian population consists of various ethnic groups, hence this disparity may affect the risk factors associated with the incidence of LC. Smoking has a high prevalence in the central and southern regions of Iran. Smoking is a major risk factor for LC,[15] hence this finding is justified. According to the results, Khuzestan had the highest incidence of LC. This might be attributed to weather conditions, environmental pollutants, particular lifestyles, or the presence of other risk factors in this province. Industrializa-

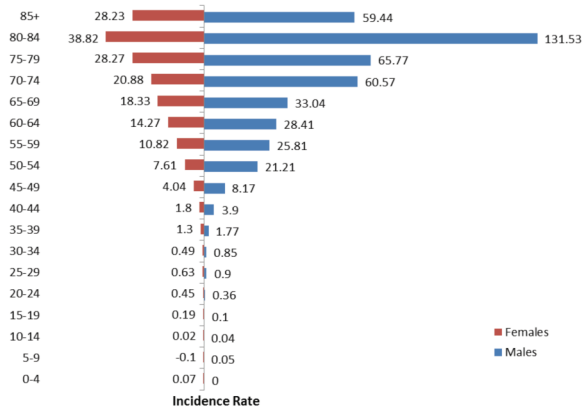


Figure 2. Age standardized incidence rate (ASR) of lung cancer by age group and gender in 2008 for Iran.

Table 2. Statistics of lung cancer (LC) according to gender and province.

Province	Males				Rank	Females				Rank
	Fre	CR	ASR	%		Fre	CR	ASR	%	
East Azarbayejan	136	7.37	9.32	5.33	8	50	2.85	3.81	2.51	>10
Fars	111	5.05	6.64	4.62	7	51	2.45	3.57	2.58	>10
Khorasan Razavi	100	3.40	4.47	2.86	8	54	1.93	2.91	1.94	>10
Isfahan	76	3.22	4.07	2.88	8	36	1.61	2.49	1.64	>10
Gilan	73	5.98	8.19	5.21	8	15	1.30	1.86	1.45	>10
Kermanshah	59	6.15	7.93	5.77	6	19	2.09	2.81	2.32	>10
West Azarbayejan	76	5.20	6.76	6.29	6	18	1.30	1.67	2.06	>10
Semnan	30	9.94	13.23	6.25	6	12	4.19	6.30	3.18	9
Kurdistan	70	9.46	12.37	7.06	4	18	2.56	3.26	2.51	8
Yazd	37	7.30	9.09	5.72	7	20	4.16	6.35	3.47	7
Chaharmahal and Bakhtiari	6	1.37	1.65	1.52	>10	5	1.20	1.64	1.81	>10
Hamadan	92	10.57	13.96	8.61	4	12	1.45	1.97	1.79	>10
Ghazvin	18	3.10	3.38	4.52	9	5	0.91	1.57	1.16	>10
Zanjan	18	3.67	4.55	4.68	7	5	1.07	1.55	2.02	>10
Ilam	8	2.87	4.36	3.77	7	1	0.38	0.42	0.68	>10
Kohkiloyeh and Boyerahamad	9	2.78	3.66	3.49	8	1	0.33	0.56	0.56	>10
Mazandaran	87	5.85	7.31	4.89	8	24	1.70	2.48	1.61	>10
Tehran	534	7.81	10.33	5.10	6	225	3.47	5.10	2.60	>10
Lorestan	46	5.28	7.04	4.75	8	12	1.45	1.72	1.69	>10
Khozestan	222	10.19	12.98	8.32	4	99	4.79	6.93	4.11	6
Markazi	25	3.60	4.97	4.36	7	8	1.21	1.70	2.07	>10
Golestan	19	2.30	2.92	3.06	9	11	1.40	1.90	2.16	>10
Qom	22	4.11	5.09	5.37	7	8	1.58	2.24	2.37	9
Ardebil	43	6.84	9.23	6.29	5	15	2.52	4.10	3.37	8
Kerman	79	5.91	7.92	7.38	4	27	2.13	3.17	3.17	9
North Khorasan	6	1.45	2.09	2.01	>10	4	1.02	1.58	1.61	>10
Bushehr	19	4.13	5.37	6.64	5	5	1.14	1.59	1.82	>10
Hormozgan	17	2.43	3.38	5.65	7	2	0.30	0.54	0.66	>10
Sistan and Balochestan	17	1.38	2.08	4.97	7	4	0.34	0.38	1.29	>10
South Khorasan	9	3.14	4.05	4.64	9	5	1.84	2.21	2.69	8
Total	2211	6.14	8.04	5.23	7	839	2.46	3.55	2.48	>10

Fre: Frequency, CR: Crude Rate, ASR: Age-standardized incidence rate

tion, social, and economic status are considered as risk factors for LC. Northern Spain, with a large industrial area, has a high registered LC incidence and mortality.[16] The current study findings have supported these results. Industrial areas in Iran are mostly concentrated in the central regions. These regions have a high ASR of LC. Industrialization leads to social and economic changes which, in turn, affect lifestyle and may increase susceptibility to cancer. Other studies have suggested that environmental factors (i.e., air pollution) influence LC risk[17] and may be the cause for disease clustering in some geographical regions. Several studies report that environmental pollutants might contribute to LC risk through the damaging effects on DNA, acceleration of tumor growth rate, or increased susceptibility to LC.[18] The current study finding has shown that provinces with high ASR are mainly located in the central regions of Iran. In many aspects, these provinces differ from other provinces. Most industrial factories are located in central provinces. The numbers of vehicles in these provinces are very high and air pollution is considered a primary problem.

The regional differences in LC incidence could be attributed to the differences in early detection and availability of screening tests in various

regions.[19] Another reason could be the centralization of diagnostic and therapeutic interventions in metropolitan areas, so that cases which belong to other regional areas might be referred to these provinces where they would be registered.

The results suggested that different forms of LC were higher in males compared to females. On the other hand, with aging, the incidence of this cancer increased in both sexes where it reached a peak between the ages of 80 to 84 years. Numerous studies have reported a higher incidence of LC among men in other parts of the world.[20] Smoking, as one of the main risk factors for LC, is more in men than women.[15] Employed men were more likely than women to be exposed to risk factors such as air pollution and chemical carcinogens such as asbestos, silica, and arsenic, radiation, indoor pollution, and lung diseases such as tuberculosis. Aging increases cancer risk because cancer occurs during old age. Its causal factors in the long-term exposures show their effects.[21] The probability of damage to DNA will increase with aging. DNA damage has emerged as a major culprit in cancer and numerous diseases related to aging. The molecular basis of this phenomenon is unclear. In cancer, DNA alterations are the major culprit.[22]

Our study had some limitations. The results of this study might not be generalizable to other countries and regions of the world. In addition, we have not addressed specific risk factors for LC. Therefore we recommend that additional studies be conducted in other geographic regions of the world to determine possible risk factors in those regions.

This study determined the hot zones of LC in Iran and could be considered a guideline for policy makers for allocation of diagnostic and therapeutic interventions. The findings demonstrate that the central and southern provinces need more attention. Increased access to screening for early detection is beneficial and cost-effective, particularity in high incidence regions.

Acknowledgement

The authors would like to thank the National Cancer Department staff at the Ministry of Health and Medical Education for providing and administrating data for research in cancer epidemiology in Iran.

Conflict of interest

No conflict of interest is declared.

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