

THE INCIDENCE OF LUNG CANCER IN IRAN: A SYSTEMATIC REVIEW AND META-ANALYSIS

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Abstract – Background: Lung cancer (LC) is one of the most common cancers around the world and evaluation of the incidence of this cancer is important for a better planning. In spite of various studies, there is no general estimate of LC incidence in Iran. Therefore, the present study is conducted to evaluate the incidence rates of LC in Iran.

Methods: A systematic search was conducted on all published studies of lung cancer incidence using Medline/PubMed, Scopus, Web of Sciences, Google Scholar, and four Iranian databases (Scientific Information Database, MagIran, IranMedex, and IranDoc) until July 2017. This systematic review was done according to the preferred reporting items for systematic reviews and meta-analyses (PRISMA).

Results: A total of 14 studies were included. Age-standardized rates (ASRs) of lung cancer were 6.33, 95% CI (5.24 to 7.42) for males and 2.57, 95 % CI (2.07-3.07) for females based on the random effect model.

Conclusions: Compared to other geographical locations, the incidence of lung cancer appears a little lower in Iran. However, organized system for collecting data of cancer is required to specify the incidence and trend of lung cancer in Iran.

KEYWORDS: Lung cancer, Iran, Meta-analysis, Systematic review, Incidence.

INTRODUCTION

Lung cancer (LC) is still the most common cancer worldwide in terms of the number of new diagnosed cases (1.8 million cases, 12.9% of all cases) and mortality rate (1.6 million deaths, 19.4% of all cases)^{1,2}. The incidence and mortality rate of LC vary greatly across different geographical locations and countries around the world^{3,4}. Most LC deaths occur in less developed countries⁵.

It is necessary to access accurate data of the incidence and outcomes for researching, planning and evaluating programs of cancers⁶. The reports have confirmed the incidence of LC is increased in the first half of the twentieth century. In the late

twentieth century, LC has been one of the world's leading causes of preventable death⁷.

According to available statistics, the incidence of LC has been increasing steadily in Iranian men and women⁸. In 2012, 4361 deaths from LC were recorded in Iran, accounting for 9.80% and 6.07% of the total deaths associated with ten most common cancers among Iranian men and women, respectively⁹.

The incidence rate of LC among Iranian males is low compare to developed countries. The prevalence of smoking among Iranian men over the age of 15 is relatively high; however, the low incidence of LC might be the result of under reporting of LC or prevalence of other cancers cause¹⁰. World Cancer Research Journal

In this regard, estimating the incidence of cancer is important to provide information on the risk of the disease. In spite of various studies, there is no general estimate of LC incidence in Iran. Therefore, the present study is conducted to evaluate the incidence rates of LC in Iran.

METHODS

These systematic review and meta-analysis were designed in 2017 and undertaken in accordance with the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guideline¹¹.

Search strategy of systematic reviews

A literature search of published studies was conducted using international databases: Medline/ PubMed, Scopus, Web of Sciences, Google Scholar for English papers. Also, Iranian databases were used such as Scientific Information Database (www.sid.ir), MagIran (www.magiran.com), Iran-Medex (www.iranmedex.com), and Irandoc (www. irandoc.ac.ir), for Persian papers.

The medical subject headings (MeSH) keywords included "lung cancer", "lung neoplasms", "lung tumor", "cancer of lung", "neoplasms of lung", "incidence", and "Iran". The obtained papers were imported into an EndNote X5 (Thomson Reuters, Carlsbad, CA, USA) library and the duplicates were removed. No language and time limitations were considered.

Inclusion and exclusion criteria

All studies with results of age-standardized rate (ASR) of LC and reports of Iranian populations were included in this review. Studies reporting prevalence rate based on pathological data, studies with inadequate sample size, and research articles (all type of conference abstracts, poster papers, letters, comments, and editorial) were not considered in this review.

Statistical Analysis

STATA version 12.0 software (Stata Corp LP, College Station, TX, USA) was used to perform all analyses. Statistical heterogeneity between the results of obtained studies was assessed using Cochran's Q statistic (with a significance level of $p \le 0.1$) combined with I² statistic (with a significance level of >50%). The meta-analysis was conducted with a random effect model (with inverse

variance method) in the studies with significant heterogeneity ($p \le 0.1$ and $I^2 \ge 50\%$). Additionally, in the absence of heterogeneity (p > 0.1 and $I^2 < 50\%$), fixed effect model was used.

RESULTS

Description of literature search

After primary search, a total of 124 potentially relevant studies were considered. Three duplicates were removed and 81 irrelevant studies were revealed by reviewing titles and abstracts. Some other studies were excluded from the review due to incorrect study population (n=17) and inadequate data (n=8). Overall, the review included 14 unique studies. Study retrieval and selection process of the literature search according to the PRISMA flowchart for this systematic review has been outlined in Figure 1.

Description of the included studies

The included studies were published from 2003 to 2016. Based on geographical locations, four studies were conducted in all states of Iran¹²⁻¹⁵, three in Fars Province¹⁶⁻¹⁸, two in Ardabil Province^{19,20}, one in Golestan Province²¹, one in Kerman Province²², one in Semnan Province²³, one in East Azerbaijan Province²⁴, one in Tehran Province²⁵ and one in Shahroud city²⁶. All the studies have reported ASRs. The main characteristics of the selected studies have been presented in Table 1.

The results of individual studies

The results of the study showed that the sex ASR ratio of male to female was 2.46. The highest ASR was reported from Golestan Province between 2004 and 2008 (15.4 per 100,000) for men²¹, and from Tehran Province between 1998 and 2001 (14.9 per 100000) for women²⁵. The lowest ASR was reported from Fars Province between 2001 and 2008 (1.9 for males and 0.25 for females per 100,000)¹⁸.

The results of meta-analysis

The results of the random effect model demonstrated that the ASR of LC was 6.33, 95% CI (5.24 to 7.42) among males and 2.57 95% CI (2.07-3.07) among females. Additionally, the results of Cochran's test showed the heterogeneity of the studies for males (Q=2092.8, df=22, I²=98.9%, p<0.001) and females (Q=1443.7, df=22, I²=98.5%, p<0.001).

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Fig. 1. Flowchart of the included eligible studies in systematic review.



TABLE 1. Basic characteristics of the stu	idies included in the review.
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Order	Author	Time period	Location	Sample size	ASR (Males)	ASR (Females)
1	Sadjadi et al ¹⁹	1996-1999	Ardabil	Not reported	7.95	3.59
2	Babaei et al ²³	1998-2002 2004-2006	Semnan Ardabil	1732 4300	9.19 10.8	4.57 4.8
3	Sadjadi et al ²²	1996-2000	Kerman	5884	7.1	2.4
4	Mehrabani et al ¹⁶	1990-2005	Fars	2993	2.18	0.82
5	Somi et al ²⁴	2006-2007	East Azerbaijan	4922	9.15	2.70
6	Mohagheghi et al ²⁵	1998-2001	Tehran	15773	14.9	7.0
7	Mousavi et al ¹²	2003-2004 2004-2005 2005-2006	Iran Iran Iran	38469 47216 55855	3.28 4.38 4.73	1.23 1.51 2.08
8	Masoompour et al ¹⁷	1998-2002	Fars	8359	6.3	2.9
9	Almasi et al ¹⁸	2001 2002 2003 2004 2005 2006 2007 2008	Fars Fars Fars Fars Fars Fars Fars Fars	743	1.9 2 1.19 1.64 2.9 6.1 8.9 7.9	1.07 0.7 0.25 0.46 1.5 1.5 4.12 3.7
10	Roshandel et al ²¹	2004-2008	Golestan	9007	15.4	5.9
	Fateh et al ²⁶	2000-2010	Shahroud	2240	2.71	1.92
12	Roshandel et al ¹³	2012	Iran	Not reported	10.3	5
13	Amori et al ¹⁴	2004-2008	Iran	301055	5.12	1.98
14	Enayatrad et al ¹⁵	2004-2009	Iran	74067	6.1	2.6

The forest plots of the random-effect meta-analysis for ASR of LC in Iran have been presented in Figure 2 and 3 for males and females, respectively. All measurements in the forest plot were multiplied by 10⁵ because of the small values of ASRs.

DISCUSSION

Cancer is the third main cause of death in Iran²⁷. According to GLOBOCAN 2012, although LC is one of the major cancers in world, it is not considered as one of the most common cancers among Iranian men and women¹.

To date, a few studies have been conducted on the epidemiology of different cancers in developing countries such as Iran²⁸⁻³⁰. This could be due to the limited tools and structures needed to manage and control this disease. The first study on the cancer incidence in Iran dates back to the 1970s³¹. That study investigated cancer incidence in the Caspian littoral region between 1968-1972³².

The result of the present study showed that the incidence of LC is low among Iranian men (ASR=6.33 per 100,000), while some Asian countries such as Armenia (72.9 per 100,000), Turkey (63.9 per 100,000), and Kazakhstan (59.2 per 100,000) have a high ASR. Moreover, countries such as Yemen (6.4 per 100,000), Bhutan (6.5 per 100,000), and Oman (6.7 per 100,000) have the lowest ASR among their men³³.

According to the results of the study, the incidence of LC in Iranian women (ASR=2.57 per 100,000) is lower compared to Iranian men, while some Asian countries such as South Korea (33.4 per 100,000), Brunei (22 per 100,000), and China (20.4 per 100,000), have high ASR for women. Some other countries like Yemen (1.7 per 100,000), Pakistan (1.7 per 100,000), and Maldives (1.8 per 100,000), have the lowest ASR³³.

Globally, countries in WPRO region (with 32.8 per 100,000) have the highest ASR. However, countries in the AFRO region (with 3.9 per 100,000) have the lowest incidence rate³⁴. In terms of sex ASR ratio, the highest difference between males and females incidence rate is observed in Western Asia with 5.3, while the lowest difference is observed in Northern America with 1.3³⁴. It can be attributed to the difference level of income, environmental factors, and lifestyles of these areas^{35,36}.



Fig. 2. Forest plot of the random-effect meta-analysis for age standardized incidence rate of lung cancer among males in Iran.

Study_name	Year	Location	ES	3 (95% CI)	% Weight
Sadjadi 2003	1996-1999	Ardabil	3.	59 (3.24, 4.10)	4.69
Babaei 2005 (1)	1998-2002	Semnan	★ 4.	57 (4.20, 5.01)	4.71
Babaei 2005 (2)	2004-2006	Ardabil	2.	40 (1.60, 3.60)	4.07
Sadjadi 2007	1996-2000	Kerman	• 0.	32 (0.66, 1.02)	4.83
Mehrabani 2008	1990-2005	Fars	2.	70 (1.90, 3.90)	4.07
Somi 2008	2006-2007	East Azerbaijan	4.	30 (3.60, 6.40)	3.51
Mohagheghi 2009	1998-2001	Tehran	—— 7.	00 (5.50, 8.80)	3.17
Mousavi 2009 (1)	2003	Iran	■ 1.	23 (1.03, 1.47)	4.81
Mousavi 2009 (2)	2004	Iran	1.	51 (1.28, 1.77)	4.80
Mousavi 2009 (3)	2005	Iran	2.	08 (1.81, 2.38)	4.78
Masoompour 2011	1998-2002	Fars	2.	90 (2.58, 3.25)	4.76
Almasi 2012 (1)	2002	Fars	•	70 (0.55, 0.89)	4.83
Almasi 2012 (2)	2003	Fars	•	25 (0.17, 0.37)	4.85
Almasi 2012 (3)	2004	Fars	•	46 (0.34, 0.62)	4.84
Almasi 2012 (4)	2005	Fars	1.	50 (0.90, 2.50)	4.32
Almasi 2012 (5)	2006	Fars	1.	50 (0.90, 2.50)	4.32
Almasi 2012 (6)	2007	Fars	4.	12 (3.74, 4.53)	4.72
Almasi 2012 (7)	2008	Fars	3.	70 (2.60, 5.20)	3.65
Roshandel 2012	2004-2008	Golestan	5.	90 (4.50, 7.70)	3.24
Fateh 2013	2000-2010	Shahroud	■ 1.	€ (1.66, 2.21)	4.79
Roshandel 2014	2012	Iran	5.	00 (3.80, 6.60)	3.51
Amori 2016	2004-2008	Iran	■ 1.	98 (1.72, 2.28)	4.79
Enayatrad 2016	2004-2009	Iran	2.	30 (1.70, 3.90)	3.93
Overall (I-squared = 98	8.5%, p = 0.000)		2.	57 (2.07, 3.07)	100.00
NOTE: Weights are from	m random effects	analysis			

Fig. 3. Forest plot of the random-effect meta-analysis for age standardized incidence rate of lung cancer among females in Iran.

So that, the incidence of LC among women was very close to that of men in these areas³⁷. Based on a study which examined the correlation between the human development index (HDI) and the ASR of LC, there is a significant relationship between life expectancy at birth, average years of schooling, and the ASR of LC³⁴.

According to the results of the present study, the highest ASR of LC in Iranian men is observed in Golestan Province (15.4 per 100,000). Golestan Province has the highest rate of esophageal cancer in Iran and one of the highest rates of esophageal cancer in the world³⁸⁻⁴⁰. Esophageal cancer risk factors are very close to LC risk factors including smoking, unhealthful diet, environmental pollution, and other cultural and socioeconomic factors affecting cancer⁴¹⁻⁴³. This can justify the high incidence rate of LC in this area. On the other hand, the highest ASR of LC among Iranian women is observed in Tehran (7 per 100,000). Tehran is heavily influenced by the cultural factors of European and Western countries⁸. Unsuitable lifestyle, smoking, and air pollution, are the main causes of LC among women in this region^{25,41}.

The results of current study indicated that the lowest ASR of LC in Iran, in both sexes, is observed in Fars Province (1.19 and 0.25 per 100,000 for men and women, respectively). The low incidence rate of LC in this province can be attributed to the demographic characteristics of people living in this area and the presence of other types of diseases and cancers^{16,44}. In Fars Province, breast cancer among women and gastric cancer among men have a higher incidence rate^{17,45}.

Finally, it should be mentioned that the prevalence of cancer-related risk factors in Iran is high and an increasing trend is observed. In fact, along with increasing the number of elderly people and life expectancy, we expect to face more new cases of cancer over the coming years.

CONCLUSIONS

Compared to other geographical locations, the incidence of LC appears a little lower in Iran. However, an organized system for collecting data of cancer is required to specify the incidence and trend of LC in Iran.

CONFLICT OF INTERESTS:

The Authors declare that they have no conflict of interests.

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