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 world3,4. Most LC deaths occur in less developed countries3.

It is necessary to access accurate data of the incidence and outcomes for researching, planning and evaluating programs of cancers3. 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 deaths3.

According to available statistics, the incidence of LC has been increasing steadily in Iranian men and women4. 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, respectively5.

The incidence rate of LC among Iranian males is lower compared 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 cause6.
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), IranMedex (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 $p\leq0.1$) combined with $I^2$ 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 ($p\leq0.1$ and $I^2\geq50\%$). 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 Province 21, one in Kerman Province 22, one in Semnan Province 23, one in East Azerbaijan Province 24, one in Tehran Province 25 and one in Shahroud city 26. 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 women 25. 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, $I^2=98.9\%$, $p<0.001$) and females (Q=1443.7, df=22, $I^2=98.5\%$, $p<0.001$).
Fig. 1. Flowchart of the included eligible studies in systematic review.

### TABLE 1. Basic characteristics of the studies included in the review.

<table>
<thead>
<tr>
<th>Order</th>
<th>Author</th>
<th>Time period</th>
<th>Location</th>
<th>Sample size</th>
<th>Sample size</th>
<th>ASR (Males)</th>
<th>ASR (Females)</th>
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<tbody>
<tr>
<td>1</td>
<td>Sadjadi et al&lt;sup&gt;19&lt;/sup&gt;</td>
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<td>3.59</td>
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<tr>
<td>3</td>
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<td>1996-2000 2004-2006</td>
<td>Kerman Ardabil</td>
<td>5884</td>
<td>7.1</td>
<td>2.4</td>
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<tr>
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<td>Fars</td>
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<td>2.18</td>
<td>0.82</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Somi et al&lt;sup&gt;24&lt;/sup&gt;</td>
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<td>East Azerbaijan</td>
<td>4922</td>
<td>9.15</td>
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<tr>
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<td>Fars</td>
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<td>6.3</td>
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<td>9</td>
<td>Almasi et al&lt;sup&gt;18&lt;/sup&gt;</td>
<td>2001 2002 2003 2004 2005 2006 2007 2008</td>
<td>Fars</td>
<td>1.9 2.0 1.19 1.64 2.9 6.1 8.9 7.9</td>
<td>1.07 0.7 0.25 0.46 1.5 1.5 4.12 3.7</td>
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<td>Iran</td>
<td>74067</td>
<td>6.1</td>
<td>2.6</td>
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</table>
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 10^5 because of the small values of ASRs.

**DISCUSSION**

Cancer is the third main cause of death in Iran. 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 women.

To date, a few studies have been conducted on the epidemiology of different cancers in developing countries such as Iran. 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 1970s. That study investigated cancer incidence in the Caspian littoral region between 1968-1972.

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 men.

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 ASR.

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 rate. 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 1.3. It can be attributed to the difference level of income, environmental factors, and lifestyles of these areas.

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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. In Fars Province, breast cancer among women and gastric cancer among men have a higher incidence rate.

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 world. Esophageal cancer risk factors are very close to LC risk factors including smoking, unhealthful diet, environmental pollution, and other cultural and socioeconomic factors affecting cancer. 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 countries. Unsuitable lifestyle, smoking, and air pollution, are the main causes of LC among women in this region.

So that, the incidence of LC among women was very close to that of men in these areas. 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 LC.

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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.

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

REFERENCES


