

## The Five-year Incidence of Bronchus and Lung Cancer in Fars Province: A Population-based Cancer Registry

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### Abstract

**Background:** Bronchus and lung cancer (BLC) is the first most prevalent cancer in terms of incidence and mortality worldwide. It is estimated that the number of new BLC cases will rise up to 15 million per year by 2020.

**Method:** We conducted this study using the data obtained from Fars Population Based Cancer Registry (FPBCR). The National Institute of Statistics (NIS) website provided the population data on Fars province. Additionally, we calculated the ASR through the WHO's standard population 2000. The standardized rates were calculated via R software and the rate trends were analyzed using chi-square test.

**Result:** Over a 5-year period (2011-2015), 1466 new BLC cases were registered in Fars province, 1009 men (68.8%) and 437 women (31.2%). BLC was amongst the first 10 most prevalent cancers in both genders. The annual incidence rate of BLC was defined to be 7.69-10.78 per 100,000 among men and 3.00-4.52 per 100,000 among women.

**Conclusion:** BLC is amongst the most prevalent cancers with geographical variations in incidence rates. Consistent with cancer reports from other province, relatively high rates of BLC were observed in Fars province, particularly among men.

**Keywords:** Lung cancer, Incidence, Population-based cancer registry, Trend

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### Introduction

Bronchus and lung cancer (BLC) is the most prevalent cancer in terms of incidence and mortality worldwide. As a leading cause of death in men (nearly one out of five

cancer deaths), BLC is the most commonly diagnosed cancer in this gender. It is also ranked fourth regarding both incidence and mortality among women.<sup>1</sup> Totally, 1.8 million new BLC cases occurred

in 2012, accounting for about 13% of all cancers. In 2018, there were 2.1 million new BLC cases, indicating the increase in the incidence of this cancer over this period.<sup>1-3</sup> It has been estimated that the number of new BLC cases will rise up to 15 million per year by 2020.<sup>4</sup>

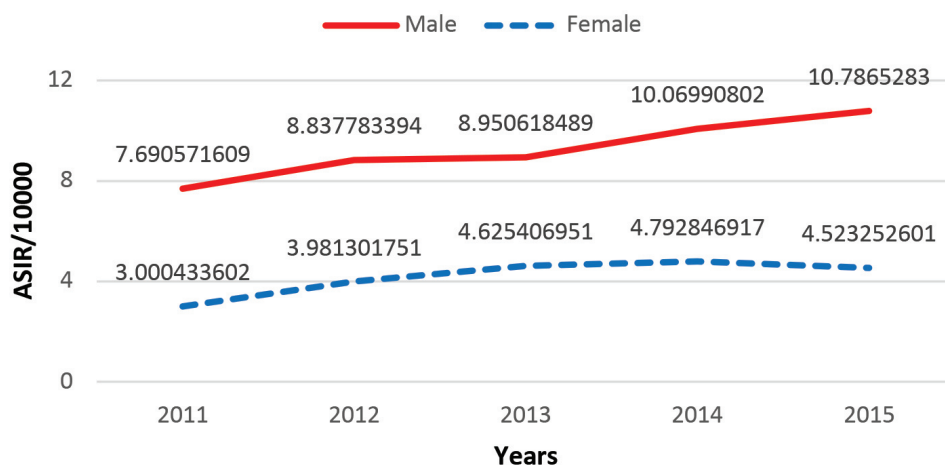
BLC incidence and mortality rates vary noticeably across different geographical areas. Considering the close relationship between human development index (HDI) and age standardized incidence rate (ASIR) of BLC,<sup>5</sup> approximately half of all BLC cases occur in countries with low HDI. On the other hand, the incidence of BLC has been growing among women in high-HDI countries.<sup>6,7</sup> The highest incidence of BLC was detected in the United States and Eastern European regions, while the lowest rates belonged to Africa, South and Central America, and South and Central Asia.<sup>8</sup> BLC is considered as a cancer with low survival even in high-income countries (HIC); therefore, its mortality rate is commonly similar to its incidence rates.<sup>9</sup> Variations in BLC trends in different regions are predominantly shaped by tobacco epidemic, since smoking is responsible for approximately 80% and 50% of worldwide BLC deaths among men and women, respectively.<sup>8</sup>

In the World Health Organization's (WHO) EMRO region, BLC was the most prevalent cancer and the incidence rate is approximately similar to bladder and breast cancers among men and women, respectively.<sup>10</sup> In China, BLC was

the most common cancer in men, accounting for 23% of all cases. It was also the second most frequently diagnosed cancer (16%) following breast cancer among women. Cancer reports from several provinces in Iran have further shown that BLC is amongst the top ten cancers.<sup>11,12</sup> In comparison to HIC, BLC incidence is low among Iranian men; however, it has been increasing progressively in both genders over the recent years. The prevalence of tobacco consumption is relatively high among Iranian men over the age of 15; therefore, low BLC incidence is interesting and might be attributed to under reporting or challenges in tissue diagnosis.<sup>5,13</sup>

The most important risk factor for BLC is tobacco smoking. Air pollution, occupational factors such as exposure to arsenic and asbestos, some organic chemicals, coal smoke, indoor emission, nutritional factors, unhealthy diets, and certain predisposing factors are among other recognized important risk factors for BLC. Moreover, environmental, social, and behavioral factors play a critical role in the variations observed in the incidence of BLC across various geographical regions.<sup>14</sup>

Cancer registry is defined as the systematic collection, storage, analysis, interpretation, and report of cancer-related data; therefore, this procedure is crucial for organizing cancer control programs.<sup>15</sup> Population-Based Cancer Registry (PBCR) collects and records data on all new cancer cases in a well-defined population over a



**Figure 1.** The 5-year trend of the standardized incidence rate of bronchus and lung cancer by gender in Fars province (2011- 2015).

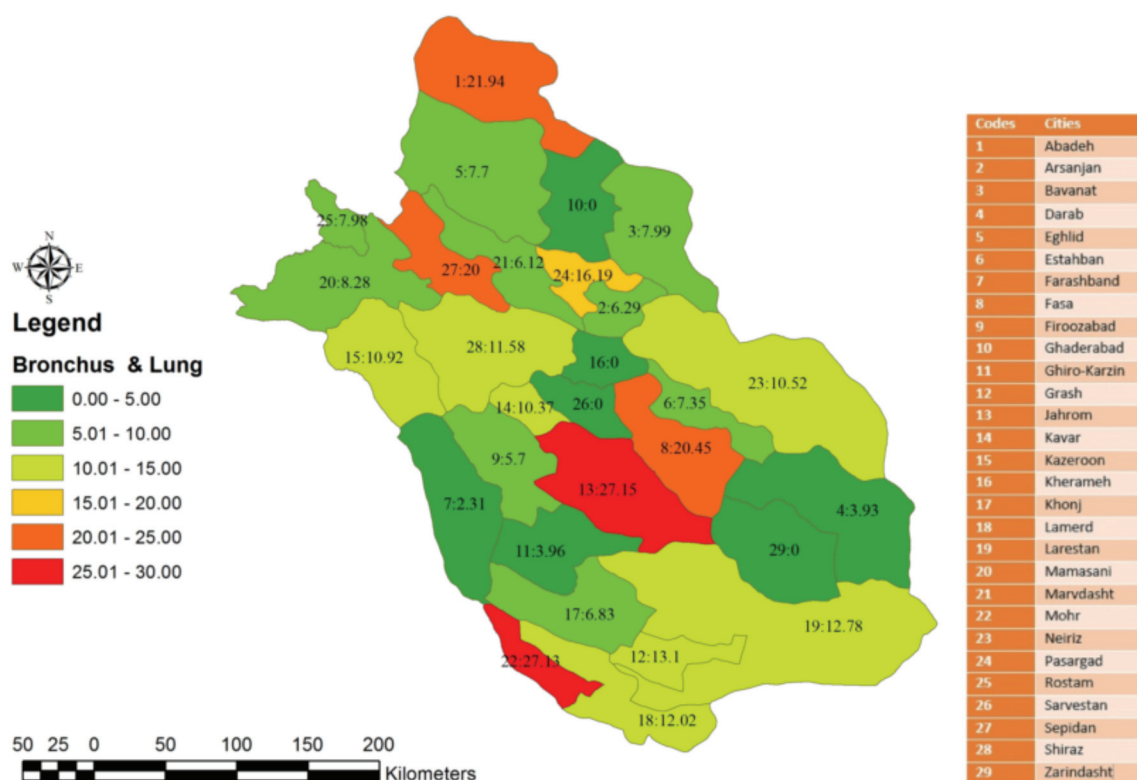
**Table 1.** The annual frequency and percentages of BLC in Fars population between 2011 and 2015

Year	Total cancer cases	Total number of BLC cases	Percent	Sex	Number of BLC cases	Percentage
2011	5678	219	3.8 %	Male	157	71.7%
				Female	62	28.3%
2012	6268	275	4.3%	Male	188	68.3%
				Female	87	31.7%
2013	6143	298	4.8%	Male	197	66.1%
				Female	101	33.9%
2014	7056	328	4.6%	Male	222	67.7%
				Female	106	32.3%
2015	7713	346	4.4%	Male	245	70.8%
				Female	101	29.2%

BLC: Bronchus and lung cancer

definite period of time; it also provides a reliable source of population-based information on cancer incidence, prevalence, and survival rates.<sup>16</sup> In this context, having access to timely, reliable, and valid population data on cancer occurrence is essential for monitoring the impact of cancer, constructing health priorities, and creating and

evaluating cancer control programs.<sup>17</sup> This is the first population-based report from Fars province from 2011 to 2015. It is known that changes always occur in cancer incidence trends; accordingly, monitoring these trends in a defined geographical area seems to be valuable for health administrators and policy makers to establish



**Figure 2.** Age-standardized incidence rate of bronchus and lung cancer among men in Fars province (2015-2016, GIS diagram).

health priorities and cancer control programs. The present study aimed to investigate the five-year trend of BLC in Fars province based on the data gained from a PBCR.

## Methods

We carried out this cross-sectional study using the data obtained from Fars Population-Based Cancer Registry (FPBCR), a province-wide cancer registry developed to a standard PBCR in 2011. Thereafter, data on cancer cases have been collected from all public and private diagnostic and therapeutic centers across the province, including hospitals, pathology centers, public health centers, and death registries affiliated to the Health Vice-chancellor for Shiraz University of Medical Sciences. FPBCR has enhanced considerably regarding the staff, reporting of cancer cases, the employed software, and data collection method during its more than ten years of operation. Since 2011, the registry has started to receive the electronic files of cancer data,

instead of paper-based operation, from the above-mentioned information resources.

The raw data were available for a five-year period from 2011 to 2015. The items recorded in FPBCR included patients' demographic and identification information and tumor characteristics such as cancer site (topography), tumor histology, and date and method of diagnosis. It should be noted that only the cases diagnosed with malignancy were recorded. We coded the tumors based on ICD-O3 and identified BLC cases through topographic codes (C17.0–20.9). Afterwards, the registered morphologic codes were matched with the diagnosis of each case to verify the accuracy. Next, we checked the morphologic codes with the ICD-O3 to find the possible incorrectly mismatched codes. The project code of this study is 95-7705. The Ethics Committee of Shiraz University of Medical Sciences approved the study (Ethics code: IR.SUMS.rec.1395.s1214).

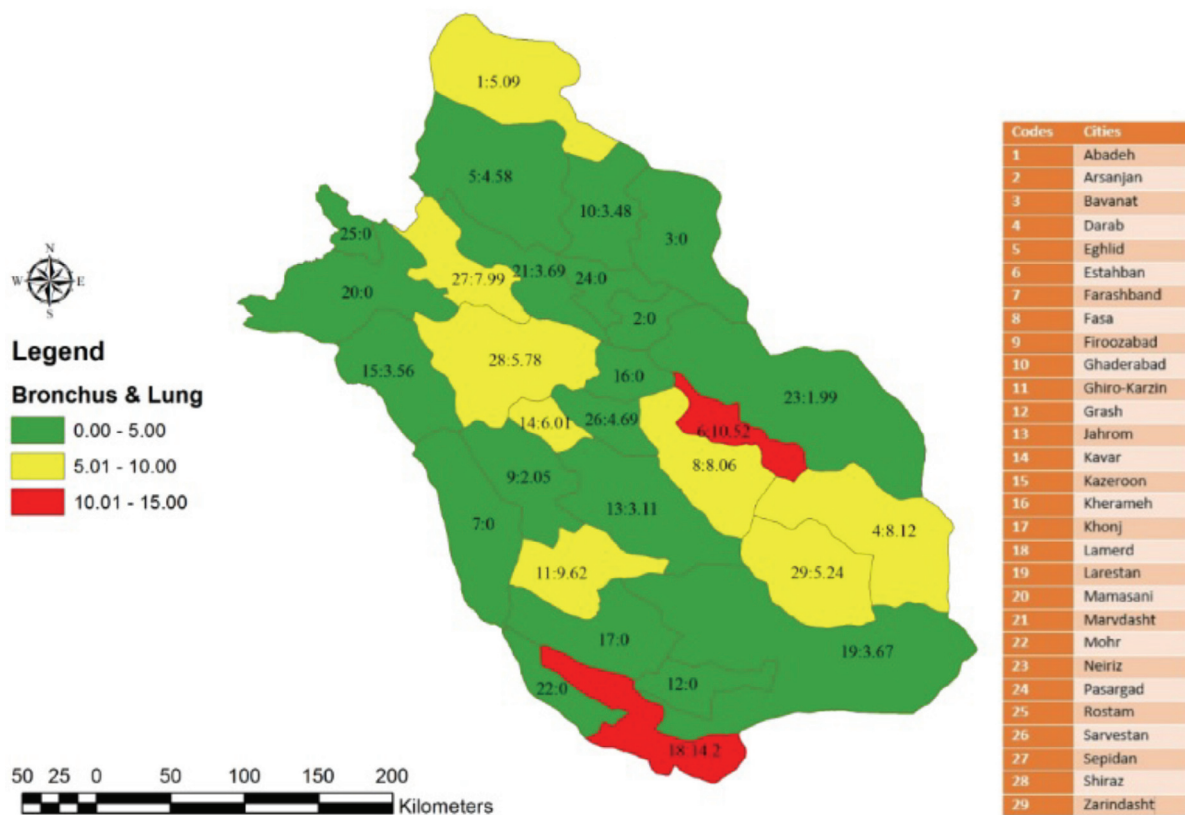


Figure 3. Age-standardized incidence rate of bronchus and lung cancer among women in Fars province (2015-2016, GIS diagram).



### Statistical analysis

Population data of Fars province were obtained from the National Institute of Statistics (NIS) website (available through [www.amar.org.ir](http://www.amar.org.ir)). Additionally, we used the WHO's standard population 2000 to calculate the ASR. Age standardization is required because comparison of incidence and mortality rates in various populations might be affected by factors, such as age. In order to adjust for age, a standard population must be selected, hence the use of WHO's standard population 2000.<sup>18,19</sup> The standardized rates were calculated via R software (version 3.4.3, 2017-11-30). This software is capable of producing a wide variety of statistical and graphical techniques with great extensibility for designing high-quality plots including mathematical symbols and formulae.

The rate trends were further analyzed using goodness of fit chi-square test. *P*-values less than 0.05 were considered as statistically significant.

### Results

Over the five-year period (2011-2015), 1466 new BLC cases were registered in Fars province [1009 men (68.8%) and 437 women (31.2%)]. The analyses of the present study revealed that BLC was amongst the ten most common cancers in both men and women in Fars province. Table 1 presents the annual frequency and percentages of BLC in Fars population in 2011-2015. Additionally, we recorded the incidence trend of BLC in Fars province in 2011-2015 for both men and women. ASIR were 7.69 per 100000 in men and 3 per 100000 in women in 2011, 8.83 per 100000 and 3.98 per 100000 in 2012, 8.95 per 100000 and 4.62 per 100000 in 2013, 10.06 per 100000 and 4.79 per 100000 in 2014, and 10.74 per 100000 and 4.22 per 100000 in 2015 (Figures 1 and 2). Based on the ASIR, the incidence rate of BLC was higher among males. Figures 3 and 4 present the GIS diagrams of ASIR for BLC among men and women, respectively. Amongst 29 cities in Fars province, the highest ASIR were detected in Mohr and Jahrom for men, and in Lamerd and Estahban for women.

### Discussion

The cancer registry of Fars province affiliated to Shiraz University of Medical Sciences was developed to a PBCR in 2007. Since then, it has been gathering data on cancer cases from both hospital and non-hospital resources.<sup>20</sup>

Cancer registration systems are essential components of cancer control programs, as well as, data collection and analysis. Detecting geographical variations in BLC trend through cancer registries provides a valuable source of information for etiological and epidemiological studies. This helps to establish prevention programs, set health resource allocation priorities, develop and implement health policies, and provide early detection, screening, and treatment in relation to resource inputs.<sup>15</sup>

In this study, we obtained BLC data from PBCR to investigate BLC incidence trends in Fars province. The results revealed that BLC comprised approximately 4% of all types of cancers and was among the ten most commonly diagnosed cancers in both men and women. During the five-year period from 2011 to 2015, the annual incidence rate of BLC was 7.69-10.78 per 100,000 among men and 3.00-4.52 per 100,000 among women. Furthermore, the annual percentage of BLC was 3.8% in 2011 and 4.4% in 2015. In a previous study conducted in the south of Iran, the total ASR of BLC was 2.18 per 100,000 in men and 0.82 per 100,000 in women in Fars province, during 1990-2005.<sup>21</sup> This measure was 3.04 per 100,000 in both genders in 2007-2010.<sup>12</sup> Therefore, the results showed a significant increase in BLC incidence rates. Consistent with other studies conducted in different parts of Iran, the current study findings demonstrated a lower ASR in women compared to men.<sup>4,13,21-24</sup> As shown in GIS diagram, ASIR of BLC is higher among southern and central cities, compared to northern cities; this could be attributed to the higher consumption of cigarettes. Also, in southern cities, such as Mohr, a higher habitual consumption of hookah among housewives resulted in higher ASIR of BLC in women. This might be due to the false belief that hookah ensues lower risks in comparison to

cigarettes.<sup>25</sup>

Evidence has documented that BLC is the most prevalent cancer in terms of incidence and mortality worldwide. It is also a leading cause of death and disability adjusted life years (DALYs) among men and ranks fourth concerning both incidence and mortality among women. It has been projected that the number of new BLC cases will rise up to 15 million per year by 2020.<sup>1,4,26</sup> The growing burden of all types of cancers in low income countries (LIC) could be due to population aging along with risk factors, such as smoking, physical inactivity, and unhealthy diets.

As noted before, there is a relationship between tobacco epidemic and BLC incidence. In some countries, such as the U.S., the U.K., and Canada, where the tobacco epidemic was recognized and peaked in mid-20<sup>th</sup> century, BLC incidence has been declining in men and plateauing in women.<sup>8</sup> According to the report by American Cancer Society, from 1990 to 2016, BLC death rates decreased by 48% among men and by 23% among women. From 2011 to 2015, the rates of new BLC cases dropped by 3% and 1.5% per year among men and women, respectively. These differences reveal a historical pattern in tobacco usage. Accordingly, women started smoking many years after men and were slower to quit this habit. A study in the U.S. showed that BLC incidence decreased among both men and women, especially men, since 2010. However, it is still the third most common cancer among both genders after prostate and breast cancers. Indeed, BLC is characterized by substantial racial differences; the incidence rate has been reported to be approximately 50% higher among African-American men in comparison to whites.<sup>27</sup>

In a study in the U.K., a rapidly declining BLC rate was observed among men between 1990 and 2011, while the incidence of BLC increased among women throughout the same period.<sup>20</sup> Moreover, BLC was the most common cancer diagnosed in Canada in the cohort of 1991-2003, accounting for 14% of all new cases and presenting in 30,075 cohort members.<sup>28</sup>

The incidence of BLC has been increasing in Asia, particularly among men. The highest rates

of BLC incidence and mortality were recorded in Democratic Republic of Korea, China, Armenia, and Turkey.<sup>6</sup> As a developing country, Iran is struggling with the growing burden of BLC, mainly as a consequence of population aging and increased tendency towards adopting a western lifestyle.<sup>4,5</sup> In Iran, BLC, accounts for 5.7% of all types of cancers,<sup>29</sup> with an ASR of 7.7 per 100,000 population.<sup>24</sup> Indeed, it ranks amongst the top ten diagnosed cancers and has experienced the same increase in incidence rates as the countries in southern and eastern Europe.<sup>13</sup> A systematic review performed on the incidence of lung cancer in Iran demonstrated that this country was low-risk for BLC. In the same study, the highest ASRs of BLC among Iranian men and women were detected in Golestan and Tehran provinces, respectively.<sup>5</sup> Furthermore, the incidence of BLC was higher in men and in the central provinces of Iran.<sup>24</sup>

Masoompour et al. investigated the cancer trends in the south of Iran and reported no significant changes compared to their previous study in 1998-2002.<sup>12</sup> Keyghobadi et al. further reported that BLC accounted for 4.92% of all cancer types in Kerman province and was the seventh most common cancer in both genders.<sup>11</sup> A study in Semnan province (a central province of Iran) revealed that BLC was the fifth common cancer in men with an ASR of 9.19. On the other hand, the ASR of BLC was observed to be 4.57 per 100,000 among women.<sup>23</sup> Another study in Ardabil province showed that BLC was the third and fifth most prevalent cancer in men and women with ASRs of 7.9 and 3.6 per 100,000, respectively.<sup>22</sup> In Fars province, southern Iran, BLC was amongst the ten most prevalent cancers in both men and women with ASRs of 2.18 and 0.82 per 100,000, respectively.<sup>21</sup>

## Conclusion

Global and national cancer statistics showed that BLC was amongst the most prevalent cancers with geographical variations in its incidence rates. Data released from different PBCRs in various provinces of Iran also revealed significant rates

of BLC. Consistent with cancer reports from other provinces, relatively high rates of BLC were observed in Fars province, predominantly among men.

## Conflict of Interest

None declared.

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