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Introduction

Lung cancer has been the most common cancer in the world for several years. Globally, it has the highest incidence and the commonest cause of death. In 2012, there were 1.8 million new cases, 1.6 million deaths and 34.7 million DALYs. In men, the highest age standardized rates (ASRs) per 100,000 are in Central Europe (66.1), East Asia (64.6) and North America (61.5) and the lowest in Western Sub-Saharan Africa (8.0), and Central Sub-Saharan Africa (12.8). The incidence rates are generally lower in women than in men with the highest rates occurring in high-income North America (41.8), Australasia (25.2) and East Asia (22.9). The lowest incidence rates per 100,000 for women are in Western Sub-Saharan Africa (2.8), Eastern Sub-Saharan Africa (3.2) and South Asia (3.8).

Global variations in lung cancer rates and trends reflect differences in the stage and degree of the tobacco epidemic and efforts in control of tobacco. Lung cancer rates have been decreasing in men and plateauing in women in several Western countries, where the tobacco epidemic peaked by the middle of the past century, such as the United States, United Kingdom, and Finland. Lung cancer rates are increasing and are likely to continue to...
increase at least for the next few decades in China, Korea, and several countries in Africa. 1-3

In 1998–2009, lung cancer ranked fourth among males and third among females in the Gulf Cooperation Council (GCC) countries. The overall incident cases (5652) constituted 4.7% from all cancers with ASRs of 7.2 and 2.2 /100,000 for males and females, respectively. Lung cancer incidence rates were significantly higher in men in all GCC states. Bahrain had the highest incidence rates in both sexes with ASRs of 29.0 and 11.0/100,000 for males and females, respectively. Qatar ranked second followed by Kuwait while the Kingdom of Saudi Arabia (KSA) had the lowest incidence rates in men (5.9/100,000) and the United Arab Emirates (UAE) for females (2.9 /100,000). 4 Lung cancer incidence continued to increase in these countries in both sexes. Over half (58%) of the lung cancer cases in GCC countries were advanced, 42.0% with regional metastasis and 16.4 % with distant metastasis. Localized tumors were present in 8.4% and unknown extent of cancer in about 32.7% of the cases. Adenocarcinoma was the most frequent histopathology type accounting to 22.2% from all lung cancers.4

Bahrain has the second highest lung cancer ASR among males in the Arab countries (28.1/100,000) after Tunisia (33.5/100,000) and the highest among females (10.5/100,000) 5. It is the second commonest cancer in Bahrain constituting 7.2% of all cancer cases and 12.8% of male cancers in 2011. The ASR among Bahraini males (15.8/100,000) is three times that of their female counterparts (4.5/100,000)6. The aim of this study was to describe the epidemiology of lung cancer among the Bahraini population during 1998–2011.

Methodology

The Bahrain Cancer Registry (BCR) is a population–based registry. Cancer reporting is mandatory in Bahrain since 1994 following a ministerial decree. Cases included in the study were those registered as having lung cancer in the BCR from 1 January 1998 to 31 December 2011, whether the cancer was microscopically or clinically diagnosed. CANREG software was used to calculate incidence rates, age specific incidence rates and ASRs. Data analysis was done through the Statistical Package for the Social Sciences, Version 20.0. The two independent sample t–test was applied to detect differences in mean age at diagnosis by gender. Pearson’s chi–square test was used to detect gender differences by type, grade, laterality and detection modality. Cox and Stuart test was applied for trend analysis and the life table for the five–year survival analysis. The Research and Ethics Committee of the Ministry of Health in Bahrain had approved the study.

Results

Six hundred sixty–four lung cancer cases (481 males and 183 females) were registered in the BCR from 1998 to 2011, of whom 11.9% were alive and 88.1% dead by the end of the study period. The annual average number of cases was (47.5) with the year 2010 having the highest reported number of cases (58) and 2009 the lowest (33). Two thirds of the cases were married and the mean age at diagnosis during the 14–year period for both sexes was 68.7±11.7 years. The difference in the mean age of males (69.2±11.2) and females (67.5±12.9) was not statistically significant.

The majority of the reported cases (82.2%) were from Salmaniya Medical Complex, the main governmental hospital in the country followed by primary health care centers (13.4%). 43.4% of the cases were diagnosed based on Cytology/Hematology and 32.2% by histology of primary (Table 1).

The overall ASR among males was 26.1/100,000 compared to 10.0/100,000 among females. The lowest ASR (12.9 /100,000) was in 2009 and the highest (36.7/100,000) in 1998 with a decline from 1998 to 2009. However, the lowest ASR (3.4/100,000) among females was in 2007 and the highest (19.0/100,000) in 1998 with a decline during the whole period (Figure 1). There was a significant decline (p=0.008) in lung cancer ASRs among males during the 14-years period while the decline for females was not statistically significant (p=0.0625).

The youngest age for lung cancer in males was 30 years and that of females 25 years. The age specific incidence rates increased dramatically to reach their maximum in the age groups 75+ years in both sexes (Figure 2).

Table 2 shows that 173 cases of lung cancer were squamous cell carcinoma (26.1%) and 119 cases (17.9%) adenocarcinoma. The grades for the majority (70.3%) of the patients were unknown, with 13.4% having poorly differentiated tumour. The stage was unknown for 65.0% of the cases, 18.5% had distant metastasis and 9.8% localized. Both lungs were affected with a higher percentage in the right (45.3%) than the left (34.9%). No treatment was given in 76.0% of the cases and chemotherapy was the commonest modality (29.5%). 88.9% of the lung cancer were dead and only 11.1% were alive. The five –year survival rate was 3.0%.

Discussion

Lung cancer is the most common cancer in Bahraini males comprising 16.9% of all male cancers with an ASR of 26.1/100,000 and the third among Bahraini females

The right lung was more affected (45.3%) than the left lung (34.9%). This is similar to Kuwait where a higher percentage (35.0%) of the lung cancer lesions were detected in the right lung than the left (20.0%).

The most common type of lung cancers found in Bahrain in this study were squamous cell carcinoma (26.1%) and adenocarcinoma (17.9%), in contrast to that reported for all GCC countries (adenocarcinoma, 22.2% and squamous cell carcinoma, 20.0%)4. The ASR for lung cancer among Bahraini males was 34.5/100,000 in the five–year period from 1973–1977 and 38.6/100,000 during 1978–1982. The corresponding rates for the Bahraini females were 10.4/100,000 and 15.4/100, 000, respectively 9. The decrease in lung cancer incidence has been attributed to tobacco control efforts in the country by the government as well as nongovernmental organizations 8. Smoking rates in Bahrain among the Bahraini adult (≥15 years) population were 17.7% among males and 3.5% among females according to the 2001 census compared to 30.6% and 9.5%, respectively in the early 1980s. 10, 11 Further, the NCD Survey in 2007 reported a prevalence of smoking of 33.4% in adult Bahraini males (20-64 years) and 7.1% among adult Bahraini females.12 The higher prevalence of smoking rates in the latter are mostly attributed to the adult case definition.

Table 1: Characteristics of lung cancer patients (N=664)

(5.8%, 10.0/100,000, respectively). The male to female ratio was 2.6:1 for the total period. Bahrain has the highest incidence rates in GCC countries for both sexes9. Furthermore, earlier reports also showed that Bahrain had higher rates than other GCC countries 7. However, the rates are still lower than those reported from high incidence areas and much above those of low incidence areas.2

The decline in lung cancer incidence rates in Bahrain is in accordance with earlier studies 8. The ASRs among males declined from 55.7 in 1998 to 20.3/100,000 in 2011. This is in contrast to the trends in other GCC countries (UAE stable trend, KSA significant increase, Qatar increase but not significant, and Kuwait and Oman decline but not significant) but is in accordance with those of some developed countries.1,4 The ASR for lung cancer among Bahraini males was 34.5/100,000 in the five–year period from 1973–1977 and 38.6/100,000 during 1978–1982. The corresponding rates for the Bahraini females were 10.4/100,000 and 15.4/100, 000, respectively 9. The decrease in lung cancer incidence has been attributed to tobacco control efforts in the country by the government as well as nongovernmental organizations 8. Smoking rates in Bahrain among the Bahraini adult (≥15 years) population were 17.7% among males and 3.5% among females according to the 2001 census compared to 30.6% and 9.5%, respectively in the early 1980s. 10, 11 Further, the NCD Survey in 2007 reported a prevalence of smoking of 33.4% in adult Bahraini males (20–64 years) and 7.1% among adult Bahraini females.12 The higher prevalence of smoking rates in the latter are mostly attributed to the adult case definition.

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Although only a quarter of the cases had advanced cancer (6.5% regional metastasis and 18.5% distant metastasis), this percentage is most likely an underestimate due to the high percentage (65.0%) of unknown stage. The present figures appear to be lower than those reported from Kuwait (18.2% with regional metastasis and 48.9% with distant metastasis). Among all GCC countries advanced lung cancer was present in 58.4% of cases (42.0% with regional metastasis and 16.4% with distance metastasis).

The BCR does not include full details on the types of treatment. No treatment was reported in 507 (76%) of the cases. 196 (29.5%) had chemotherapy, the commonest modality in Bahrain.

The differences in lung cancer incidence rates between males and females in Bahrain are most likely due to the differences in risk factors, mainly smoking rates, lifestyle and occupational exposures. The higher prevalence and long history of smoking in Bahrain have been attributed to the higher lung cancer incidence rates compared to other GCC countries.

Despite the advances in cancer control in Bahrain, the five-year survival rate (3.0%) of lung cancer was less than that of North Africa and the Middle East (8.0%), Britain (9.5%) and the United States (17.8%), which could be attributed to late detection and treatment modalities.

### References


### Table 2: Topography, type, grade, stage and laterality of cases

<table>
<thead>
<tr>
<th>Topography</th>
<th>n</th>
<th>%</th>
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<tbody>
<tr>
<td>Main bronchus</td>
<td>8</td>
<td>1.2</td>
</tr>
<tr>
<td>Upper lobe lung</td>
<td>38</td>
<td>5.7</td>
</tr>
<tr>
<td>Middle lobe lung</td>
<td>4</td>
<td>0.6</td>
</tr>
<tr>
<td>Lower lobe lung</td>
<td>26</td>
<td>3.9</td>
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<tr>
<td>Lung, NOS</td>
<td>588</td>
<td>88.6</td>
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<table>
<thead>
<tr>
<th>Type</th>
<th>n</th>
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<tbody>
<tr>
<td>Neoplasm, Malignant</td>
<td>109</td>
<td>16.4</td>
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<tr>
<td>Carcinoma, NOS</td>
<td>96</td>
<td>14.5</td>
</tr>
<tr>
<td>Large Cell Carcinoma, NOS</td>
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<td>1.8</td>
</tr>
<tr>
<td>Small Cell Carcinoma, NOS</td>
<td>80</td>
<td>12.0</td>
</tr>
<tr>
<td>Non-small Cell Carcinoma</td>
<td>23</td>
<td>3.5</td>
</tr>
<tr>
<td>Squamous Cell Carcinoma, NOS</td>
<td>173</td>
<td>26.1</td>
</tr>
<tr>
<td>Adenocarcinoma, NOS</td>
<td>119</td>
<td>17.9</td>
</tr>
<tr>
<td>Papillary Adenocarcinoma, NOS</td>
<td>11</td>
<td>1.7</td>
</tr>
<tr>
<td>Others</td>
<td>41</td>
<td>6.2</td>
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<thead>
<tr>
<th>Grade</th>
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<th>%</th>
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<tbody>
<tr>
<td>1 (Well differentiated)</td>
<td>19</td>
<td>2.9</td>
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<tr>
<td>2 (Moderately differentiated)</td>
<td>50</td>
<td>7.5</td>
</tr>
<tr>
<td>3 (Poorly differentiated)</td>
<td>89</td>
<td>13.4</td>
</tr>
<tr>
<td>4 (Undifferentiated unplastic)</td>
<td>38</td>
<td>5.7</td>
</tr>
<tr>
<td>B cell</td>
<td>1</td>
<td>0.2</td>
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<tr>
<td>Unknown</td>
<td>467</td>
<td>70.3</td>
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<table>
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<tr>
<th>Stage</th>
<th>n</th>
<th>%</th>
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<tr>
<td>In Situ</td>
<td>1</td>
<td>0.2</td>
</tr>
<tr>
<td>Localized</td>
<td>65</td>
<td>9.8</td>
</tr>
<tr>
<td>Regional Direct Extension</td>
<td>20</td>
<td>3.0</td>
</tr>
<tr>
<td>Regional Lymph nodes</td>
<td>18</td>
<td>2.7</td>
</tr>
<tr>
<td>Regional Direct Extension &amp; Lymph nodes</td>
<td>5</td>
<td>0.8</td>
</tr>
<tr>
<td>Distant Metastasis</td>
<td>123</td>
<td>18.5</td>
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<tr>
<td>Unknown</td>
<td>432</td>
<td>65.0</td>
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<thead>
<tr>
<th>Laterality</th>
<th>n</th>
<th>%</th>
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<tr>
<td>Right</td>
<td>301</td>
<td>45.3</td>
</tr>
<tr>
<td>Left</td>
<td>232</td>
<td>34.9</td>
</tr>
<tr>
<td>Bilateral</td>
<td>21</td>
<td>3.3</td>
</tr>
<tr>
<td>Paired lateral unknown</td>
<td>110</td>
<td>16.6</td>
</tr>
</tbody>
</table>

The fact that there were considerable numbers of cases with unknown grade (467; 70.3%) and stage (432; 65.0%) of cancer is disappointing. This reflects the incompleteness of the data and does not give a clear account of the true grades and stages.

and large cell carcinomas, accounted for 39.9%. This might be partly explained by the higher smoking rates in Bahrain compared to most other GCC countries as well as the possibility of better cancer reporting in Bahrain.

Squamous cell carcinomas have the highest incidence in males in the United States during 1973–2010 followed by adenocarcinomas, small cell carcinomas, large cell carcinomas, and bronchoalveolar carcinoma (BACs). In contrast, adenocarcinomas have the highest incidence in females, followed by small cell carcinomas, squamous cell carcinomas, large cell carcinomas, and BACs.

The fact that there were considerable numbers of cases with unknown grade (467; 70.3%) and stage (432; 65.0%) of cancer is disappointing. This reflects the incompleteness of the data and does not give a clear account of the true grades and stages.

### Conclusion

A welcomed decline in the incidence of lung cancer has been noted over the past 14 years. However, more efforts should be put to reduce the proportion of lung cancer cases with unknown stage and grade. Future research should be directed towards better understanding of the lung cancer risk factors and the effectiveness of tobacco control measures in the country.


