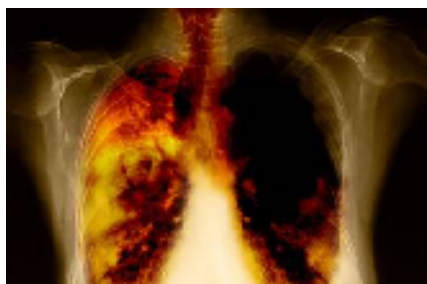


# Lung Cancer

## around the World and Arab Countries

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AMAAC Workshop, Algiers November, 19, 2011



### Introduction

Lung cancer was considered to be rare in the beginning of the 20<sup>th</sup> century but has now reached almost epidemic proportions. It was the most commonly diagnosed cancer worldwide as well as the leading cause of cancer death in males in 2008. Among females, it was the fourth most commonly diagnosed cancer and the second leading cause of cancer death. Lung cancer accounts for 13% (1.6 million) of the total cases and 18% (1.4 million) of the deaths in 2008 and it will rise to three millions per year by the year 2010. Global incidence of lung cancer is increasing at 0.5% per year. According to the American Cancer Society, the chance that a man will develop lung cancer in his lifetime is about 1 in 13, for a woman, it is 1 in 16 (including smokers and non-smokers). According to the World Health Organization, three people die every minute worldwide from lung cancer which could be called 'one of the epidemics' of the 20<sup>th</sup> century.

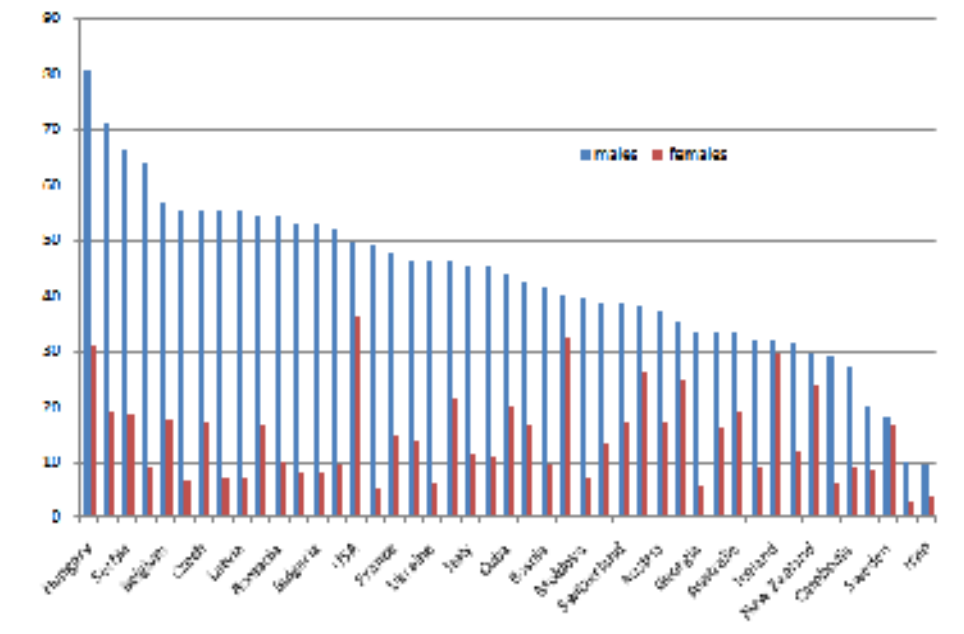
### Lung cancer Worldwide

There is a great variation in the prevalence of lung cancer in different geographical areas. Nearly 70% of all the new cases of lung cancer in the world occur in the developed countries.

It is still the most common cancer in men worldwide (1.1 million cases, 16.5% of the total). Central-Eastern and Southern Europe, and Northern America have the highest incidence (>50 per 10<sup>5</sup> population) followed by China, Korea, Japan, Western Europe, Turkey and Australia with a moderate incidence (35-50 per 10<sup>5</sup> population) and low incidence (<35 per 10<sup>5</sup> population) countries include Latin America, most Asian countries, Scandinavia and Middle and Western Africa (ASRs 2.8 and 3.1 per 100,000 respectively).

In females, incidence rates are generally lower, but, worldwide, lung cancer is now the fourth most frequent cancer of women (516 000 cases, 8.5% of all cancers) and the second most common cause of death from cancer (427 000 deaths, 12.8% of the total). The highest incidence rate is observed in Northern America (where lung cancer is now the second most frequent cancer in women), and the lowest in Middle Africa (15th most frequent cancer). Incidence and mortality from lung cancer in females is rising while it is declining in males in developed countries. The ratio of mortality to incidence is 0.86.

**Fig.1: Lung cancer incidence in some countries worldwide** (Globocan 2008)



### Lung Cancer in Arab Populations

Even if the incidence is low (under 35 per 10<sup>5</sup> population) in the entire Arab world, lung cancer has a high prevalence. Among the Arab Mashrek countries, lung cancer is the most common cancer among males in Bahrain, Qatar, UAE, Jordan, Lebanon and Syria and ranks second, third and fourth in Kuwait, Oman, and Saudi Arabia, respectively. Lung cancer is also the most common cancer affecting males in Arab Maghreb countries, including Algeria, Morocco, and Tunisia. In fact, apart from Mauritania and Sudan, all other Arab countries have lung cancer as one of the five most prevalent cancers affecting males. Lung cancer was 3 times more common in Tunisian, Bahraini and Lebanese than Egyptian Saudi or Emirati males and nearly 5 times more common among the Bahraini and Lebanese females than the Omani, Qatari or Sudanese females. This incidence in Bahraini and Lebanese females was greater than in females in African, Asian and most of the European countries. It is notable that the rate among Tunisian females was not higher same the rates among Lebanese and Bahraini females event though rate among Tunisian males is high.

**Fig.2: Frequency of lung cancer from all cancer sites (%)**

(Data from Globocan 2008)

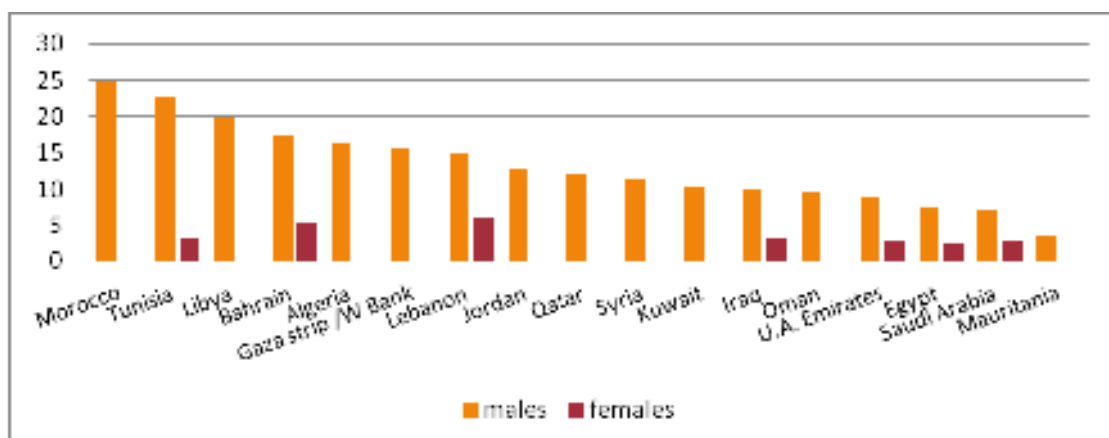


Fig.3: Lung cancer Incidence in Arab countries (Globocan 2008)

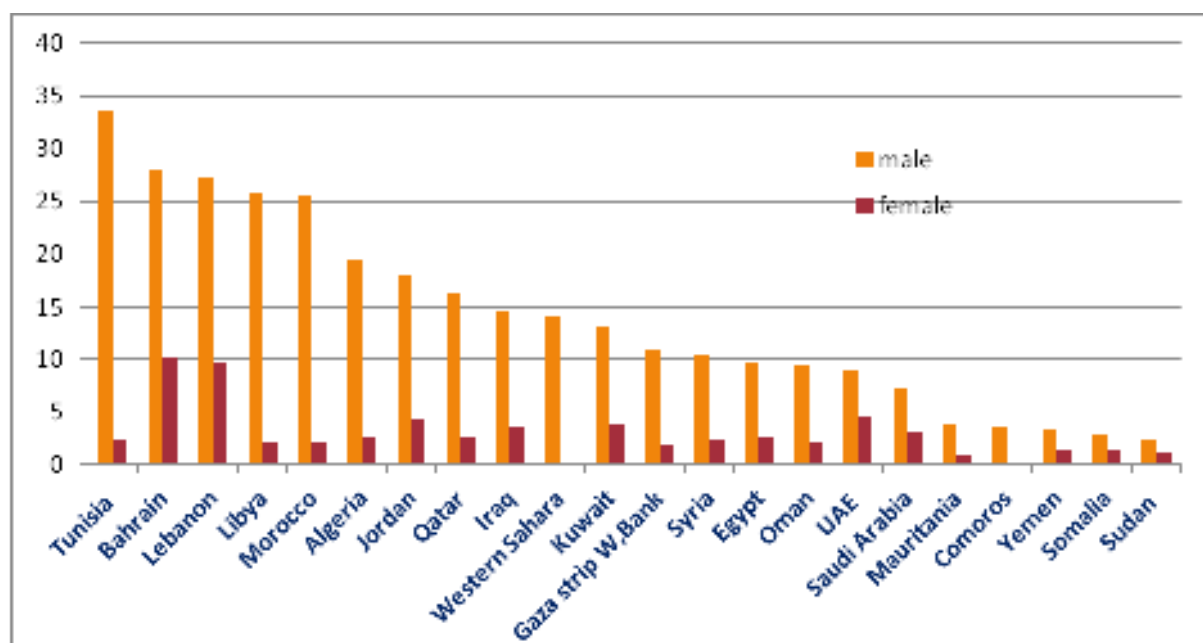
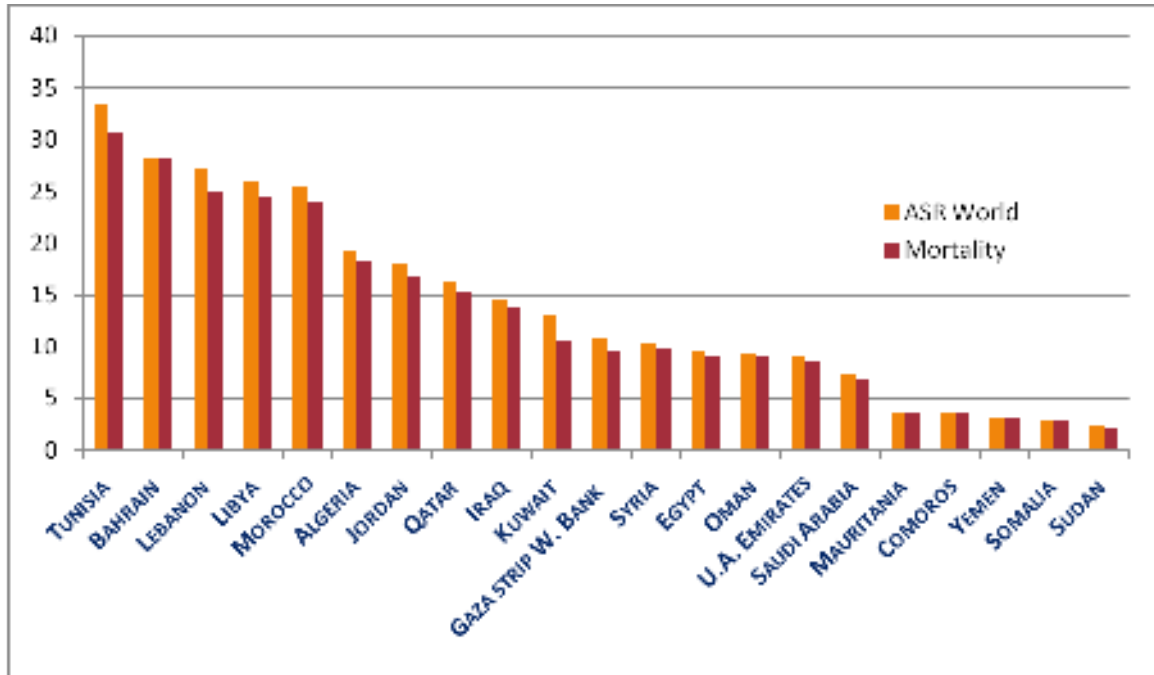


Table 1: Lung cancer in Arab countries, Incidence and Mortality

(Globocan 2008)

Country	Men		Women	
	Incidence	mortality	Incidence	mortality
Algeria	19.4	18.2	2.5	2.4
Bahrain	28.1	28.1	10.4	8.1
Comoros	3.6	3.6	0.0	0.0
Egypt	9.6	9.1	2.5	2.3
Gaza strip and west bank	10.8	9.6	1.8	1.9
Iraq	14.6	13.9	3.6	3.4
Jordan	18.0	16.8	4.2	3.9
Kuwait	13.2	10.4	3.9	4.8
Lebanon	27.3	24.9	9.7	8.9
Libya	25.9	24.5	2.2	2.0
Mauritania	3.7	3.7	0.9	0.9
Morocco	25.6	24.0	2.1	2.0
Oman	9.3	9.1	2.2	2.3
Qatar	16.4	15.4	2.5	2.5
Saudi Arabia	7.2	6.8	3.0	2.8
Somalia	2.9	2.9	1.4	1.3
Sudan	2.4	2.2	1.2	1.1
Syria	10.3	9.7	2.3	2.1
Tunisia	33.5	30.8	2.3	2.1
U.A. Emirates	9.0	8.6	4.6	4.3
Western Sahara	14.1	14.1	-	-
Yemen	3.3	3.2	1.4	1.3

**Fig. 4: Incidence and Mortality by lung cancer in men (source: Globocan 2008)**



### Age of Diagnosis

Lung cancer rarely occurs before the age of 50 years, after which incidence rates increase with age to peak at 70-79 years for males and females. Worldwide during 2002, 5% of lung cancer cases were diagnosed among people aged 0 to 44 years, 14% in the 45 to 54 age group, 25% in the 55 to 64 age group, and 55% among those aged 65 years and over. These proportions were fairly uniform for both sexes. [1]. In Europe in younger people, before 25 years old, age incidence rate is under 1 case per 10<sup>5</sup> inhabitants; between 25 and 34 years old, age incidence rate is also 1 case per 10<sup>5</sup> inhabitants. These rates are remaining stationary since 30 years. After 35 years old age incidence rate increase dramatically.

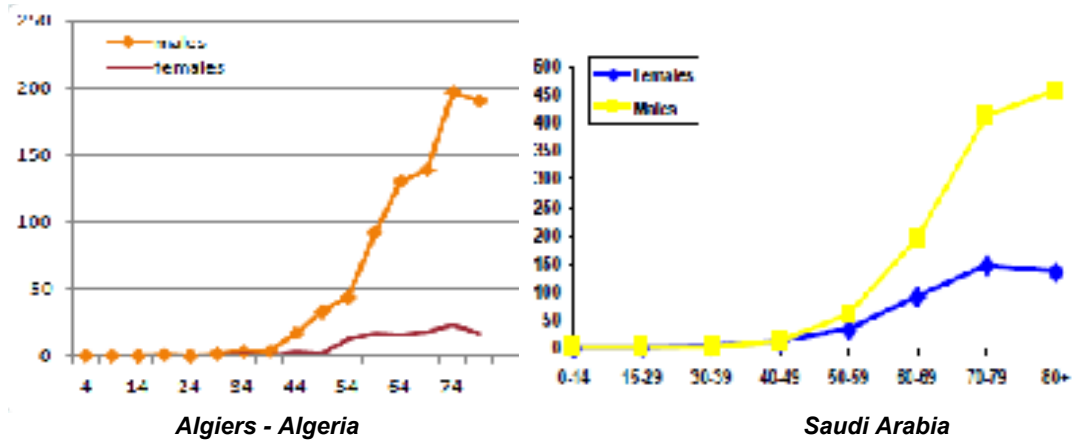
Age-specific incidence rates were between 1.5 to 2.3 times higher for more developed countries compared with less developed countries within each age group. There was also a significantly higher proportion of lung cancer patients aged 65 years and over at diagnosis within more developed countries (62% compared with 49% in less developed countries). This primarily reflects the higher life expectancy and different age distribution in more developed countries compared with less developed countries.

In USA, the average age at which lung cancer is diagnosed is 70, with less than 3% of lung cancers diagnosed under the age of 45. The median age at diagnosis in some Arab countries is as see as below :

Country	Median age at diagnosis	% < 45 years
Algeria	67.0	15
Bahrain	69.5	00
Egypt	60.0	12.1
U.A. Emirates	63.4	-
Jordan	63.2	7.5
Kuwait	70.0	5.0
Oman	61.2	2.7
Qatar	60.8	-
Saudi Arabia	65.8	6.6

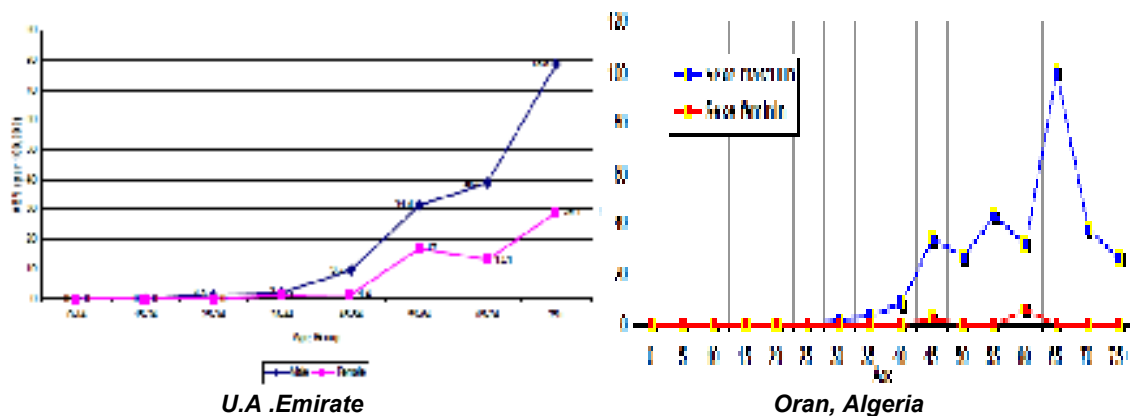
USA	70.0	3.0
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Fig.5: Age specific lung cancer incidence in Algiers (2007) and Saudi Arabia (1995-2005)



The incidence of lung cancer rose sharply with age, from the age group 40–49 years for both males and females, which continued to rise steadily among males to a peak in the age group 70–74 years.

Fig. 6: Age Specific Incidence Rate in UAE (1998-2001) and Oran (2005)



### Gender

In developed countries, males have a greater lifetime risk of lung cancer than females (7.81% vs. 5.8%) [ ]. In developing countries where cigarette use by females is low, there is a greater disparity: Arab males have a higher overall rate of lung cancer (twice to 14 fold that of females).

Table 2: Lung cancer in Arab countries Incidence, %, and male to female ratio

(Globocan 2008)

Country	Men	%	Women	%	Male to female Ratio
Tunisia	33.5	22.8	2.3	3.2	14.6
Bahrain	28.1	17.3	10.	5.3	2.8
Lebanon	27.3	14.9	9.7	6.2	2.8
Libya	25.9	20	2.2	-	11.8

Morocco	25.6	24.7	2.1	-	11.8
Algeria	19.4	16.3	2.5	-	7.8
Jordan	18.0	12.9	4.2		4.3
Qatar	16.4	12.2	2.5	-	6.7
Iraq	14.6	10	3.6	3.2	4.0
Western Sahara	14.1	13.0	0.0	-	-
Kuwait	13.2	10.4	3.9	-	3.4
Gaza strip and west bank	10.8	15.8	1.8	-	6
Syria	10.3	11.3	2.3	-	4.5
Egypt	9.6	7.5	2.5	2.3	3.8
Oman	9.3	9.5	2.2	-	4.2
U.A. Emirates	9.0	9.1	4.6	2.8	2.0
Saudi Arabia	7.2	7.2	3.0	2.6	2.4
Mauritania	3.7	3.6	0.9	-	4.1
Comoros	3.6	-	0.0	-	-
Yemen	3.3	-	1.4	-	2.3
Somalia	2.9	-	1.4	-	2.1
Sudan	2.4	-	1.2	-	2.0

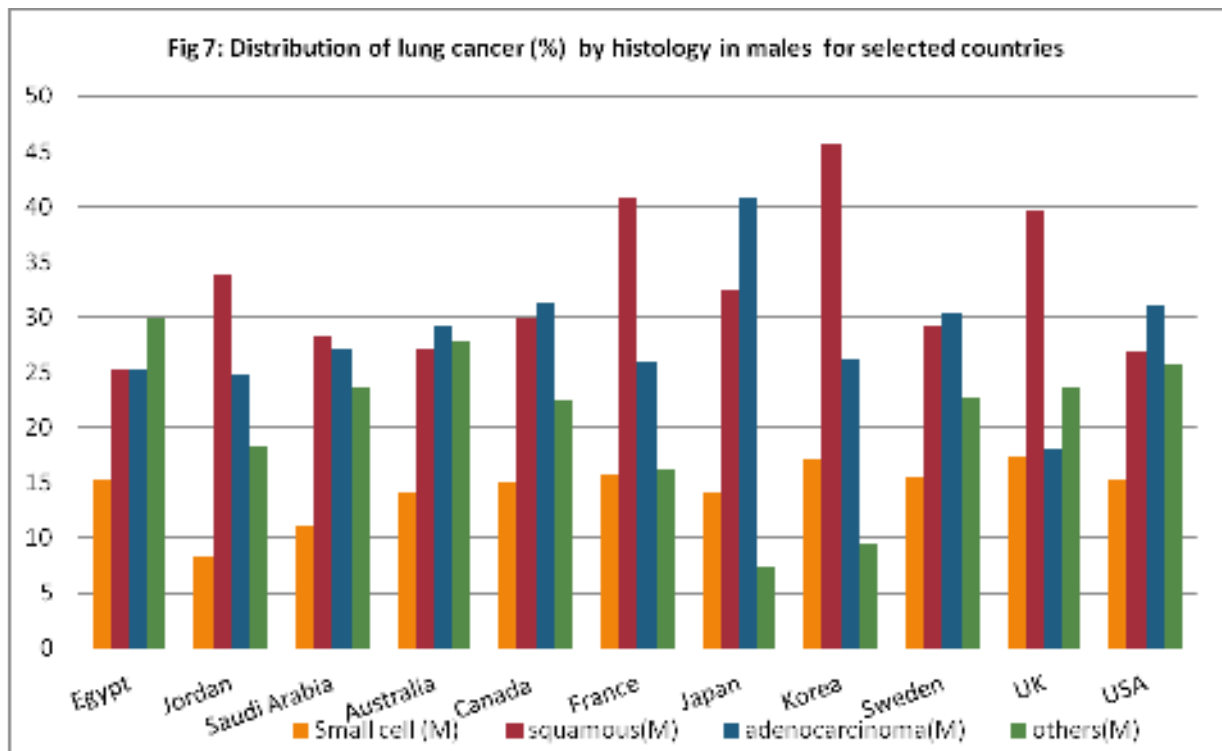
## Histology of lung cancer

The histological type of lung cancer is an important factor in the epidemiology, treatment, and prognosis of lung cancers. Lung cancers can be divided into two main types:

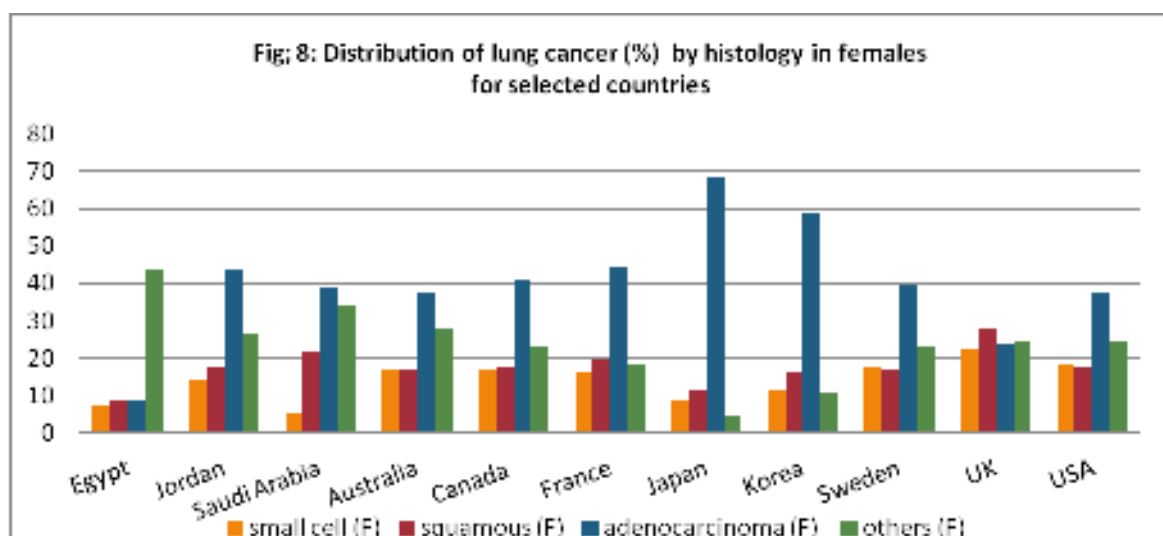
- **small cell lung cancer (SCLC)**
- **Non-small cell lung cancer (NSCLC).**

SCLCs are the most aggressive form of the disease, having greater potential to metastasis than other types of lung cancer. Nearly all patients (over 95%) diagnosed with SCLC are current or ex-smokers. NSCLCs are a heterogeneous group, of which the most common subtypes are:

- **Squamous cell carcinomas** and adenocarcinoma. Squamous cell carcinomas are also predominantly linked to smoking. These tumors tend to grow in the center of the lung and have the capacity to grow to large sizes.
- **Adenocarcinoma** usually occurs in the periphery of the lung. Although it is the most common type of lung cancer seen in nonsmokers, smoking has been increasingly associated as a cause of adenocarcinoma in more recent years.

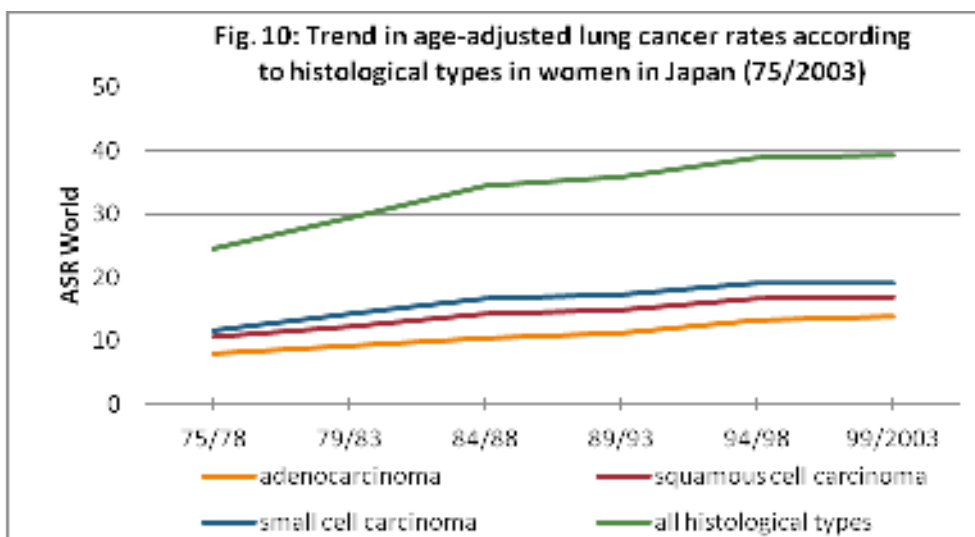
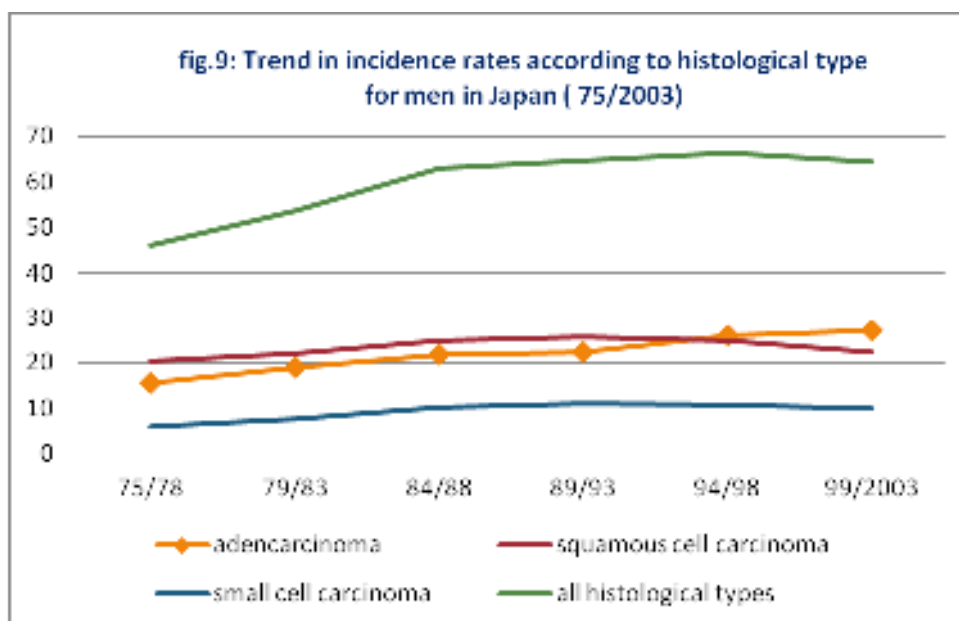


Within each of these countries, squamous cell carcinoma comprised a much higher proportion of lung cancers diagnosed among males than females, whereas adenocarcinoma comprised a greater proportion of lung cancers diagnosed among females compared with males. Among males, squamous cell carcinoma was the most common histological type of lung cancer in Korea, Jordan, France, United Kingdom, and the Saudi Arabia whereas adenocarcinoma was the most common type in the United States, Japan, Canada, Sweden, and Australia. With the exception of the United Kingdom and Egypt, adenocarcinoma made up the greatest proportion of lung cancers among females for all of the countries shown. Small cell cancers comprised between 14% to 17% of lung cancers among males, and between 7% to 22% of lung cancers among females.



At the Gulf Cooperation Council (Bahrain, Oman, Saudi Arabia, Kuwait and Qatar), the predominant types were squamous cell carcinoma in males (except in Qatar) and adenocarcinoma in females [2].

To date, increase in the incidence rates of lung adenocarcinoma (ADC) and decrease in the incidence rates of squamous cell carcinoma (SQCC) and small cell carcinoma (SMCC) have been reported in Japan [3] and in Western countries also.



**Table 3: Histological type (%), by sex in selected Arab countries and US SEER**

Histology	Oman	Saudi	Egypt			Jordan			USA		
	2007	Arabia	1996-2001			1996-2001			SEER 1996-2001		
	Total	Total	Total	Male	female	Total	Male	female	Total	Male	Female
Carcinoma	-	-	94.6	94.4	95.8	96.7	96.9	96.6	98.8	98.8	98.8

Squamous cell carcinoma	12	27	21.1	25.3	8.4	31.4	33.9	17.7	21.0	24.8	16.3
Adenocarcinoma	16	<b>30</b>	21.1	25.3	8.4	27.7	24.7	<b>43.4</b>	37.2	34.2	<b>40.9</b>
Small cell carcinoma	9	10	13.3	15.3	7.4	14.3	8.4	14.1	14.1	13.1	15.3
Large cell carcinoma	2		<b>25.6</b>	<b>26.4</b>	<b>23.2</b>	3.5	3.0	6.2	6.2	6.4	5.9
Others carcinoma	51	-	5.3	3.4	20.8	20.5	15.3	20.4	18.4	18.4	18.4

This table indicates a remarkably high proportion of adenocarcinoma in Jordan in the women population (43.4%), and a remarkable proportion of large cell carcinoma in Egypt (25.6%). In Benghazi the proportion of adenocarcinoma (34%) is also higher [4].

### Lung Cancer Trends

The observed variations in lung cancer rates and trends across countries or between males and females within each country largely reflect differences in the stage and degree of the tobacco epidemic. Smoking accounts for 80% of the worldwide lung cancer burden in males and at least 50% of the burden in females.

Lung cancer incidence rates peaked among males in North America, Australia, New Zealand, and many countries in North-Western Europe during the 1980s and have since been declining.

In contrast, the incidences rates for males in many Southern and Eastern European countries, Japan and China, and for females from most developed countries, either continue to increase or have recently begun to plateau.

**Fig. 11: Trends in incidence of lung cancer (in males) in selected countries**



Generally, lung cancer trends among females lag behind males because females started smoking in large numbers several decades later than males. Therefore, lung cancer rates in females are increasing in many countries except the United States, Canada, the United Kingdom, and Australia, where they are plateauing. In 1990, lung cancer accounted for about 10 percent of all cancer deaths among women worldwide and more than 20 percent of cancer deaths among women in some developed countries. In the United States, incidence of lung cancer has decreased significantly by 1.8% per year from 1991 to 2006 among men and increased significantly by 0.4% per year from 1991 to 2006 among women.

**Fig. 12: Trends in incidence of lung cancer (in females) in selected countries**

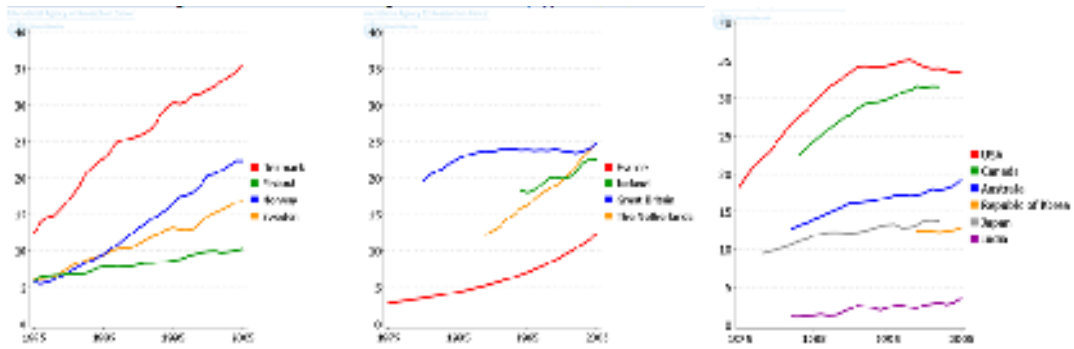
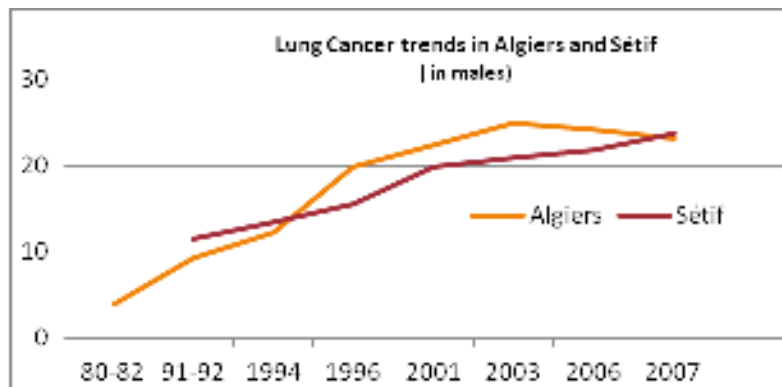
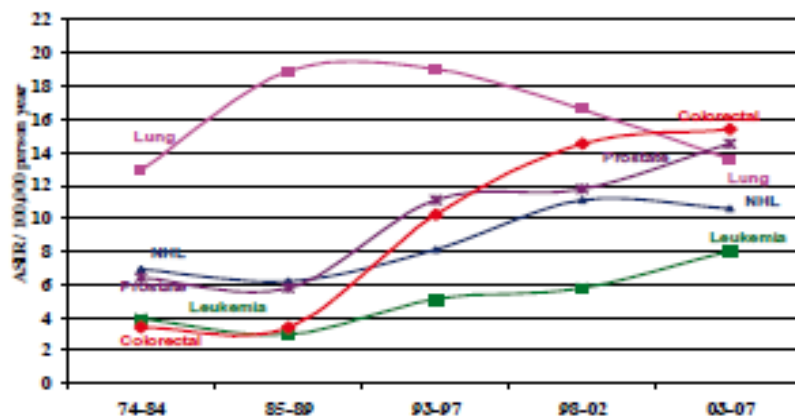


Fig. 13: Trends in incidence of lung cancer (in males) in Algeria



For males, in Algeria, an increasing trend in the ASR was observed in the two registries of Algiers and Setif but in Kuwait the ASR has increased until 1990 and has decreased from then onward.

Fig. 14: Time trend of ASR incidence for the five most common cancer sites In Kuwait in Males 1974-2007



### Variation between histological types

The trends in lung cancer incidence were not the same for every histological type. Among men in the United States and Western Europe the age incidence rate for squamous cell carcinoma rose to

25-60 per 100,000 person-years in the early 1980s and then declined to 20 in the 1990s. The same trend was found for small cell carcinoma, the peak also being reached at the beginning of the 1980s. The rates for adenocarcinoma rose from 5-15 per 100,000 person-years in the 1970s to 10-35 in the 1990s. In other countries the peak in the incidence of adenocarcinoma had not been reached at the beginning of the 1990s.

Among European women the incidence rate for every histological type increased from 1-2 per 100,000 in the 1970s to 2-5 in the 1990s. However, for American women the rise in the incidence of adenocarcinoma from 2-7 per 100,000 to 13-15 was marked.

In Australia and Europe squamous cell carcinoma is still the most common type of cancer among men, whereas in North America adenocarcinoma is now the leading lung cancer cell type among both men and women. Adenocarcinoma is relatively more common in women (representing about one third of full lung carcinomas) than in men (15-25% of all lung carcinomas).

There was also a birth cohort trend apparent for the different histological subtypes of lung cancer: squamous cell carcinoma declined among men born after 1910-25, whereas adenocarcinoma only declined among men born after 1930-35[5].

### **Survival of lung cancer**

Worldwide, the prognosis for patients with lung cancer is very poor, because metastases are often present at the time of diagnosis. Survival is associated with age and tumour stage: one-year relative survival rates decreased from 40% for patients younger than 45 years old to 20% for patients of 75 and older, and was better for patients with localized disease (40-65%) than for those with metastasized disease (15- 30%).

In North America the 1- and 5-year survival rates in the 1980s were about 30% and 12%, respectively. Between European countries large variations in lung cancer survival rates existed between 1978 and 1985: 1-year rates varied between 21% and 42%, and 5-year rates between 5% and 15%, being highest in Finland, France, the Netherlands and Switzerland, and lowest in Denmark, England, Poland and Scotland.

The 1-year survival rate for lung cancer has increased from 34% in 1975 to 42% in 1998. Despite major advances in understanding and treating cancer, the 5-year relative survival rate is only 15%, a rate that has improved only slightly over the last 30 years.

Current overall 5 year survival rate is 11%, impacted by age, tumor stage, histological subtype, and treatment. Developed countries have higher survival rates than developing countries (13% vs. 9%). Improvements in diagnostic and therapeutic technologies have contributed to an increase in survival (1 year survival 37% in 1975, 42% in 2000).

While developed countries have higher survival rates, it is important to point out that lung cancer care/treatment is very expensive.

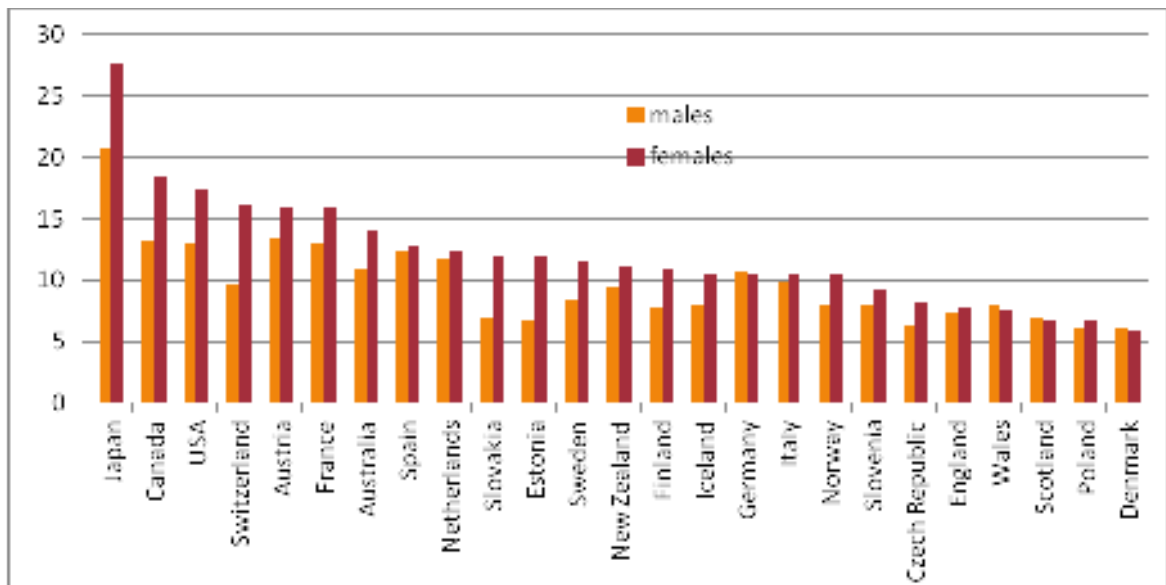
Cancer survival tends to be poorer in developing countries, most likely because of a combination of a late stage at diagnosis and limited access to timely and standard treatment.

Survival rates of lung cancer are low (about 10% to 15 % at 5 years in the US: localized 50 %; Regional 16%; distant: 2%) and have improved little over time [6].

Although there is some variation in lung cancer survival rates between countries, the prognosis for people diagnosed with lung cancer remains poor worldwide, with 5-year relative survival typically between 6 to 14% among males and 7 to 18% among females.

**Fig 15: Lung cancer 5 years relative survival (%) for selected countries (1990-1994)**

*Source: Eurocare-4*



One reason for the low lung cancer survival rates relates to the lack of observable symptoms for early stage lung cancer. Lung cancers diagnosed based on symptoms alone are usually well advanced and treatment options are limited. Surgical resection remains the most effective treatment for early localized tumors, but only a minority of lung cancers is diagnosed at that stage. Another probable reason for poor survival among lung cancer patients is the effect of smoking, in those smoking-related comorbidities such as cardiovascular diseases or chronic obstructive pulmonary disease may have an additional negative impact on survival. There is also some evidence that current or previous smoking reduces the effectiveness of radiotherapy or chemotherapy when treating lung cancer.

International comparisons of lung cancer survival data can be problematic. However, even after considering these caveats, survival for lung cancer patients diagnosed in Japan seems to be higher than in other more developed countries, followed by North America, whereas generally lower survival rates were reported for European countries.

Data on cancer survival among less developed countries is limited, with 5-year survival for lung cancer averaging around 9% in developing countries for both males and females combined.

Although this is considerably lower than the survival reported for some developed regions such as Japan and North America, it is similar to the average 5-year survival for lung cancer of just under 11% for all persons that was recently estimated for Europe.

Lung cancer survival is generally, but not always, better for females and for younger patients. Some commentators have suggested that any survival advantage among younger lung cancer patients may be due to more aggressive treatment compared with older patients.

Prognosis for SCLC is usually inferior compared with NSCLC. In the United States, the 5-year relative survival rate by type of lung cancer was about 17% for patients with NSCLC and only 6% for those diagnosed with SCLC between 1996-2003. Similar differences in survival by histology have been reported for Canada, Australia, and throughout Europe.

The results from several large, recent studies have indicated that non smokers who develop lung cancer have a better prognosis than smokers, after taking into account other factors such as demographic characteristics and existing comorbid diseases.

4 months is the median survival for patients with advanced lung cancer at time of diagnosis [7] 13 months is the median survival for patients with advanced lung cancer who are still alive two years after diagnosis [7] and over 4 years is the median survival for patients with advanced lung cancer who are still alive five years after diagnosis [7].

## Time trends in prognosis

### Variations between histological subtypes

Besides being dependent on age and tumour stage, survival for lung cancer patients is closely related to the histology of the tumour. Survival was best for patients with non-small cell carcinoma and poorest for patients with small cell carcinoma. Despite recent advances in treatment the 5-year survival rate for patients with non small-cell lung cancer is still less than 15% and that for small-cell carcinoma only 5%.

Although non-small-cell lung cancer is often considered to be one clinically uniform category, several studies indicate that survival differs according to histological subtype, being better for squamous cell carcinoma and adenocarcinoma (1-year survival rates of 40-50%) than for large-cell undifferentiated carcinoma (1-year survival rates of 25-30%) .

**Table 4: Trends in 1-year survival (%) of histological subtypes of lung cancer in selected countries**

Country	All histological types			Non –small cell carcinoma			Small cell carcinoma		
	78/82	83/87	88/92	78/82	83/87	88/92	78/82	83/87	88/92
Denmark	22	22	22	25	25	25	17	21	22
Finland	37	38	33	43	45	40	26	24	23
France	35	35	34	38	38	34	27	27	32
Italy	28	30	-	34	34	-	25	26	-
Netherlands	35	37	37	40	41	41	17	26	24
Slovenia	-	27	29	-	31	32	-	25	24
Sweden	29	29	30	29	30	31	-	21	25
Switzerland	34	37	38	33	38	39	29	26	-
UK	22	25	24	32	34	31	16	18	17

Prognosis for patients with lung cancer was best in Finland, France, the Netherlands and Switzerland and worst in Denmark and the United Kingdom. One-year survival rates for patients with small-cell carcinoma increased in Denmark, France and the Netherlands. For patients with squamous cell carcinoma one-year survival increased slightly in the Netherlands, Slovenia and Switzerland, but decreased in Finland and France. The survival rates for patients with adenocarcinoma remained stable in most cancer registries, but decreased in Finland and the Netherlands.

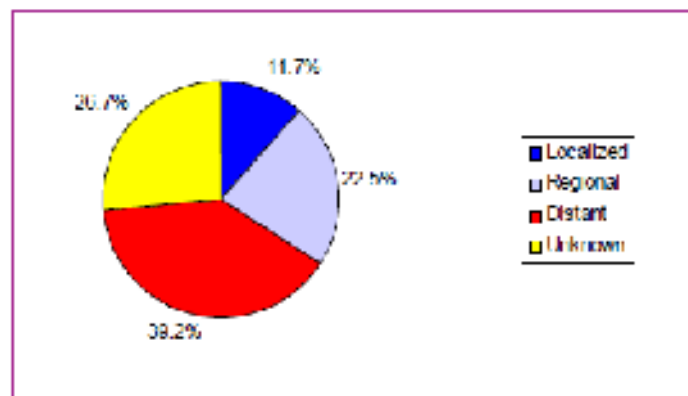
## Stage at Diagnosis

Lung cancer is typically asymptomatic in its early stages of development, and even when symptoms appear, they are usually nonspecific. As a result, the majority of lung cancer patients are diagnosed after the disease has progressed to a more advanced stage.

In USA, between 1996 and 2003, over half of lung cancers are diagnosed at an advanced stage: 16% are diagnosed at the earliest stage; 25% are diagnosed after they have spread beyond the primary site to lymph nodes; 51% are diagnosed after they have spread (metastasized) to distant regions of the body. In Canada, 10% are diagnosed in stage I; 6, 5% in stage II; 35% in stage III and 48, 5 % in stage IV. [8].

#### In Arab countries :

In U.A. Emirates, tumor metastasis was observed in 80.6 % of the cases: 55.2% had distant metastasis, 16.4 % had regional direct extension and lymph node involvement and 9 % had regional direct extension only. In Saudi Arabia stage distribution showed that 54.5% had distant metastasis at presentation, and localized disease, regional and unknown represent 17.4, 14.5 and 13.6%, respectively [9].



**Fig. 16: Stage distribution of lung cancer in Saudi Arabia (1990/2000)**

Source: Haya S. et al. Cancer Incidence Report Saudi Arabia - 1999 – 2000

### Cost of lung cancer treatment

*"The number of cancer cases has increased proportionately more than medical expenditures, indicating that the increase in the cost of treating cancer has been driven mainly by the increase in the number of cases and not by the cost per treated cancer case,"* Justin Trogon, told The ASCO Post. He added that early detection and enhanced prevention are sound strategies for addressing the upcoming cancer population problem [10].

Because lung cancer is a major health care problem in the world and also in Arab countries, it would be useful to identify the direct health care costs of diagnosing and treating this disease. Treatment is carried out in phases including initial diagnosis, initial treatment, follow-up and maintenance treatment, and, for those who do not survive, terminal treatment and palliative care. Some components of each treatment are unique to each phase, but most medical activities and services may occur more than once over the course of the disease from diagnosis to death or cure.

In Canada, in 1988, the average five year cost per case was **\$21,000**, and ranged from a high of \$29,860 for limited disease SCLC, to a low of \$16,500 for Stage IV NSCLC. Over 82% of this total was spent in the first year for diagnostic tests, therapy (surgery, chemotherapy, radiation therapy, or combinations of these), hospitalization and follow-up costs [11].

The lifetime cost of treating lung cancer in 1984 is \$12510 in USA for three phases of cancer treatment (initial therapy, maintenance care, and terminal care) [12]. In 1998, all lung cancer patients incur an initial treatment cost of **\$26,042**. Those who survive through the year also incur maintenance care costs for the remaining three quarters of the year. The total first-year costs of those who survive the year are: Initial treatment: \$26,042; maintenance treatment: \$8,493 ( $.75 \times \$11,325$ ) → Total First/Year Cost: **\$34,535**.

DALYs are the sum of years of life lost (YLL) and years lived with disability (YLD) resulting from a disease. They represent the sum of potential life-years lost due to premature mortality caused by a disease and the equivalent years of “healthy life” lost due to living with a disease. The economic value of Disability Adjusted Life Years (DALY) lost due to cancer amounted to US \$895 billion in 2008 globally. This represents roughly 1.5% of the world GDP. The top three cancers which account for the highest economic value of DALYs are **lung cancer (19.9%) at US \$178 billion**, colon/rectum cancer (11.0%) at US\$99 billion and breast cancer (9.8%) at US\$88 billion. The economic value of DALYs lost to cancers on average amounts to 2.22% of GDP in low-income countries whereas in high-income countries this loss amounts to about 1.69% of GDP. For nearly half the countries in the world the economic value of DALYs lost to cancer amount to more than 1% of annual GDP. This finding suggests that cancer prevention warrants attention as a major economic and health policy strategy [13].

## Risk Factors for Lung Cancer

### Smoking

The rapid increase of lung cancer over the last century from a rare disease to an epidemic is attributed to the exposure to newly introduced major risk factors, which includes smoking at the top of the list. Around 85 - 90% of lung cancer could be attributed to the use of tobacco directly or indirectly. The relative risk of dying from lung cancer is 11 - 20 times more in smokers compared with nonsmokers. The risk of lung cancer is dependent on the number of cigarettes smoked per day and the duration of smoking, with an increase in the risk of smoking started at a younger age. Smoking cessation at any age is of proven benefits of reduction of lung cancer risk over an extended period of time (15-20 years), but it remains higher than never-smoker risk. In the 20th century, approximately 100 million people died worldwide from tobacco-associated diseases such as cancers, chronic lung disease, diabetes and Cardio-Vascular Diseases. According to studies conducted in Europe, Japan and North America, 83–90% of lung cancers in men and 57–80 in women, are imputable to tobacco. Between 80 and 90 % of oesophagus, larynx and oral cavity are caused by tobacco and alcohol. In developing countries, an estimated one-third of all cancer deaths were attributable to smoking in 1995 [14].

### Radon gas

The exposure to radon is an established risk factor of lung cancer, which was initially observed in uranium miners. However, this naturally occurring radioactive gas accumulates also in buildings and homes, especially in basements and lower-level floors. The exposure to the indoor radon may be

responsible for up to 9% of lung cancer in Western countries as it has a synergistic effect with smoking.

### **Industrial and occupational exposure**

Exposure to various carcinogens has been linked to lung cancer. The list of these carcinogens includes arsenic, polycyclic hydrocarbons, diesel exhaust, herbicides and insecticides, silica, asbestos, beryllium and chromium. Asbestos is a well known cause of not only mesothelioma but also of primary lung cancer.

### **Air pollution**

Exposure to outdoor pollution, especially nitrogen oxides from the traffic fumes, has been linked to an increase risk of lung cancer.

### **Other Risk Factors**

There are other risk factors that were associated with an increase in the incidence of lung cancer, including family history, sedentary life, alcohol and dietary factors, with a variable strength of association.

### **Tobacco consumption**

In the World today, 48 % of men and 10 % of women smoke [15] World tobacco demand is expected to increase until the year 2010 due to population and income growth. While in developed countries tobacco smoking is set to continue to decline, in developing countries consumption will increase, the report said (*Projections of tobacco production, consumption and trade to the year 2010*). World tobacco production is projected to reach over 7.1 million tonnes of tobacco leaf in the year 2010, up from 5.9 million tonnes in 1997/99. The number of smokers is expected to grow from 1.1 billion in 1998 to around 1.3 billion in 2010, according to the report. This is an increase of about 1.5 percent annually. Despite the overall increase of tobacco use, FAO expects consumption per adult to decline by around 10 percent by 2010, and individual consumption will probably be around 1.4 kg per year (from around 1.6 kg in 2000). Applying an aggressive anti-smoking and anti-tobacco policy, tobacco consumption per person could even drop by 20 percent, FAO said. Consumption per person is declining in developed, and modestly declining in developing countries, including China. Cigarette smoking is the most prevalent type of tobacco consumption.

Tobacco demand in developed countries is declining slowly and will reach about 2.05 million tonnes in 2010. This is 10 percent lower than the 2.23 million tonnes consumed in 1998. This can be attributed to a slower population and income growth Tobacco demand in developed countries is declining slowly and will reach about 2.05 million tonnes in 2010. This is 10 percent lower than the 2.23 million tonnes consumed in 1998. This can be attributed to a slower population and income growth. In addition, in developed countries an increasing awareness of the damaging health effects of smoking, together with the anti-smoking measures of governments including intensified anti-smoking campaigns, the banning of advertising and increased taxation, have had a strong negative effect on consumption of tobacco products. But more tobacco will be smoked in developing countries, where tobacco consumption is expected to grow to 5.09 million tonnes by 2010 (from 4.2 million 1997/99). This is an average annual growth rate of 1.7 percent between 1998 and 2010. In Africa, total tobacco demand increased in the 1990s with record growth of 3.5 percent per year.

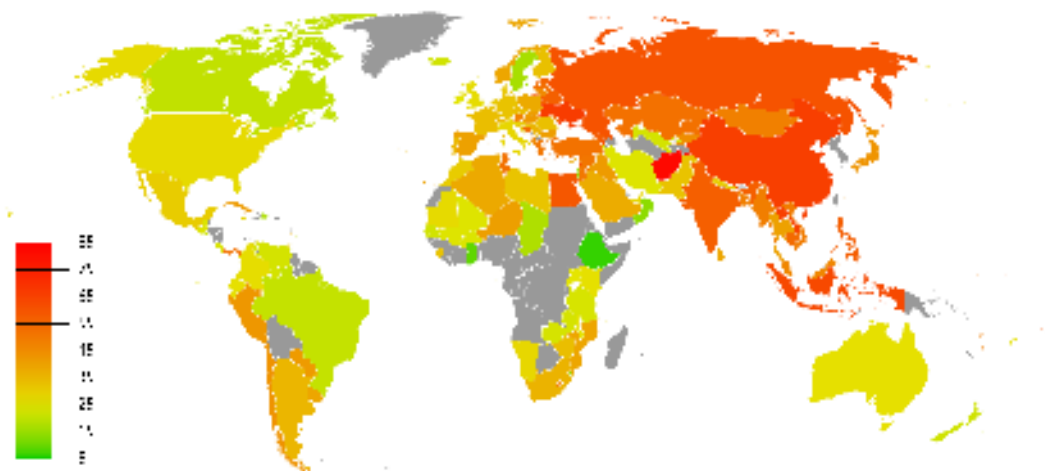
Growth for the period to 2010 is expected to continue at a similar rate. In the Near East, the demand for tobacco is expected to grow at 0.42%, a growth rate a little lower than experienced in the 1990s (0.44%).

WHO has estimated that there are about 1100 million smokers worldwide; this represents about one-third of the global population aged over 15 years. About 73% of these smokers (700 million males, 100 million females) are in developing countries; in industrialized countries there are 200 million male smokers and 100 million female smokers. In Mediterranean countries, smoking has been a male prerogative until quite recently, so that there have been minimal changes to date in mortality rates in females. Males in all countries show dramatic increases (Parkin).

In general, patterns of smoking in men and women are different in developing and industrialized countries; significantly more men (40–60%) but fewer women (2–10%) smoke in developing countries compared with the approximately 25–30% of both men and women who smoke in industrialized countries. Women in developing countries tend to have lower rates of smoking, start smoking later than men, and consume fewer cigarettes daily. This is mainly the result of sociocultural, religious, or economic factors. For example, in some societies, it may be considered improper and indecent for females to be seen smoking in public; in addition, there may be religious and economic arguments against it [16]. In many Muslim societies it is considered improper and shameful for women to smoke cigarettes, especially in public. Between 1990 and 1997, cigarette consumption increased 24% in the Middle East. The Middle East and Asia are the only two regions of the world where cigarette sales increased during that period. This trend reflects the high male smoking prevalence in the Arab world and the uptake of smoking by a growing number of women [17].

#### **Percentage of males smoking any tobacco product.**

Source: WHO report on the Global Tobacco Epidemic 2008, 267-288.



#### **Percentage of females smoking any tobacco product.**

Source: WHO report on the Global Tobacco Epidemic 2008, 267-288.

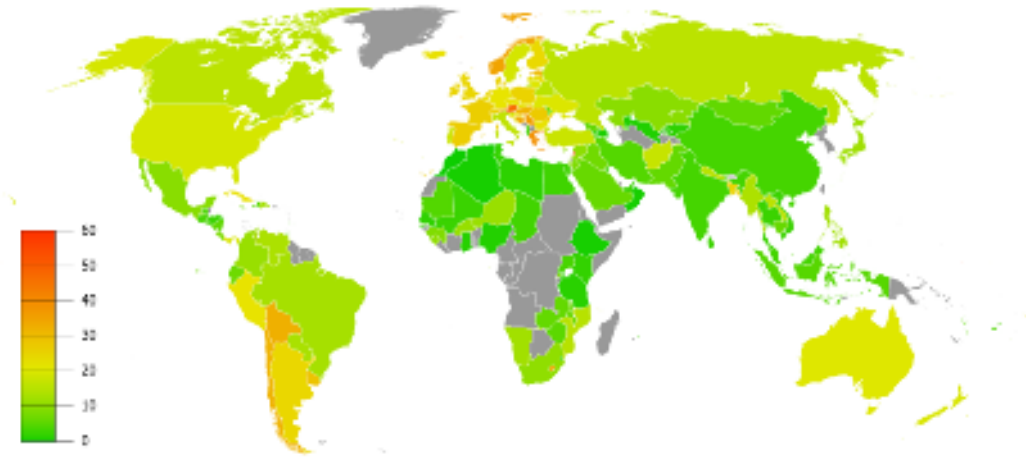
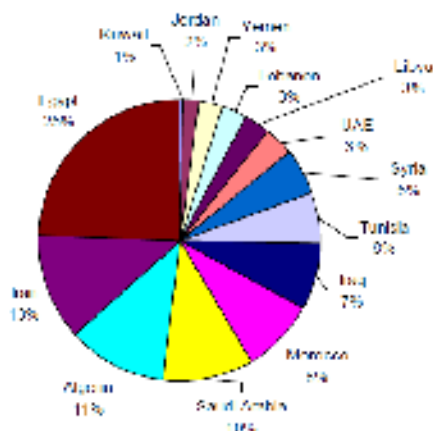


Fig. 17: Percentage Share of total Arab World and Iran consumption, 1999[18]



In 1999, total cigarette consumption for the MNA region (Middle East and North Africa ) was 191,450 million pieces, accounting for 3.7% of the world total consumption (MNA’s population was around 5% of the world total in 2000). Cigarette consumption was been increasing in most Arab countries during the 1990s. However, the rates of increase vary considerably. In Libya and Syria consumption increased by nearly 60% during that period. In 1999, Egypt was the biggest cigarette consuming country, with 46,600 million pieces cigarette consumed, or one fourth of the region’s total.

Fig. 18: Cigarette consumption in 1999 in selected Arab countries

Source USDA and FAO

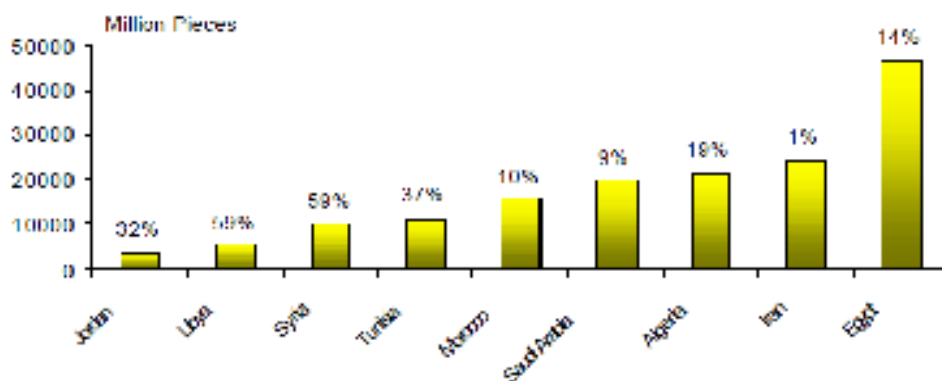
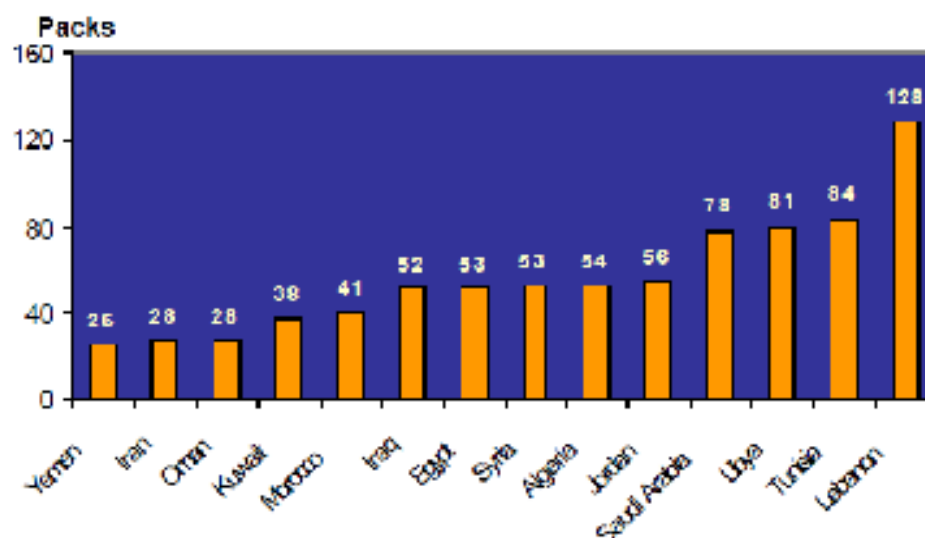


Fig.19: cigarette consumption per adult 15 years old and over, 1999



The rate of cigarette consumption per person 15 years and older, was highest in Lebanon, Tunisia, Libya and Saudi Arabia. Smoking prevalence differs greatly among Arab countries, from 7% in Oman to 53% in Lebanon. Overall, 23% of adults in the region are smokers and average annual consumption for these smokers was 212 packs in 1999.

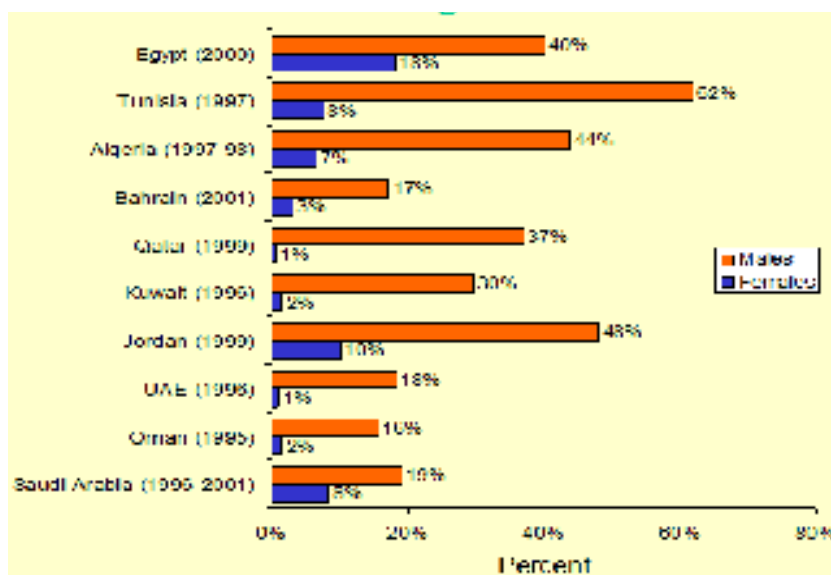
In Algeria, an epidemiological investigation of tobacco consumption was conducted among grade-school students in the Wilaya de Setif during the 1986-87 academic years. The fundamental data on tobacco dependency in grade school was obtained. 1,771 students from 12 to 20 years of age were polled through individual and anonymous questionnaires: 18% of these students are smokers. The majority (97%) are boys. Smoking begins early, after age 10, with a high point at 14.

To face this situation, a National Committee against Tobacco was introduced by the Ministry of Public Health. A grade school programme is in the planning. The following proposals were made: to inform, widely and objectively, the grade-school population, the teachers and the parents; to take action above all in the primary schools, which constitute an ideal setting to reach these children, who are potential smokers, before they become long-term smokers [19]. In Tunisia, the average consumption of tobacco calculated over the period of 10 years (1981-90) was 1493 g per person and per year; equivalent of 75 packets of cigarettes. Cigarette smoking increased from 1981 to 1993 but since has decreased slightly. The current prevalence of tobacco smoking is 30.4% for both sexes: around 52% for males and 6% for females. Average consumption is 17.7 cigarettes/day. For young people, the prevalence is 29.21%: 50% for males and 3.9% for females. Young people who attend school smoke less than those who do not (18.1% versus 38.4%). Most started smoking between 14 years and 18 years.

**Table 5: Prevalence (%) of smoking among men and women in selected Arab countries**

Geographical area, year(s) of survey	Prevalence (%)	
	Men	Women
<b>Middle East</b>		
Jordan, 1984	65.0	15.0
Turkey, 1988	63.0	24.0
Israel, 1989	45.0	30.0
Cyprus, 1990	42.5	7.2
Bahrain, 1981–83 (non-Bahrainis) (ref. 27)	40.4	7.9
Saudi Arabia, 1994 (Saudi Arabians) (ref. 22)	40.0	8.2
Iraq, 1990	40.0	5.0
Kuwait, current study (Kuwaitis)	34.4	1.9
Bahrain, 1981–83 (Bahrainis) (ref. 27)	30.6	9.5
<b>North Africa</b>		
Tunisia, 1985	58.0	6.0
Algeria, 1980	53.0	10.0
Egypt, Cairo, 1985	39.8	1.0
Morocco, 1990	39.6	9.1

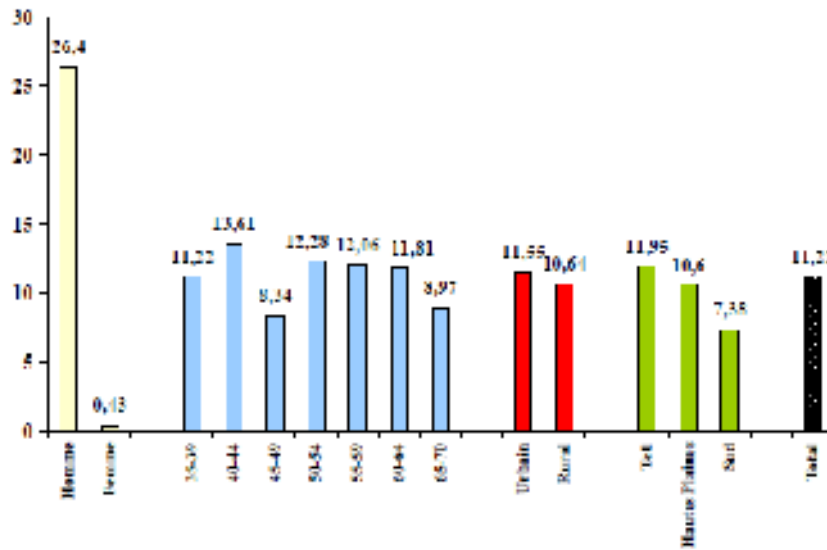
Source: Anjum Memon et al WHO, 2000



**Fig.20 : Prevalence of smoking in Arab World**

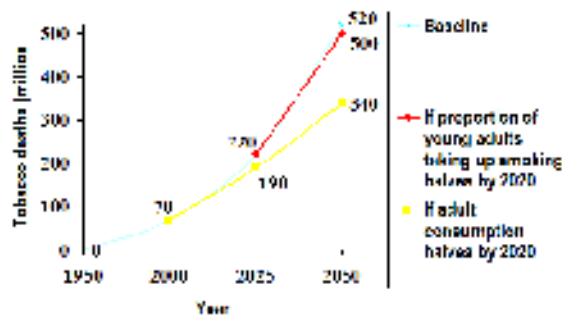
Source : Inas El Attar ,Cancer in the Arab World : Magnitude of the problem. NCI Egypt ( 2004)

**Fig 21: Prevalence of smoking among algerians adults by sex, age, walk of life ( urban vs rural) and area ( North, high shelves, South )**  
 source : Enquete Tahina , Institut national de santé publique , 2008



Tobacco kills 4, 9 Millions persons each year, half of them live in developing countries. The death toll is estimated to double in the 2020. 70% of these deaths occur in developing countries.1 in 2 long-term smokers die because addiction and half of them will die prematurely , losing 20-25 years of life [ WHO 2003 & Peto et al.]

**Unless current smokers quit, smoking deaths will rise dramatically over the next 50 years**



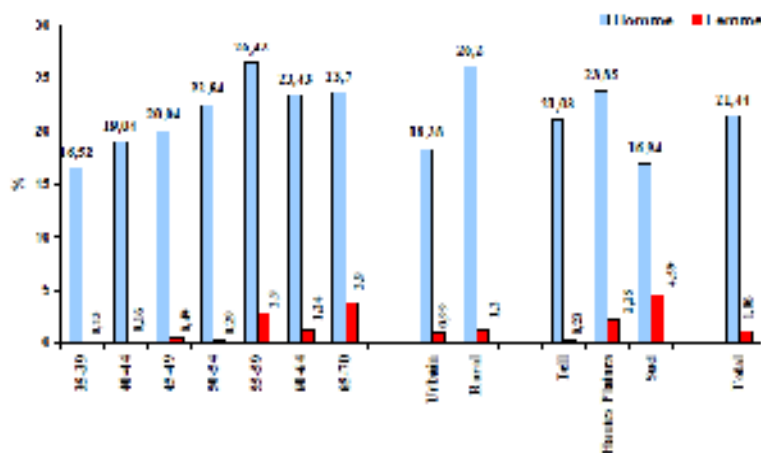
Source: Peto and others, 1994

### Smokeless tobacco consumption

Smokeless tobacco is used in many regions of the world (America, Europe, Asia, Middle-East and Northern Africa). 28 carcinogens have been identified in smokeless tobacco in US. Use of

smokeless tobacco can lead to a number of consequences detrimental to health. Smokeless tobacco rapidly delivers high doses of nicotine, which can lead to dependence and is also a source of carcinogenic nitrosamines. Changes usually develop in the mouth area where the smokeless tobacco is most often placed. Oral premalignant lesions are leukoplakia, erythroplakia, submucosal fibrosis and lichen planus. There is conflicting evidence with regard to snuff users about the risk of oral and gastro-esophageal cancer. Smokeless tobacco is not recommended to help smoking cessation [23]. Ethnicity strongly influences prevalence due to social and cultural practices, as well as socioeconomic differences. In population terms, survival rates around the world show little improvement. In terms of etiology, the effects of tobacco use, heavy alcohol consumption, and poor diet together explain over 90 percent of cases of head and neck cancer. [24]

**Fig. 22: prevalence of smokeless tobacco** (chemma tobacco and snuff) in Algeria by sex , age, walk of life, area.



### The nargileh or waterpipe

The waterpipe, traditional method of smoking tobacco (also known as *gouza*, *nargileh*, hubble-bubble, hookah or *shisha*) has been used for smoking tobacco for centuries in the Eastern Mediterranean Region. Formerly associated almost exclusively with older males, usually of lower socioeconomic level, waterpipe smoking is now spreading to other segments of society in the Region, particularly young men and women, and those from higher socioeconomic levels [25].

The nargileh is popularly considered a less dangerous form of smoking, even by some physicians, because of the supposed filtration by the water. Nargileh has been in use for a long time in the Arab world [26].

Research indicates that the nargileh has short and long term effects on health [25].

- Short term effects: smokers have elevated levels of expired air CO, plasma nicotine, and heart rate after 45 minutes of nargileh smoking. Compared to cigarettes, 45-minutes of nargileh use about doubles CO and triples nicotine exposure, with almost similar cardio vascular effects. In addition, analyzed blood samples indicate that average COHb concentrations of nargileh users were significantly higher than those of cigarette users.
- Long-term effects: the nargileh has been linked to cancer of the lung, bladder, mouth, and the bronchi. Similarly to cigarettes, babies born to women who use nargileh during their pregnancy were more likely to have low birth weight, low Apgar scores and respiratory distress (26). Environmental tobacco smoke (ETS) exposure effects: Children of parents who smoke nargileh had an increased frequency of respiratory disease as compared to children whose parents did not smoke nargileh.

## Prevention and Tobacco control measures

Smoking cessation and eliminating the risk of tobacco will eradicate the majority of lung cancer cases, making it one of the most preventable cancers. Minimizing the occupational exposure to the above-mentioned carcinogens will decrease the risk further.

Overall the Arab world has quite a good record on tobacco control. The Ministries of Health in most countries are the national authority responsible for tobacco control. By 1980, most countries had issued regulations to restrict or ban smoking in closed public areas. By 1995, most countries had placed a ban or some restriction on smoking in workplaces, schools, and health care facilities.

Programmes to control and prevent the use of tobacco in the region need to be tailored to the factors likely to contribute to an increase in smoking in developing countries in the future. These programmes should use the experience of industrialized countries in tobacco control in combination with specific knowledge of the local factors involved.

Measures to reduce demand:

- Higher tobacco taxes ( Youth are more sensitive to price/tax increases )
- Increased access to nicotine replacement and other cessation therapies

### Early detection

various studies using chest X-ray, sputum cytology and spinal computed tomography (CT) scans were not supportive of routine mass screening.

## Conclusion

Lung cancer is the most frequent cancer in term of incidence with worldwide more than 1.3M new cases each year and the most common global cause of cancer death in men and second only to breast cancer in women.

Developing countries are seeing an increased lung cancer burden because of the increased prevalence of the main risk factor: tobacco use.

Most of the worldwide burden of lung cancer could be avoided by applying proven tobacco control interventions that include raising the price of cigarettes and other tobacco products, banning smoking in public places, the restriction of advertising of tobacco products and treating tobacco dependence.

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