

## REVIEW

# Cancer Epidemiology and Control in the Arab World - Past, Present and Future

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## Abstract

The Arab world, stretching from Lebanon and Syria in the north, through to Morocco in the west, Yemen in the south and Iraq in the east, is the home of more than 300 million people. Cancer is already a major problem and the lifestyle changes underlying the markedly increasing rates for diabetes suggest that the burden of neoplasia will only become heavier over time, especially with increasing obesity and aging of what are now still youthful populations. The age-distributions of the affected patients in fact might also indicate cohort effects in many cases. There are a number of active registries in the region and population-based data are now available for a considerable number of countries. A body of Arab scientists are also contributing to epidemiological research into the causes of cancer and how to develop effective control programs. The present review covers the relevant PubMed literature and cancer incidence data from various sources, highlighting similarities and variation in the different cancer types, with attempts to explain disparities with reference to possible environmental factors. In males, the predominant cancers vary, with lung, urinary bladder or liver in first place, while for females throughout the region breast cancer is the greatest problem. In both sexes, non-Hodgkins lymphomas and leukemias are relatively frequent, along with thyroid cancer in certain female populations. Adenocarcinomas of the breast, prostate and colorectum appear to be increasing. Coordination of activities within the Arab world could bring major benefits to cancer control in the eastern Mediterranean region.

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## Introduction

The countries of the Arab Middle-east share a great deal in terms of culture while markedly differing in their levels of economic development. The variation between and within populations is reflected in different disease profiles, although in all cases the burden of cancer is already appreciable. The available data indicate that incidence rates are rising and with aging as well as continued population growth this means that the problem will loom larger in the future.

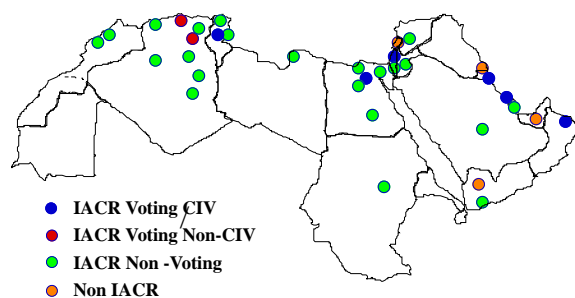
Since the literature regarding cancer registration data and associated epidemiological findings are scattered, the present research was undertaken to provide an overview. The countries/populations included are the Lebanon, Syria, Palestine (the West Bank and Gaza and Israeli - Palestinians), Jordan, Egypt, Sudan, Djibouti and Eritrea and the Maghreb countries of North Africa (Libya, Tunisia,

Algeria, Morocco and Maruitania) as well as Saudi Arabia, Yemen, the Sultanate of Oman, the United Arab Emirates, Qatar, Bahrain, Kuwait and Iraq. Although population-based cancer incidence rates in Jordan, with and without Egypt, have been published (Freedman et al., 2003; Freedman et al., 2007), a more general coverage has not been hitherto been available. All sources available to the authors were therefore accessed to give as comprehensive a picture as possible regarding the cancer burden, risk factors and preventive approaches. Representative relevant papers in PubMed were cited with the focus on individual organ sites, in an attempt to explain variation in incidence rates in terms of accepted risk and beneficial factors.

## Cancer Registration in the Arab World

The established cancer registries within the Arab world are shown in Figure 1. The oldest population-based

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**Figure 1. Cancer Registries in the Arab Countries of Asia and the North African Region**

**Table 1. Numbers of Middle Eastern Countries and Registries in the Series of Nine Volumes of CIV**

Volume	I	II	III	IV	V	VI	VII	VIII	IX
Kuwait*					1	1	1	1	1
Oman*								1	1
Algeria: Setif								1	
Bahrain*								1	
Egypt: Gharbia								1	
Tunisia: Sousse									1

\*: National Cancer Registry

registry is that of Kuwait, which has been reporting to Cancer Incidence in Five Continents since 1987 (see Table 1), with Algeria, Bahrain, Egypt and Tunisia being included in the last issue, in 2007. The population-based age-standardized cancer incidence data for the major body sites in Volume IX were examined for the present paper (see Tables 2 and 3 for females and males respectively). In addition, findings for Jordan and the Palestinian Authority were obtained from <http://mecc.cancer.gov> (Freedman et

al., 2007) and for Lebanon, Saudi Arabia and Qatar, from Shamseddine et al (2004), Bazarbashi et al (2001) and Bener et al (2008), respectively.

Percentages of all neoplasms for the five most frequent cancers for these and other countries illustrated graphically in Figure 2 were from Globocan 2002 or from hospital-based registries in Libya (El Mistiri et al., 2007), Yemen (Al-Thobhani et al., 2001), Bahrain (Alsayyad and Hamadeh, 2007) and Iraq (Habib et al., 2006; 2007).

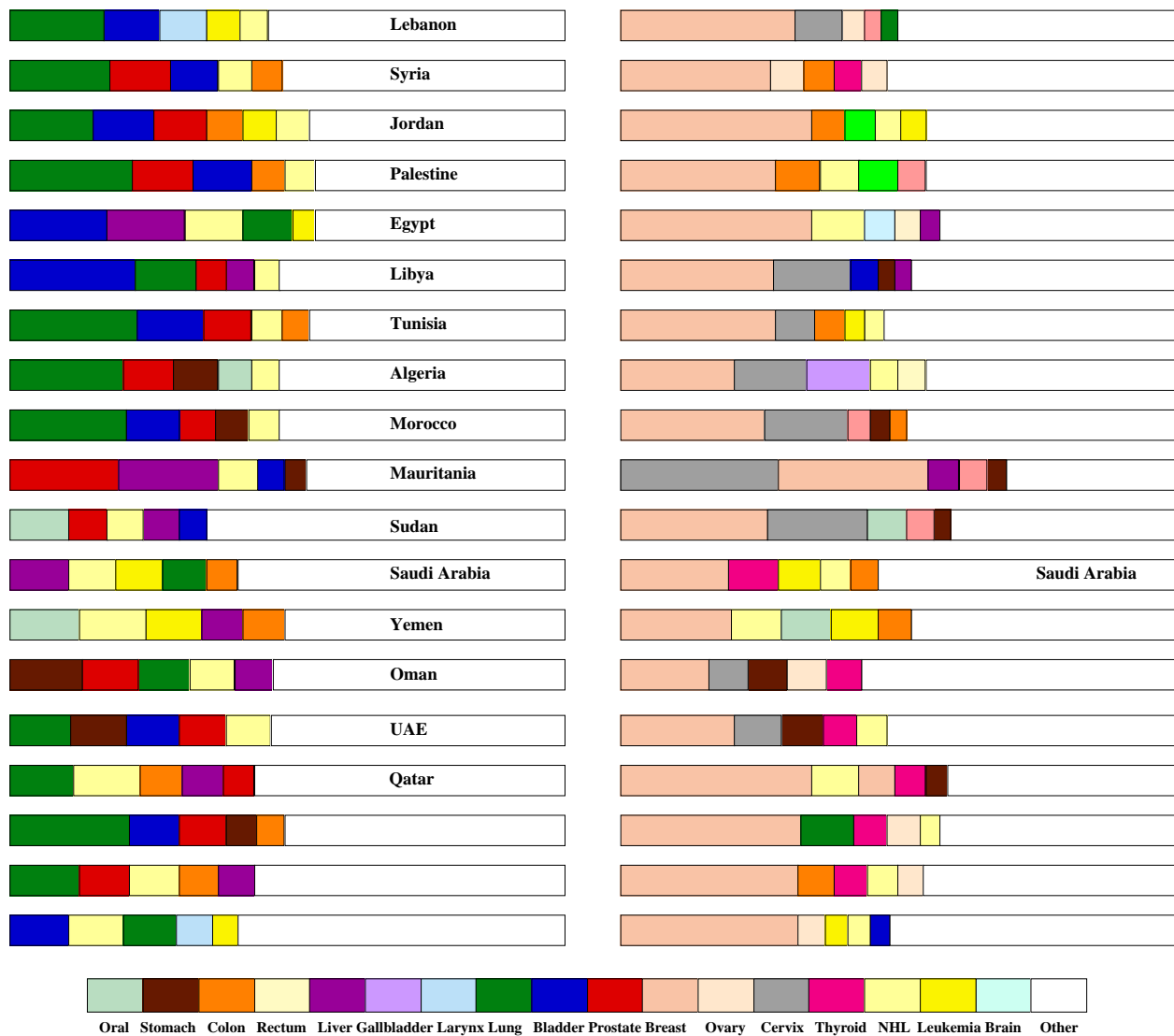
In males, while lung cancer featured in the most frequent neoplasms in the latest data in all but the Yemen case, urinary bladder tumours were more prevalent in three countries and liver and oral cavity lesions occupied the first position in Saudi Arabia and the Yemen, respectively. Mauritania was also exceptional in having prostate cancer as number one. For countries not included in Figure 2, Syrian males in Aleppo demonstrated age-adjusted incidence rates highest for bladder, leukaemia and lung cancers, in that order (Mzayek et al., 2002), while in Libya the most frequently diagnosed malignancies were lung cancer (19%) and colorectal cancer (10%), followed by cancers of the head and neck (9%) and bladder (9%) (El Mistiri et al., 2007). In the Moroccan National Oncology Institute, for 1986 and 1987 in males, nasopharyngeal cancer accounted for 12.3%, lymphoma 10.1%, laryngeal cancer 8.2% and lung cancer 6.5% of the total (Chaouki and el Gueddari, 1991). In the Al Jouf region of Saudi Arabia, lymphomas and leukemias combined, colorectal and skin cancers have been reported to be the most common (El Hag et al., 2002). In Gaza, lung cancer, and again leukaemia and lymphoma appear to be the most frequent (Kahan et al., 1997).

Breast cancer, almost without exception, is the most

**Table 2. Population-based Cancer Registry Data for Arab Countries - Females**

	Jordan <sup>#</sup>	Palestine <sup>*</sup>	Egypt <sup>*</sup>	Saudi <sup>**</sup>	Algeria <sup>*</sup>	Tunisia <sup>*</sup>	Oman <sup>*</sup>	Qatar <sup>##</sup>	Bahrain <sup>*</sup>	Kuwait <sup>*</sup>
Buccal	2.3	0.7	0.1	1.3	0.2	0.7	1.0	0.7	1.6	1.5
Pharynx	0.2	0.4	1.8	0.3	0.6	0.3	0.5	-	1.5	0.2
Nasopharynx	0.5	0.4	1.8	0.7	1.7	1.9	0.3	-	0.3	0.8
Oesophagus	0.7	0.4	0.9	0.9	0.2	0.2	2.7	1.1	1.8	1.6
Stomach	3.5	3.5	2.0	1.7	3.1	2.5	6.2	2.5	5.4	2.6
Colon	7.2	10.8	2.7	3.1	2.8	6.1	2.2	2.2	5.1	7.6
Rectum	3.0	3.7	1.7	1.8	3.8	2.9	1.4	6.1	2.2	4.2
Liver	1.3	0.7	4.5	2.2	0.8	0.7	3.2	1.8	3.1	3.6
Gallbladder	0.3	2.8	1.0	1.1	10.0	3.1	1.1	0.7	0.9	1.7
Pancreas	1.0	2.4	2.3	0.6	0.3	1.9	1.6	1.1	2.8	3.0
Larynx	0.4	0.6	0.3	0.1	0.1	0.2	0.3	-	0.7	0.5
Trachea, lung	3.1	5.1	3.6	1.4	1.7	1.7	2.3	2.5	11.8	4.6
Breast	38.0	38.5	42.5	11.8	18.8	29.8	14.6	30.1	46.8	41.3
Ovary	4.6	3.7	5.1	2.3	2.1	3.3	6.2	-	7.4	5.4
Corpus uteri	5.8	9.0	2.6	2.0	1.1	3.4	0.9	-	5.2	3.6
Cervix uteri	2.6	2.4	2.1	2.2	11.6	7.1	6.5	-	6.0	4.5
Kidney	1.9	1.6	1.5	1.2	1.2	1.6	1.6	1.8	3.5	2.0
Bladder	1.8	1.7	3.1	1.2	0.5	2.2	2.2	0.7	3.8	2.9
Brain	3.6	3.3	6.2	1.3	1.6	1.8	2.6	1.4	0.9	3.1
Thyroid	4.5	7.0	2.6	4.4	3.6	3.1	5.9	5.7	7.7	7.3
Non-Hodgkin	5.4	9.1	9.9	4.1	3.8	3.7	4.4	6.8	5.6	6.5
Leukemia	4.9	3.9	4.1	2.7	2.4	3.6	3.3	-	3.3	3.8
Total	112	134	122	58	85	106	91	87	143	129

From: <sup>\*</sup>Curado et al., 2007; <sup>\*\*</sup>Bazarbashi et al., 2001; <sup>#</sup>Freedman et al., 2007; <sup>##</sup>Bener et al., 2008

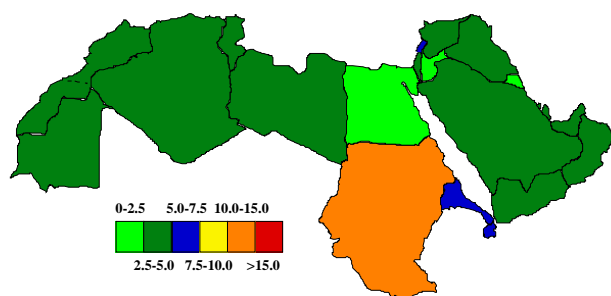


**Figure 2. Percentage Data for the Five Most Prevalent Cancers in Countries of the Middle East**

**Table 3. Age-standardized Cancer Incidence Data for Arab Countries - Males**

	Jordan <sup>#</sup>	Palestine <sup>*</sup>	Egypt <sup>*</sup>	Saudi <sup>**</sup>	Algeria <sup>*</sup>	Tunisia <sup>*</sup>	Oman <sup>*</sup>	Qatar <sup>##</sup>	Bahrain <sup>*</sup>	Kuwait <sup>*</sup>
Buccal	2.6	2.7	0.5	1.0	1.4	2.6	2.3	-	3.3	1.8
Pharynx	2.3	0.5	1.8	0.3	4.5	0.7	0.4	-	0.8	0.3
Nasopharynx	2.3	1.1	1.8	2.5	5.4	4.6	1.0	0.7	2.9	1.7
Oesophagus	1.5	1.1	1.7	1.3	0.2	0.5	2.6	0.4	4.2	2.2
Stomach	6.0	6.7	3.3	2.4	7.1	5.1	13.4	2.0	8.5	3.4
Colon	7.6	10.6	4.2	2.4	3.0	6.5	2.5	3.4	7.9	8.4
Rectum	3.9	8.3	2.1	2.4	3.6	5.1	2.1	3.0	4.4	5.2
Liver	1.9	2.6	21.9	5.9	1.1	2.2	7.4	3.4	5.3	8.1
Gallbladder	0.8	2.0	1.2	0.8	2.1	1.8	0.7	-	0.8	1.8
Pancreas	1.8	5.0	4.0	1.1	0.5	2.5	2.1	0.7	4.9	3.7
Larynx	4.8	6.1	4.2	1.4	2.8	5.7	1.4	0.9	4.7	2.7
Trachea, lung	16.4	40.4	14.0	4.1	19.9	37.1	9.8	5.9	34.2	15.6
Prostate	11.2	20.0	8.5	3.4	7.5	14.1	10.5	3.0	14.3	10.5
Kidney	3.4	4.4	2.5	1.7	0.7	2.6	1.7	1.6	4.7	5.8
Bladder	13.2	18.1	27.9	2.9	4.5	19.0	5.1	1.8	14.7	6.3
Brain	4.4	4.9	4.0	1.9	0.7	3.7	3.5	2.0	3.0	5.1
Thyroid	1.7	2.0	1.1	1.5	1.4	1.3	1.7	-	1.1	3.5
Non-Hodgkin	7.3	10.0	16.9	4.4	5.3	6.7	8.2	5.9	7.1	10.4
Leukemia	7.3	7.3	5.4	3.9	3.1	5.1	4.8	-	7.7	4.9
Total	115	183	162	59	94	160	105	51	160	121

From: <sup>\*</sup>Curado et al., 2007; <sup>\*\*</sup>Bazarbashi et al., 2005; <sup>#</sup>Freedman et al., 2007; <sup>##</sup>Bener et al., 2008



**Figure 3. Male Melanoma Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)

frequent tumour type in females, followed by colon in five populations and cervix in three. In Syrian females age-adjusted incidence rates were highest for breast, uterus (+ cervix) and leukaemia (Mzayek et al., 2002). In Gaza, leukaemia and lymphoma occupy second and third place (Kahan et al., 1997). Cervical cancer was earlier found to be number one in Morocco (Chaouki and el Gueddari, 1991), but it is conceivable that the situation has now changed.

## Organ Specific Epidemiology

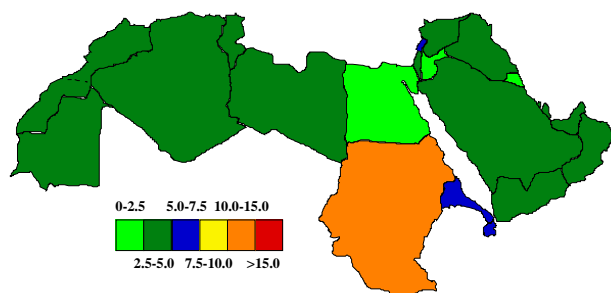
### Skin Cancer

Skin cancer, including melanoma, is rare in the region, with the exception of Sudan (see Figure 3). The most common skin cancers seen, at least in Saudi Arabia, are the basal cell carcinoma (BCC) and squamous cell carcinoma (SCC), with site distributions similar to studies in Caucasians pointing to sun as the risk factor, followed by Kaposi's sarcoma (Al-Maghrabi et al., 2004). In Qatar, BCC is the commonest skin cancer but expatriates account for a large proportion, especially Europeans (Mahmoud and Azadeh, 1996).

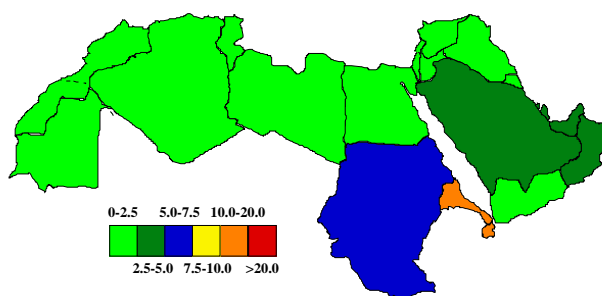
### Oral Cancer

Cancer of the buccal cavity is relatively rare across the Arab countries, with the exception of parts of the Yemen where it may be number one (see Figure 4), thought to be related to the habits of chewing tobacco and qat (Sawair et al., 2007). Qat chewing can provoke the development of oral keratotic white lesions which become more severe with duration (Ali et al., 2004; Scheifele et al., 2007).

Furthermore, in Saudi Arabia there are very wide regional disparities in incidence, with an almost thirty-fold difference between the lowest and highest rates (Brown et al., 2006). The lower lip may be the most



**Figure 4. Male Oral Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)



**Figure 5. Male Oesophageal Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)

commonly affected site followed by the tongue in Iraq (Al-Rawi and Talabani, 2008). In Jordan, the floor of the mouth is the most common site, then again the tongue (Ma'aita, 2000). Of the cases of cancer recorded in the Kuwait Cancer Registry in the 10 years 1979-1988, 7.4% involved the lip, oral cavity or pharynx (Morris et al., 2000).

### Oesophageal Cancer

In clear contrast to Iran, the Arabic world has generally very low incidences of oesophageal cancer (see Figure 5). CIV data for relative incidence of the squamous cell carcinoma and adenocarcinoma types are listed in Table 4.

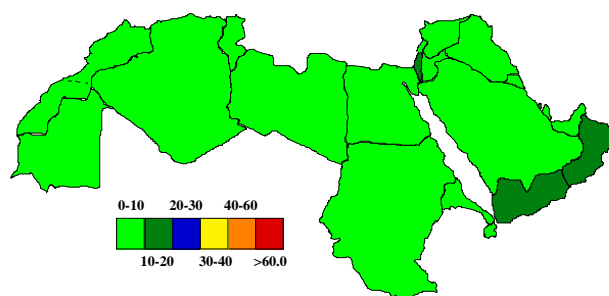
The reason for the variation between countries and sexes remains unclear. In Bahrain, in direct opposition to the CIV data, SCC (males) and adenocarcinomas (females) were reported to be the main histological types, with the lower and upper third of the oesophagus as the most and least frequently involved sites, respectively (Al-Hilli and Malik, 2003). The reason why the CIV data are not in agreement is unclear. In the Yemen, a preponderance of women with carcinoma of the mid-oesophagus was noted, previously only recorded in areas of high prevalence, with a high frequency of Qat chewing and water-pipe smoking found for both men and women (Gunaid et al., 1995). A slight preponderance of female cases was also earlier found for Qataris, in this case with nutrition and social status reported to be probable etiologic factors (Ejeckam et al., 1993).

### Stomach Cancer

With the exception of males in Oman, gastric cancer incidences are low (Figure 6). The fact that Omani females also have a relatively high value suggests a specific factor in this country. The marked difference from Iran is not

**Table 4. Oesophageal Cancer Histopathology: SCC-AC Percentages (Curado et al., 2007)**

	Male			Female		
	SCC	AC	Ratio	SCC	AC	Ratio
Egypt	60	25	2.4:1	80	14	5.7:1
Palestine	28	27	1.0:1	18	37	0.5:1
Algeria	33	0	---	33	33	1.0:1
Tunisia	100	0	---	50	50	1.0:1
Bahrain	52	52	1.0:1	80	0	---
Kuwait	38	38	1.0:1	67	33	2.0:1
Oman	28	26	1.0:1	25	31	0.8:1



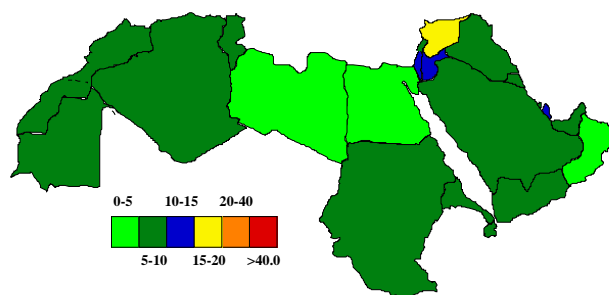
**Figure 6. Male Gastric Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)

due to a lower frequency of the more virulent *H. pylori* strains, at least from data for Iraq (Hussein et al., 2008). Furthermore, in the Gulf, there was no difference found between farmers with a lower standard of living and non-farmers in respect of their *H. pylori* profiles (Bener et al., 2006). The prevalence of infection with the bacteria in dyspeptic patients in Yemen appears high (Gunaid et al., 2003).

#### Colorectal Cancer

The incidences of colon and rectum cancer in the Arab world are relatively low, although in some of the more affluent countries it is number two after breast (see Figure 7). There is only limited variation in incidence rates between sexes and the colon-rectum ratio varies from approximately 1:1 to 3:1 (see Table 5), with the one exception of Algeria where rectal cancers are in the majority.

In Yemen there is a relatively high proportion of early-onset tumors (19.3% of cases were <40 years), with a left sided subsite distribution (49.4% of cases in the rectum and rectosigmoid junction) (Basaleem and Al-Sakkaf, 2004). Similarly, in Egypt 38% of patients are younger than 40 and 75% of lesions are on the left side (Abou-



**Figure 7. Male Colorectal Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)

**Table 5. Colorectal Cancers: Colon and Rectal Carcinoma Incidences and Ratios (Curado et al., 2007)**

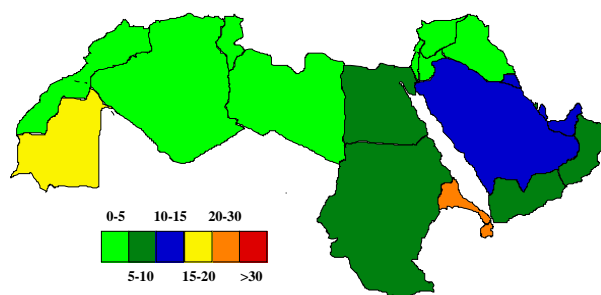
	Male			Female		
	Colon	Rectum	Ratio	Colon	Rectum	Ratio
Egypt	4.2	1.2	3.5:1	2.7	1.7	1.6:1
Palestine	10.6	8.3	1.3:1	10.8	3.7	2.9:1
Algeria	3.0	3.6	0.8:1	2.8	3.8	0.7:1
Tunisia	6.5	5.1	1.3:1	6.1	2.9	2.1:1
Bahrain	7.9	4.4	1.8:1	5.1	2.2	2.3:1
Kuwait	8.4	5.2	1.5:1	7.6	4.2	1.8:1
Oman	2.5	2.1	1.2:1	2.2	1.4	1.6:1

Zeid et al., 2002), and in Qatar the descending and sigmoid colon is the most common anatomical site affected (Rasul et al., 2001). Cases in Saudi Arabia also tend to be relatively young (Mansoor et al., 2002). The profound rightward shift of colorectal carcinoma described in Saudi Arabia, compounded with a rising incidence of advanced lesions in younger age group, is also of interest (Guraya and Eltinay, 2006). Arab patients appear to be relatively young in Palestine with a high percentage of poorly-differentiated and mucinous, advanced stage cancers (Shpitz et al., 2006). A high proportion of familial MSI cases and a low incidence of TP53 mutations were recently reported to be hallmarks of Saudi colorectal carcinomas (Bavi et al., 2008).

The low incidence of colorectal cancer in the Arab countries could be due to the dietary factors, with high intake of fruit and vegetables (Al-Shamsi et al., 2003). One environmental factor might be pesticides. Thus farming in Egypt is associated positively with high serum organochlorines and serum levels in colorectal cancer patients may be higher than in appropriate controls (Soliman et al., 1997).

#### Liver Cancer

Liver cancer, while much less frequent than in high-incidence countries, is nevertheless a major problem in males in Egypt and Saudi Arabia and to a lesser extent in the other countries of the Gulf (see Figure 8). The hepatocellular carcinoma accounts for the majority of tumours although there some variation between the sexes in the relative incidence of cholangiocellular carcinomas (CCC) (see Table 6). The hepatitis B virus (HBV) is the leading cause of HCC in Lebanon (Yaghi et al., 2006) and in Egypt (Anwar et al., 2008), but in the latter HCV has now become the predominant factor associated with the more recent epidemic. It has been well documented



**Figure 8. Male Liver Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)

**Table 6. Liver Cancer Histopathology: HCC-CCC Percentages (Curado et al., 2007)**

	Male			Female		
	HCC	CC	Ratio	HCC	CC	Ratio
Egypt	88	4	22.0:1	80	6	13.3:1
Palestine	69	3	23.0:1	42	14	3.0:1
Algeria	39	31	1.3:1	0	60	---
Tunisia	65	18	3.6:1	60	20	3.0:1
Bahrain	75	15	5.0:1	54	27	2.0:1
Kuwait	77	8	9.6:1	89	11	8.1:1
Oman	77	16	7.7:1	67	27	2.5:1

that Egypt has one of the highest prevalence rates of HCV infection in the world with different strains involved (Abdel-Hamid et al., 2007), but there may also be an etiological role for aflatoxin B1 (Hifnawy et al., 2004). There is significant geographic variation in incidence among districts (Lehman et al., 2008). Prevalence of HCC is high in the Nile Delta area, and is more common in males, rural residents and farmers so that pollution due to insecticides might be a risk factor (Abdel-Wahab et al., 2007).

#### Gallbladder Cancer

Algerian females appear to be exceptional in having a relatively high proportion of gallbladder cancer cases (see Figure 2), the tumour elsewhere in the region being generally rare.

#### Pancreatic Cancer

Except in the Lebanon and Syria, rates for pancreatic cancer are generally low (see Figure 9), the reported clustering of cases in the northeast Nile delta region possibly being related to water pollution (Soliman et al., 2006), very probably linked to cadmium and farming (Kriegel et al., 2006). In general, multiple tobacco consumption methods, passive smoking, pesticide exposures, and diabetes are associated with an increased risk for pancreatic cancer, with prolonged lactation and increased parity associated with a reduced risk (Lo et al., 2007).

#### Nasopharyngeal Cancer

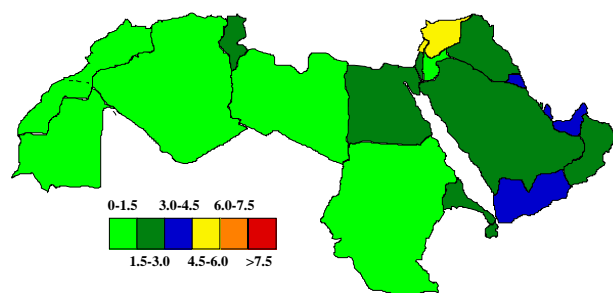
Nasopharyngeal cancer is relatively common in Western North African males but otherwise rare. Characteristics of NPC patients in Lebanon and their parameters of outcome are comparable to those reported in Western series (Geara et al., 2005). Early onset suggests a possible underlying genetic susceptibility in Saudi Arabians (Andejani et al., 2004).

#### Laryngeal Cancer

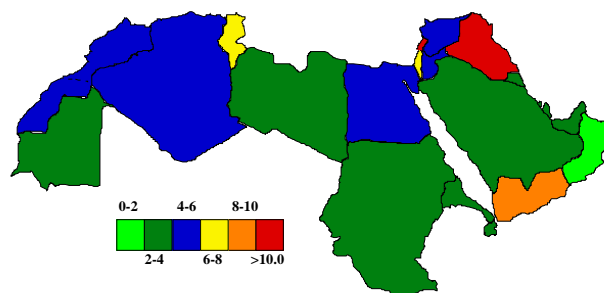
Iraq, the Lebanon and to a lesser extent the Yemen, Egypt and relatively developed North Africa, have high incidences of laryngeal cancer, it elsewhere appearing of relatively minor importance (see Figure 10).

#### Lung Cancer

Although incidences are lower than in the West (see Figure 11), of the countries included in Figure 2, seven of



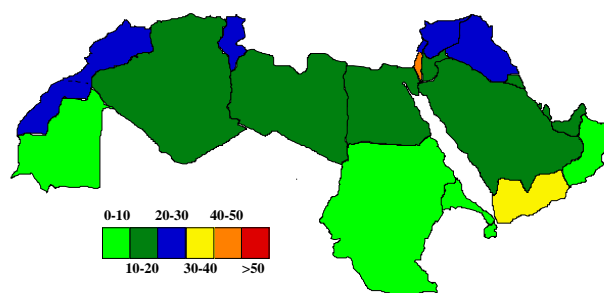
**Figure 9. Male Pancreatic Cancer Incidences/100,000** (Globocan, 2002: Ferlay et al., 2004)



**Figure 10. Male Laryngeal Cancer Incidences/100,000** (Globocan, 2002: Ferlay et al., 2004)

thirteen have lung cancer as number one, and all but one include the site in the most frequent five. In a recent survey, the highest ASR was in Bahrain (34.3 for males, 12.1 for females) followed by Qatar (18.5 and 5.5 ) and Kuwait (13.8 and 4.0); the lowest rates were in Saudi Arabia (4.8 and 1.3 for females) (Al-Hamdan et al., 2006). From CIV data, squamous cell carcinomas and adenocarcinomas account for approximately the same proportions in males, while adenocarcinomas (AC) tend to predominate in females (see Table 7). In Tunisia, the AC incidence was relatively low in 1990 when compared to western countries, but this has been shown to increase to become more common than the SCC type (B'chir et al., 2007). This was not evident in the CIV data, however.

The marked increase in the incidence of lung cancer among Palestinian Arab men during the last decade, without any evidence of increased smoking prevalence, might reflect a gradual loss of some apparent protection in this subpopulation (Tarabeia et al., 2008). In Egypt there has been a report that pleural mesothelioma is increasing, survival being linked to genetic alteration (Gaafar and Eldin, 2005).

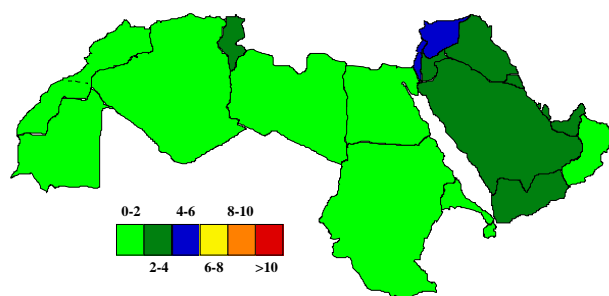


**Figure 11. Male Lung Cancer Incidences/100,000** (Globocan, 2002: Ferlay et al., 2004)

**Table 7. Lung Cancer Histopathology: SCC-Adenocarcinoma Ratios (Curado et al., 2007)**

	Male			Female		
	SCC	AC	Ratio	SCC	AC	Ratio
Egypt	22.4	24.2	0.9:1	9.1	50.0	0.2:1
Palestine	28.0	26.6	1.1:1	7.4	50.0	0.1:1
Algeria	63.0	6.4	9.8:1	43.8	28.1	1.6:1
Tunisia	46.6	18.5	2.5:1	23.5	29.4	0.8:1
Bahrain	34.5	21.6	1.6:1	26.9	30.8	0.9:1
Kuwait	17.1	18.9	0.9:1	18.8	37.5	0.5:1
Oman	28.5	26.0	1.1:1	25.0	31.3	0.8:1





**Figure 12. Male Kidney Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)

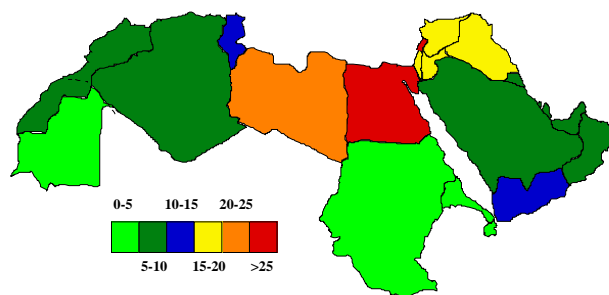
#### Kidney Cancer

With the exception of males in Syria, Lebanon and Palestine, renal cancer incidences are low in the Arab world (see Figure 12).

#### Urinary Bladder Cancer

While urinary bladder cancers are well known to be the predominant neoplasm in Egyptian males (see Table 2), high rates are also present in Iraq, Jordan Tunisia and Bahrain, but not in Qatar and elsewhere in the Gulf, pointing to considerable variation in risk factors across the Arab world (see Figure 13). Data for the histopathological distribution are summarized in Table 8.

Traditionally, *Schistosoma haematobium* has been considered the most important etiological agent (Bedwani et al., 1998), but transitional cell carcinoma has recently become the most frequent type in Egypt, replacing lesions with squamous features generally associated with parasites, corroborating findings from small-scale hospital-based studies indicating that the etiology of bladder cancer has changed significantly over the past 26 years (Felix et al., 2008). A remarkably strong association with various measures of cigarette smoking has been found that could explain 75% of bladder cancer cases among males from



**Figure 13. Male Urinary Bladder Cancer Incidences/100,000** (Globocan, 2002; Ferlay et al., 2004)

**Table 8. Urinary Bladder Cancer Histopathology: TCC-SCC Ratios (Curado et al., 2007)**

	Male			Female		
	SCC	TCC	Ratio	SCC	AC	Ratio
Egypt	19.9	69.0	0.29:1	40.1	47.4	0.85:1
Palestine	0.0	96.4	INF:1	0.0	96.2	INF:1
Algeria	11.4	58.6	0.19:1	0.0	60.0	INF:1
Tunisia	1.1	94.3	0.01:1	4.5	90.9	0.05:1
Bahrain	2.7	79.5	0.04:1	10.0	75.0	0.13:1
Kuwait	4.3	91.3	0.04:1	4.8	81.0	0.06:1
Oman	12.0	80.7	0.15:1	8.6	68.6	0.13:1

Alexandria (Bedwani et al., 1997). This is in line with the fact that polymorphisms in glutathione S-transferase genes are associated with increased risk of bladder cancer (Saad et al., 2005). Interestingly, odds ratios were 15.8 for male ever-smokers with a history of urinary schistosomiasis, compared with never-smokers without such a history, and 3.2 for men ever-infected with urinary *Schistosoma haematobium* and ever-employed in high-risk occupations, compared with those never-infected and with no high-risk occupational history (Bedwani et al., 1998).

Despite the high prevalence, there are no population-based bladder screening programs in place. Combining NMP22 with malignant or suspicious cytological result improved sensitivity for the detection of bladder cancer but with a major decrease in specificity, suggesting a potential role in screening rather than diagnosis (Kapila et al., 2008).

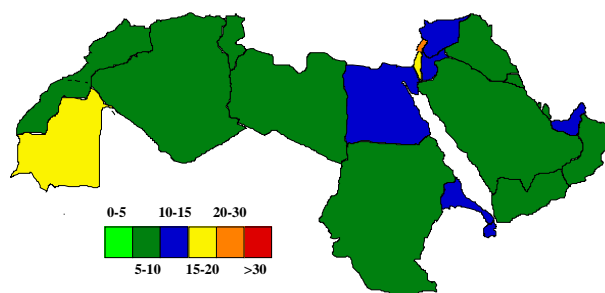
#### Prostate Cancer

In many of the countries of the Middle-east, prostate cancer is already a problem (see Figure 14) and in Mauritanian males it is the most frequent neoplasm (see Figure 2). A Egyptian case-control study pointed to sausages, butter and natural ghee as risk factors, while vegetables were protective (Kamel et al., 2006).

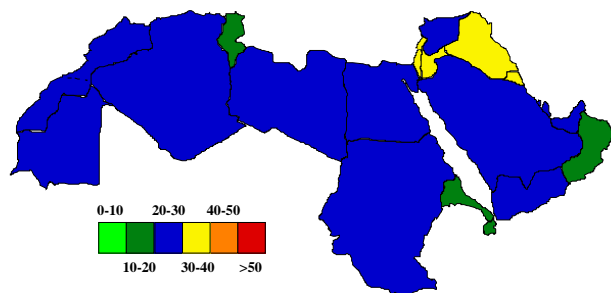
Screening is opportunistic. However, data should be interpreted with caution because public awareness campaigns have led to large numbers of individuals being found positive. Arab Kuwaiti and Omani men were reported to have lower serum PSA levels and prostate volumes than those reported for Caucasians, but similar to those reported for Asians (Japanese and Chinese) (Kehinde et al., 2005). Mean PSA values for Saudi men are also low (Kamal et al., 2003). Although raised serum PSA is commonly associated with prostate cancer, subclinical prostatitis is a significant source of high serum PSA in over 40% of men in Kuwait, suggesting the need for a locally applicable paradigm to identify prostate cancer (Anim et al., 2007).

#### Breast Cancer

Breast cancer now occupies the number one position in all countries of the Arab world, even if absolute rates are relatively low (see Figure 15). Cases tend to be young and almost half of patients are below 50, with a median age of 49-52 years as compared to 63 in industrialized nations (El Saghier et al., 2007). A preponderance in



**Figure 14. Prostate Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)



**Figure 15. Female Breast Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)

relatively young individuals has been reported for the Lebanon (El Saghir et al., 2002), Alexandria in Egypt (Hosny and Elkaffas, 2002a), and Aden in the Yemen (Abdul Hamid et al., 2001).

Epidemiological findings point to the same risk factors as in the Western world. A positive family history of breast cancer, young age at menarche, late age at last full-term pregnancy and wide inter-birth interval were significant predictors for occurrence in Egypt (Kishk, 1999). Postmenopausal obesity is a significant risk factor in Jordan, along with number of pregnancies (more than 4) (Atoum and Al-Hourani, 2004a). On the other hand, longer period of breast feeding (more than 24 months) decreases the risk (Atoum and Al-Hourani, 2004b). Risk factors in Kuwait include high BMI, lack of regular exercise, early age at menarche, late age at first pregnancy, hormonal therapy, and frequent consumption of carbohydrate, sweets, animal fat, and vegetable oil (margarine) with low intake of fresh vegetables and olive oil (Saleh et al., 2008). In Iraq, family history and oral contraceptives use were found to be associated (Fakri et al., 2006). Parental consanguinity in Arabs, even when a marriage is between first cousins or double first cousins, was not associated with an altered risk of breast cancer (Denic et al., 2005). Infertility and usage of infertility drugs in general are not associated with increased risk for breast cancer (Lerner-Geva et al., 2004). One analysis yielded an estimated 73% higher breast cancer incidence in the highest compared to the light at night exposed communities (Kloog et al., 2008). High-risk HPV infections are associated with human breast cancer progression in Syrian women (Akil et al., 2008).

Locally advanced disease is very common in Egypt, Tunisia, the Yemen, Saudi Arabia, Kuwait, Syria, Palestine and others, and total mastectomy is the most commonly performed surgery (Abdul Hamid et al., 2001; Chiedozi et al., 2003; El Saghir et al., 2007; Saleh et al., 2007; Tarabeia et al., 2007). Metastases were reported to be relatively low in one study (Abuzallouf et al., 2007), but this appears exceptional. Overall 5 year survival rates available from the literature are 59.6% in Saudi Arabia (Ravichandran et al., 2005) and 68.8% in Bahrain (Fakhro et al., 1999) while in Oman 5-year relapse-free and overall survival rates were reported to be 62% and 64%, respectively (Al-Moundhri et al., 2004). Prevalence of HER2/neu overexpression in a small sample of Qatari female cases was found to be 26%, linked to an elevated relapse rate and mortality (Rasul et al., 2003).

Results from recent studies like the Cairo Breast Cancer Screening Trial show a positive impact of clinical breast

examination leading to more early diagnosis and breast-conserving surgery, so that population-based screening in those countries with affluent resources and accessible care should be implemented (El Saghir et al., 2007).

Knowledge of breast cancer risk-factors and screening awareness are high among women nurses and teachers in Amman, Jordan (Madanat and Merrill, 2002) but health workers infrequently offered screening examinations and women were found to lack adequate knowledge about breast cancer screening in Qatar (Bener et al., 2001). Health planners and healthcare providers must capitalize on encouraging factors and minimize deterring factors to optimize breast cancer screening practices (Bener et al., 2002). Screening campaigns should also target husbands to encourage their wives to enrol (El Saghir, 2007).

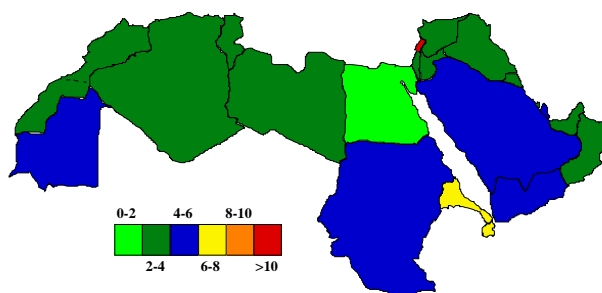
Positive correlations were found between nursing students BSE practice and their academic experience in nursing college in Saudi Arabia (Alsaif, 2004). Female secondary-school students in Jeddah demonstrated only low knowledge of risk factors and presentation in those not having familial experience (Milaat, 2000), although the vast majority demonstrated a positive attitude towards learning breast self-examination (Altaf et al., 2004). There is a significant association between failure to practise breast self-examination and diagnostic delay in Egypt (Abdel-Fattah et al., 2000). Guidelines are clearly needed (Altaf, 2004). Husbands whose wives have breast cancer may also need a network of support to address their specific issues and concerns (Woloski-Wruble and Kadmon, 2002).

### Ovarian Cancer

Ovarian cancer is moderately frequent in the Middle-east (see Figure 16). The majority of lesions are serous, followed by mucinous and adenocarcinoma types (Curado et al., 2007). It has been suggested that substitution of non-animal for animal fat during adult life might reduce the risk of ovarian cancer (Lubin et al., 2006).

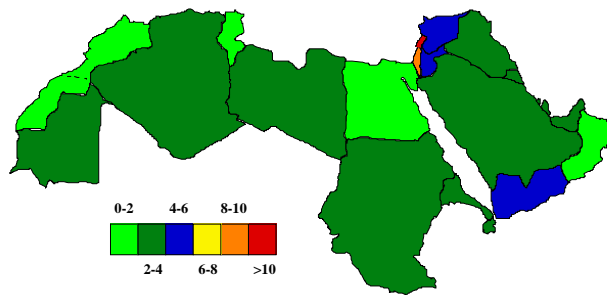
### Endometrial Cancer

Endometrial cancer of the corpus uterus is relatively infrequent, with a picture similar to that for the ovary (see Figure 17). Research has indicated elevated risk with increased number of abortions, ovarian cycles and live births, and decreased risk with increased parity as compared to the nulliparous case (El-Khwsy et al., 2006). In another study, endometrial thickness >5mm, diabetes, hypertension and obesity were not found to be among the risk factors, in contrast to age and occurrence of post



**Figure 16. Ovarian Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)





**Figure 17. Endometrial Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)

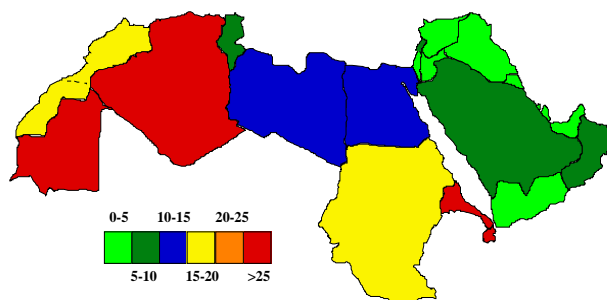
menopausal bleeding (Al-Kadri et al., 2004).

#### *Cervical Cancer*

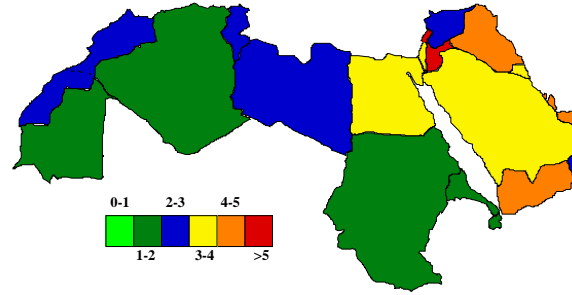
While cervical cancer is generally low in the Arab world (see Figure 18) and does not appear to be increasing, it still occupies second place for frequency in Algeria, Tunisia and Oman. Furthermore, there may be some under-reporting and in a prospective study in Saudi Arabia the percentage of abnormal pap smears was 4.7%, much higher than the 1.6% reported in the compounded literature (Altaf, 2006). Adeocarcinomas account for approximately 10% of the lesions (Curado et al., 2007).

Clearly the human papilloma virus is the prime risk factor and the Muslim religious background is naturally of great significance in this regard. It should be mentioned in this context that penile cancer is also extremely rare, as for example documented in Saudi Arabia (Abomelha, 2004). Regarding risk factors, early marriage, frequent coitus started early in life and increasing number of pregnancies are predisposing factors, while abortions and age at menarche are without influence (Ejeckam et al., 1994). Polygamy, smoking and hormonal contraception were not identified as risk factors in one study, whereas positive women again showed higher parity (Hajjaj et al., 2006). In Egypt, HPV 16/18 is the major risk factor, frequently with mixed infections and bilharzial infestation (el-All et al., 2007).

Screening programs are not in place and one problem is with attitudes. Of 98 physicians who participated in a study in the UAE, only 40% reported ever having performed a Pap smear, so that a training programme on cervical screening was considered necessary (Badrinath et al., 2004). In Jordan, about a third of women were found to be unaware of the significance of a positive cervical smear and three-quarters did not know the causes of



**Figure 18. Cervical Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)



**Figure 19. Male Brain and Nervous Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)

neoplastic development (Maaaita and Barakat, 2002).

#### *Brain and Nervous Tissue Cancer*

Relative to world levels, incidence rates for brain and nervous cancer in the region are relatively high (see Figure 19). The incidence of acoustic neuroma in Qatar is slightly higher than that in other countries, with a possible link to frequent cellular phone use (Salahaldin and Bener, 2006).

#### *Thyroid Cancer*

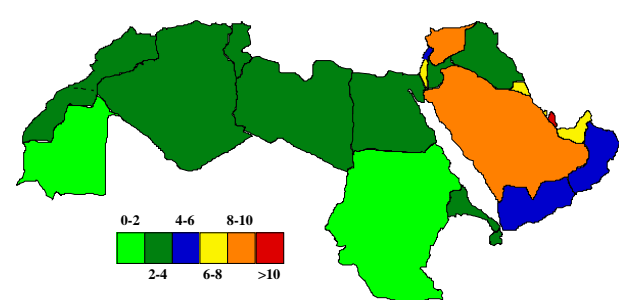
Thyroid cancer is of medium importance (see Figure 21), but occupies the number two position in females in Saudi Arabia and is prevalent in other countries of the Gulf as well as Jordan. The dramatic decline in the incidence of follicular thyroid carcinoma combined with the increase in the advanced forms in Central Jordan may suggest a possible environmental factor (Shomaf et al., 2006). In contrast, papillary carcinomas form the bulk of cases in the Yemen, where the salt iodization program might have an effect on the incidence (Abdulgumhni et al., 2004).

#### *Leukemias and Lymphomas*

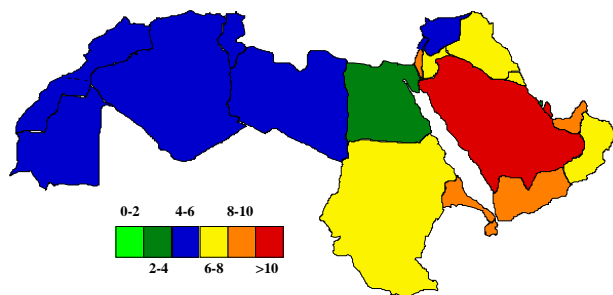
In both sexes, Non-Hodgkins lymphomas and to a lesser extent leukemias, are relatively important neoplasms across the region (see Figures 21 and 22). However, research findings are limited, especially as to risk factors. There is some support for the hypothesis that NHL is a malignant outcome of chronic HCV infection (Cowgill et al., 2004). It is possible that the tumour type is increasing, from data for Alexandria, particularly in the elderly population (Abdel-Fattah and Yassine, 2007).

#### *Childhood cancers*

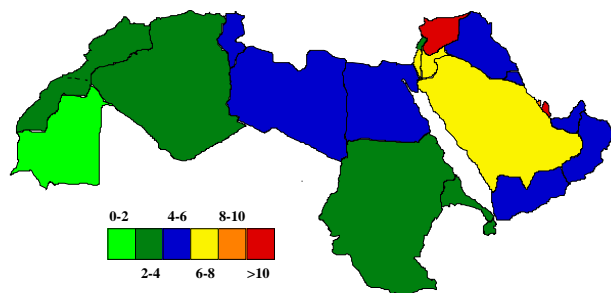
There are only limited research data for cancers of childhood in the Middle-East. However, it is likely that



**Figure 21. Male Thyroid Cancer Incidences/100,000**  
(Globocan, 2002; Ferlay et al., 2004)



**Figure 22. Male Non-Hodgkins Lymphoma Incidences/100,000** (Globocan, 2002; Ferlay et al., 2004)



**Figure 23. Male Leukemia Incidences/100,000** (Globocan, 2002; Ferlay et al., 2004)

lymphatic and haemopoietic cancer incidences are increasing (Hosny and Elkaffas, 2002b).

## Future Perspectives

It should be stressed that cancer registry data in the region are scanty, especially for those countries with large populations, so that emphasis should be placed on better development of regional and national registries. There may be too much reliance on pathology reports and leukemias, for example are likely to be under-reported. Optimally, governments would make registration mandatory, with roles for WHO/UICC/OARC in assuring quality and reliability. To create an environment conducive to more allocation of resources and personnel, Arab scientists need to report their data in peer-reviewed journals (El-Saghir et al., 2007).

Although most of the registries in the Middle East have not been operating for a sufficient length of time to give information on time trends, data are available over 30 years for Palestinians and for 25 years for Kuwaitis (see Table 9). Common to both are relatively consistent increases in cancers of the colon, prostate, endometrium and breast, as well as Non-Hodgkins lymphomas and perhaps ovarian and thyroid cancers. All of the adenocarcinomas are considered linked to a Westernized lifestyle. A nutrition transition, as well documented for Egypt (Galal, 2002) has occurred in the context of abundant dietary energy availability, urbanisation and moderate fat intakes. The prevalence of obesity in adults in the region is very high, particularly among women. The prevalences of diabetes mellitus and of hypertension parallel that of obesity. Smoking, physical inactivity, and obesity contribute substantially to the burden of chronic disease (Centers for Disease Control and Prevention, 2002; Kulwicki and

**Table 9. ASR Cancer Incidence Over Time - CIV**

Volume	IV*	V**	VI#	VII##	VIII##	IX+
<b>Kuwait</b>						
Oesophagus	---	1.7	3.7	1.7	1.7	2.2
Stomach	---	5.6	4.1	4.1	5.6	3.4
Colon	---	6.3	1.9	3.5	6.3	8.4
Rectum	---	4.0	2.4	3.9	4.0	5.2
Liver	---	4.4	7.2	7.3	8.4	8.1
Prostate	---	11.4	4.4	6.5	11.4	10.5
Breast	---	15.9	17.2	32.8	32.8	41.3
Ovary	---	3.3	3.7	4.7	5.7	5.4
Endometrium	---	1.8	2.4	2.4	3.8	3.6
Cervix	---	3.9	4.1	7.6	4.2	4.5
Thyroid	---	6.3	1.4	6.1	7.6	7.3
Larynx	---	3.5	2.4	2.5	3.5	0.5
Lung	---	21.5	14.5	20.3	21.5	15.6
Kidney	---	3.8	2.4	2.1	3.8	5.8
Bladder	---	4.6	5.7	7.0	4.6	6.3
NHL	---	8.6	7.3	5.5	8.6	10.4
Leukemia	---	5.5	7.4	5.1	5.5	4.9
<b>Palestine</b>						
Oesophagus	1.0	1.0	1.1	0.5	0.7	1.1
Stomach	7.2	7.9	6.9	6.8	6.7	6.7
Colon	3.3	4.7	4.6	6.2	9.6	10.6
Rectum	3.1	3.0	3.6	3.1	3.8	8.3
Liver	2.4	2.9	3.0	2.6	3.2	2.6
Prostate	4.9	6.5	7.7	10.4	14.8	20.0
Breast	11.0	14.0	17.0	21.3	27.7	41.3
Ovary	3.8	3.4	2.4	3.0	4.0	5.4
Endometrium	1.2	3.1	2.8	4.9	5.7	3.6
Cervix	2.1	3.0	2.6	3.0	2.5	4.5
Thyroid	1.8	2.5	2.6	4.1	4.8	7.3
Larynx	6.4	4.9	4.1	3.7	5.4	6.1
Lung	28.8	23.4	26.2	29.1	35.1	40.4
Kidney	8.6	2.5	3.3	3.3	3.3	4.4
Bladder	1.8	12.5	9.1	13.1	15.5	18.1
NHL	7.5	6.7	5.4	8.3	9.7	10.0
Leukemia	5.9	5.1	6.2	6.0	7.8	7.3

\*Waterhouse et al., 1982; \*\*Muir et al., 1987; #;##;###Parkin et al., 1992;1997;2002; +Curado et al., 2007

Kepler, 2001).

It is well known from migrant studies that Arab populations were earlier characterized by generally low rates for cancers of colon and rectum, lung, ovary and prostate (McCredie et al., 1994). Cancers which tended to be more common in migrants were stomach, liver, and bladder. These still are important but the future will see the main burden in diabetes-associated tumours, as in the developed world. To what extent these are affluence-related needs to now be determined by epidemiological research into psychosocial factors. The Arab countries are particularly interesting in this regard, given the wide variation in Gross National Product. Hopefully, such enigmas as the decreasing lung rates in Kuwait and very low incidences in some of the Arab countries, despite clear increase in Palestinians, will thereby also be explained.

Given the recent increase in 'hubble bubble' (Arkila, Narkila) smoking by youth across the region, more stress needs to be placed on anti-smoking efforts. Advertising is rampant and uncontrolled in many countries and more protection is clearly required for adolescents. Other areas which need particular attention are smoking nutrition

including the role played by local vegetables and herbs (Abu-Rabia, 2005). The importance of environmental exposure to pesticides and other contaminants has also be highlighted (Safi, 2002). Given the clear variation in cancer burden within the Arab world, despite a shared culture, collaboration across individual registries across the region should lead to a far better understanding of the status and the evidence base which is essential for effective cancer control programs.

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