

RESEARCH COMMUNICATION

Patterns of Cancer Incidence Among the Population of Qatar: A Worldwide Comparative Study

Abdulbari Bener^{1,4}, Hanadi Ayub², Rasul Kakil², Wanis Ibrahim³

Abstract

Background: Cancer is a major public health problem all over the world. Monitoring the evolution of the cancer burden in the State of Qatar is of great value but has never been explored in depth. **Aims:** The aim of the study was to determine the incidence patterns of cancer cases, assess trends during the period 1991 – 2006 and make comparisons with other countries. **Methods:** This was a retrospective cohort study based on the Cancer disease registry of Al Amal Cancer hospital, State of Qatar, from 1991 – 2006. All Qataris and non-Qataris, males and females, who were diagnosed with any type of cancer were included in this study. The diagnostic classification of definite cancer cases was made according to the International Classification of Disease 10th revision (ICD-10). **Results:** A total of 5,825 cancer cases were registered in Qatar during the period 1991 – 2006 with 56.7% in males and 43.3% in females, 35.6% in Qataris and 64.4% in non-Qataris. Incidence rates per 100,000 population showed that lung (5.9), lymph node (5.9), bone marrow (4.1) and connective tissue (3.9) were the top major cancers in men. In women, breast (30.1), genital organs (9), lymph node (6.8), rectum (6.1) and thyroid (5.7) cancers were the leading cancers. There was a sharp rise in the total number of cancer cases during the period 2002-2006 of 57.1% compared to the period 1991-1996. The incidence rate of cancer cases increased with increasing age in all cancer types except for breast cancer in women above 65 years old. During the study period, the five most common cancers among women were different from those in men. The incidence rate per 100,000 population of all cancer types in Qatar (63.1) was remarkably lower than the other Middle East countries and the UK. **Conclusions:** Cancer is an important public health problem in Qatar, with increase in incidence with age. Incidence rates of all cancers were higher across all age groups of women compared to men. Lung cancer was the most frequent cancer diagnosed in men and breast cancer in women. More epidemiological studies are now required to elucidate the patterns of cancer and related risk factors.

Key Words: Epidemiology - cancer - incidence - lifestyle - Qatar

Asian Pacific J Cancer Prev, 9, 19-24

Introduction

Cancer is as a major public health problem worldwide. Each year, ten millions of people are diagnosed with cancer around the world, and more than half of the patients eventually die from it (WHO, 1997). The World Health Organization estimates show that these figures will have doubled by the year 2020 with 20 million new cases and 12 million deaths from cancer alone (Sikora, 1998). Some time ago (Parkin, 1999), cancer accounted for one-tenth of all the deaths in developing countries.

In many countries, cancer ranks the second or third most common cause of death following cardiovascular diseases. With significant improvement in treatment and prevention of cardiovascular diseases, the cancer will soon become the number one killer in many parts of the world. As elderly people are most susceptible to cancer and

population ageing continues in many countries, cancer will remain a major public health problem around the globe (Ma and Yu, 2006).

During 2006 in Europe (Quinn et al., 2003), there were an estimated 3,191,600 cancer cases diagnosed and 1,703,000 deaths from cancer. Cancer remains an important public health problem in Europe and the ageing of the European population will cause these numbers to continue to increase even if age specific rates remain constant. It is documented that although the total population will remain fairly constant, compared with the year 2000, by 2015 there will be a 22% increase in the population aged >65 and a 50% increase in those above 80 years of age. Given the strong association between cancer risk and age, this will lead to a major increase in the cancer burden.

Cancer is a dreadful disease which brings tremendous

¹Dept. of Medical Statistics & Epidemiology, Hamad General Hospital, ²Dept. of Oncology & Hematology, Al Amal Hospital, ³Dept. of Medicine, Hamad General & Rumeilah Hospitals, Hamad Medical Corporation, Qatar, ⁴Dept. Evidence for Population Health Unit, School of Epidemiology and Health Sciences, The University of Manchester, Manchester, UK *For Correspondence: Weill Cornell Medical College, Qatar PO Box 3050, Doha –State of Qatar Fax: + 974-439 3769e-mail: abener@hmc.org.qa, abaribener@hotmail.com

social distress, psychological suffering and hardship to the patients and relatives (Boyle and Ferlay, 2004).

Current evidence indicates that most cancer types are potentially avoidable and can be prevented using the knowledge that is already available. Individual people can do much to reduce their risk of developing cancer. It is now established that cancer is principally caused by environmental factors, of which the most important are tobacco, dietary factors, body mass and physical activity and exposure in the workplace (Magrath and Litvak, 1993; www.werf-uk.org, 2007). Cancers occurring among adolescents and young adults are more likely related to genetic predisposition and exposure to risk factors early in life as compared with cancers among the elderly population.

Qatar, like many other developing countries, has witnessed rapid change in many aspects of life during the last two decades. The discovery of oil in the mid-1900s contributed to significant social change, and Qatar has experienced a rapid transition in its socioeconomic status. This rapid growth and changing environmental and social conditions in the State of Qatar affected the prevalence and patterns of cancer.

No study has yet been conducted to assess the trend and patterns of cancer cases in Qatar other than the Gulf Cooperation Countries cancer incidence report in 1998. Information on overall cancer incidence patterns will not only provide leads for etiologic research but also help us to identify cancers that have the greatest impact on different age groups. The aim of the present study was thus to determine the incidence patterns of cancer cases, assess trends during the period (1991-2006) and make comparisons with other countries.

Materials and Methods

This retrospective, cohort hospital-based study which was conducted during the period from 1991 to 2006 in the State of Qatar, an oil-producing country located halfway along the western coast of the Arabian Gulf. The population in Qatar was estimated to be 838,065 in the year 2006. 22.6% of the population is under the age of 15 years and only 1.2% is over the age of 65 years. Also, 66.7% of the total population is male and 33.3% female.

There is a National Cancer Disease Registry in hospitals registering all the reported cases in Qatar. They record complete information on the patients diagnosed with any type of cancer. The Qatar National Cancer Registry was established first at the Hamad General Hospital in the year 1990 as a hospital based registry. After the opening of Al Amal hospital in June 2004 for cancer and blood disorders, it was transferred to Al Amal hospital which offers a multidisciplinary approach to cancer care. The cancer incidence data for the period (1991 – 2003) were obtained from the registry of the Hamad General Hospital and for the period (2004 – 2006) from Al Amal Hospital. The main tertiary care center, Hamad General Hospital, has one Central Laboratory for histopathology and cytological diagnosis of cancer. The computer system in the pathology department is organized such that on reporting any cancer cases, a copy of the histopathology report is sent to the cancer registry. Following receipt of this diagnosis, a cancer registry record is made of all the patient's case notes. All the positive cases of cancer reports from the Hamad General Hospital Central Lab are forwarded to the cancer disease registry, thus ensuring that any cancer patient in Qatar would be

Table 1. Cancer Incidence Rates per 100,000 Population by Age Group Among the Male Population in Qatar

ICD 10	SITE	Age Group							All Ages
		0-14	15-24	25-34	35-44	45-54	55-64	65+	
C33-C34	Lung	--	1.4	0.7	--	14.0	43.3	125.2	5.9
C77	Lymph node	3.1	4.3	3.5	4.5	8.2	27.6	31.3	5.9
C42	Bone Marrow	3.1	2.9	3.5	1.5	5.8	15.8	31.3	4.1
C47,C49	Connective tissue	1.0	2.9	4.2	3.0	8.2	--	31.3	3.9
C44	Skin	--	--	2.1	1.5	5.8	23.6	62.6	3.6
C18	Colon	--	1.4	0.7	2.3	8.2	27.6	--	3.4
C22	Liver	--	--	0.7	0.8	8.2	23.6	62.6	3.4
C61	Prostate	--	--	--	--	--	19.7	187.8	3.0
C19-C21	Rectum	--	--	1.4	3.8	3.5	15.8	46.9	3.0
C70-C72	Brain	2.1	2.9	2.8	--	1.2	3.9	15.6	2.0
C16	Stomach	--	1.4	0.7	--	--	11.8	93.9	2.0
C67	Bladder	--	--	--	0.8	2.3	15.8	46.9	1.8
C64-C66,	Kidney	1.0	--	--	1.5	1.2	7.9	46.9	1.6
C40-C41	Bone	1.0	--	1.4	2.3	--	--	--	1.1
C32	Larynx	--	--	--	0.8	--	3.9	46.9	0.9
C11	Nasopharynx	--	1.4	--	1.5	1.2	--	--	0.7
C37-C38	Other Thoracic organ	--	--	1.4	0.8	--	3.9	--	0.7
C25	Pancreas	--	--	--	--	2.3	3.9	15.6	0.7
C74-C75	Endocrine Gland	--	--	1.4	--	--	--	--	0.4
C15	Oesophagus	--	--	--	--	1.2	--	15.6	0.4
C07-C08	Salivary Gland	--	--	0.7	--	1.2	--	--	0.4
C17	Small Intestine	--	--	--	--	--	7.9	--	0.4
	Others Sites	--	--	0.7	3.0	5.8	--	15.6	2.0
	All Cancers	11.4	18.6	26.0	27.8	78.1	256.0	876.4	51.2

-- no cases

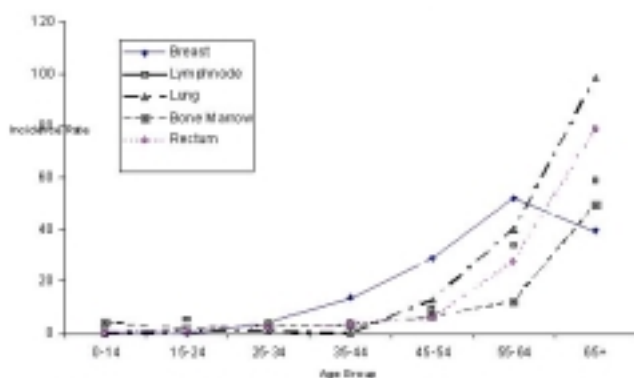


Figure 1. Incidence Rates for Five Major Cancers in Qatar by Age Group During 2006

accurately documented. When cancer cases are diagnosed in a hospital, the attending physician in the relevant specialty completes the notification forms and sends them to Cancer Registry.

All Cancer cases are coded using the International Classification of diseases (ICD). Duplicate entry checking is done by their health card number. Data obtained from the Pathology & Laboratory department for all cancer cases were compared with that received from the clinical units of the hospital. This Cancer Registry database was used to identify all cases of cancer by ICD 10 occurring in the State of Qatar. The following information was abstracted from the computer records: date of diagnosis, recorded age group, patient status (alive or dead), sex, site of the cancer and ICD 10. According to ICD-10, malignant neoplasms were coded between (C00 – C97). Data are expressed as mean and standard deviation (SD) unless otherwise stated. Student-t test was used to ascertain the significance of differences between mean values of two continuous variables. The Fisher exact and Chi-square test for trend were used to compare frequencies between

two or more than two categories. The level $p < 0.05$ was considered as the cut-off value for significance.

Results

A total of 5,825 cancer cases were registered in Qatar during the 15-year period from 1991 to 2006 with 3,303 males (56.7%) and 2,522 females (43.3%); 2,076 Qataris (35.6%) and 3,749 Non-Qataris (64.4%).

Table 1 shows the cancer incidence rate per 100,000 population by age group among male population in Qatar during the year 2006. In men, incidence rates per 100,000 population revealed that lung and lymph node cancers were the most frequently recorded malignancies, followed by bone marrow, connective tissue. In men above 65 years of age, the most common primary sites were prostate, lung, stomach, liver, followed by skin. In men, the incidence rate of all cancer sites per 100,000 population started to increase sharply from the age 45 years; 78.1 in the age group (45-54), followed by 256 in the age group (55-64) and 876.4 in the age group above 65 years.

Table 2 presents the cancer incidence rate per 100,000 population by age group among the female population in Qatar during the year 2006. Among women, breast cancer (30.1) had become the most common form of cancer, followed by genital organs (9.0), lymph node (6.8), rectum (6.1) and thyroid gland (5.7). Cancers of the female breast began to occur at an early age (25-34) increased sharply with increasing age until 65 years. Incidence of breast cancer cases declined drastically in women above 65 years (105.4/100,000), whereas the incidence rate of other cancer sites peaked in the age group above 65 years old.

Table 3 indicates the trend in the incidence of cancers at the major sites in Qatar by five year period during 1991 - 2006. The most frequent sites of cancer by rank order were breast and genital organs in all three periods (1991–

Table 2. Cancer Incidence Rates per 100,000 Population by Age Group Among the Female Population in Qatar

ICD 10	SITE	Age Group							All Ages
		0-14	15-24	25-34	35-44	45-54	55-64	65+	
C50	Breast	--	--	13.6	49.6	136.2	233.5	105.4	30.1
C51-C58	Genital organs	--	4.5	1.7	10.3	35.1	68.7	105.4	9.0
C77	Lymph node	1.1	6.7	5.1	2.1	13.2	54.9	105.4	6.8
C19-C21	Rectum	--	2.2	3.4	2.1	13.2	68.7	131.8	6.1
C73	Thyroid Gland	--	2.2	6.8	10.3	17.6	13.7	26.4	5.7
C42	Bone Marrow	5.4	--	1.7	6.2	8.8	--	79.1	5.0
C47,C49	Connective tissue	2.1	--	1.7	2.1	17.6	--	26.4	3.2
C44	Skin	--	--	--	4.1	4.4	41.2	52.7	2.9
C33-C34	Lung	--	--	1.7	--	8.8	27.5	52.7	2.5
C16	Stomach	--	--	--	--	13.2	13.7	79.1	2.5
C18	Colon	--	--	--	2.1	--	41.2	52.7	2.2
C64-C66,C68	Kidney	2.1	--	--	--	8.8	13.7	--	1.8
C22	Liver	--	--	--	--	--	13.7	105.4	1.8
C70-C72	Brain	1.1	2.2	--	--	4.4	--	26.4	1.4
C15	Oesophagus	--	--	--	--	--	13.7	52.7	1.1
C25	Pancreas	--	2.2	--	--	--	27.5	--	1.1
C67	Bladder	--	--	--	--	--	--	52.7	0.7
C23-C24	Gall Bladder	--	--	--	--	4.4	--	26.4	0.7
C03-C06	Mouth	1.1	--	--	--	--	--	26.4	0.7
	Others	--	--	1.7	4.1	4.4	13.7	--	1.8
	All Cancers	12.9	20.2	37.3	93.0	289.9	645.6	1107.0	87.1

-- no cases

Table 3. Trend in the Incidence of Cancers at the Major Sites in Qatar by Five Year Period during (1991 – 2006)

Sites	1991-1996				1997-2001				2002-2006				Total
	Q	NQ	T	%	Q	NQ	T	%	Q	NQ	T	%	
Breast	68	102	170	11.1%	91	149	240	12.8%	126	234	360	14.9%	770
Genital System	59	101	160	10.4%	87	114	201	10.8%	88	172	260	10.8%	621
Bone marrow	41	86	127	8.3%	59	112	171	9.2%	44	138	182	7.5%	480
Skin	31	102	133	8.6%	36	73	109	5.8%	27	90	117	4.8%	359
Lung	33	59	92	6.0%	43	65	108	5.8%	38	79	117	4.8%	317
Colon	23	43	66	4.3%	38	53	91	4.9%	43	87	130	5.4%	287
Thyroid	31	39	70	4.6%	49	66	115	6.2%	44	54	98	4.1%	283
Liver	17	33	50	3.3%	46	43	89	4.8%	44	72	116	4.8%	255
Bladder	26	50	76	4.9%	34	52	86	4.6%	31	59	90	3.7%	252
Lymph Node	8	8	16	1.0%	11	17	28	1.5%	70	116	186	7.7%	230
Stomach	23	51	74	4.8%	24	46	70	3.8%	22	56	78	3.2%	222
Brain	2	14	16	1.0%	16	32	48	2.6%	22	43	65	2.7%	129
Kidney	7	16	23	1.5%	12	24	36	1.9%	17	47	64	2.7%	123
Rectum	10	23	33	2.1%	7	5	12	0.6%	19	34	53	2.2%	98
Pancreas	5	12	17	1.1%	18	18	36	1.9%	16	19	35	1.5%	88
Larynx	5	11	16	1.0%	9	10	19	1.0%	16	12	28	1.2%	63
Tongue	1	10	11	0.7%	5	9	14	0.8%	5	18	23	1.0%	48
Others	143	246	389	25.3%	164	232	396	21.2%	122	293	415	17.2%	1200
All Cancers	533	1006	1539	100.0%	749	1120	1869	100.0%	794	1623	2417	100.0%	5825

Q – Qatari NQ – Non Qatari

1996), (1997–2001) and (2002 – 2006). Overall, there was a sharp increase in the number of cancer cases in the period (2002 -2006) 2417 cases from 1539 cases in (1991–1996) with an increase 57.1%. Also, number of total cancer cases among Qataris increased in the period (2002-2006) to 794 cases from 533 in (1991-1996) with an increase of 49%, while among non-Qataris, it was slightly higher 61.3%.

Table 4 compares the incidence rate of the major cancer cases in Qatar with other countries. The incidence rate per 100,000 population of all cancer sites in Qatar was 63.1 which is remarkably lower than in Egypt, Jordan, Cyprus, Israel and UK. But the incidence rate of breast cancer was very high in Qatar compared to Egypt, Jordan, Israel, but lower than in UK.

Figure 1 shows the incidence rate of five major cancers in total population of Qatar by age group during the year 2006. For the five major cancers, the age specific incidence rate increased with age in the total population. After 64 years, the incidence became nearly two fold for lymph node, lung, bone marrow and rectum, but for breast

cancer, the incidence declined sharply in women above 65 years.

Figure 2 indicates the top major cancer cases in Qatar during the period 1991 to 2006. During this period, the five most common cancers among women were different from those in men. In women, breast (30%), genital organs (15.7%), thyroid (7.8%), bone marrow (5.8%), and skin (4.7%) were the top five major cancer cases, while among men, bone marrow (10.1%), lung (8.3%), skin (7.3%), bladder (6.9%) and genital organs (6.8%) were the leading cancer sites.

Discussion

Cancer is usually considered to be a disease of the industrialized world, whereas infectious diseases are the main disease burden of the developing world. The increase in life expectancy in most developing countries, even in the least developed ones together with drastic changes in life style are expected to lead to an epidemic of cancer in developing countries by the next century (WHO, 1997).

Table 4. Incidence Rates per 100,000 Population for All Sites and the Top Major Ten Cancers in Qatar and the Comparison with Other Countries in Incidence Rates

Sites	Qatar*	Egypt‡	Jordan‡	Cyprus‡	Israel(Arab)‡	UK*
	2006	(1999-2001)	(1996-2001)	(1998-2001)	(1996-2001)	(Doll et al., 2005) 2004
All Sites	63.1	143	113.3	164.2	149.8	597.1
Breast	30.5	25.1	18.7	30.2	19.2	74.7
Female Genital system	9.0	6.4	6.6	12.9	8.1	55.8
Lymph node	6.2	16.3	8.9	10.6	12.9	-
Lung	4.8	7.7	9.9	13.4	20.4	64.1
Rectum	4.1	2.0	3.9	5.4	5.4	23.0
Connective tissue	3.7	2.8	1.1	1.3	2.0	2.3
Skin	3.3	0.7	1.1	2.9	2.1	121.1
Colon	3.0	3.9	7.4	11.9	9.9	37.4
Prostate	3.0	3.6	5.6	16.4	8.4	119.6
Liver	2.9	12.5	1.4	1.5	1.5	4.8

* Crude rate per 100,000 population ‡ Age standardized rate (Middle East Cancer Consortium, 2005)

The Middle East has witnessed changes in the past 25 years. Rapid modernization and its accompanying urbanization and westernization have also been associated with changes in the pattern of diseases, specially the incidence of cancer cases.

State of Qatar, like other developing countries, went through an economic transition from primarily agricultural activities to more industrial development and manufacturing after the oil boom in the Arabian Gulf. Similar to other developing countries, cancer burden is increasing in Qatar as people adopt western lifestyles such as cigarette smoking, higher consumption of saturated fat and calorie-dense foods and reduced physical activity. Moreover, Qatar is a multiracial and multicultural society. There are some studies of cancer incidence and mortality in the Middle East region (El-Helal et al., 1997; Denic et al., 2005; Bener et al., 2001; Middle East Consortium, 2005). But in Qatar, this is the first comprehensive hospital based study investigating the trend and pattern of incidence rate of cancers for the past 15 years.

The overall cancer incidence rate per 100,000 population in Qatar (63.1) is remarkably lower than the other countries; Cyprus (164.2) (El-Helal et al., 1997), Egypt (143.0) (El-Helal et al., 1997), Jordan (113.3) (El-Helal et al., 1997), and UK (597.1) (Cancer research, 2005), United States and Europe (Quinn 2003). The differences in rates can be attributed to several factors; Cultural disturbances associated with modernization, rich diet, physical inactivity and increasing trends of smoking may all lead to increased burden of cancer in these countries. The overall male to female ratio of cancer cases in Qatar was 1.1 which is much lower than the ratio in Korea (1.8) (Shin et al., 2002), but similar to the ratio of Gulf countries; Saudi Arabia (1.2) (King Faisal Specialist Hospital, 1996), Kuwait (1.3) (Executive Board of the Health Ministers' Council, 2002), Oman (1.1) (Executive Board of the Health Ministers' Council, 2002).

The present study revealed that for all cancer sites, the age specific incidence rate increased with age for both men and women. In the year 2006, the crude incidence rate per 100,000 population of all cancers was more predominant in women (87.1) than in men (51.2) in Qatar. Even the age incidence rate of all cancers was higher in all the age groups of women compared to men. On the

contrary, several studies done in Egypt (Middle East Cancer Consortium, 2005), Jordan (Middle East Cancer Consortium, 2005), Saudi Arabia (King Faisal Specialist Hospital, 1996), and Korea (Shin et al., 2002) showed that the cancer incidence rates were much higher in men than women. The incidence rate/100,000 population of all cancers among women is substantially lower than the rates of women in Kuwait (127.3) (Landis et al., 1998), Jordan (112.2) (Middle East Cancer Consortium, 2005), Egypt (135.0) (Middle East Cancer Consortium, 2005), USA (110.4) (Landis et al., 1998), UK (121.3) (Doll et al., 2004).

The cancers which are more common in Qatar, namely Breast, Lymph node, Lung, Bone marrow and Rectum were reported as the most common types of cancers worldwide. Rates of Lung cancer were highest in Eastern Europe and China for men, but are highest in North America for women, where as rates were low in Latin America and Mumbai (www.ncic.cancer.ca, 2007). Consistent with these findings, the present study data revealed that Lung Cancer was the most frequent cancer diagnosed in men, but the rate was very low in women. These results reflect the cigarette smoking patterns of 10 to 20 years earlier in these countries. In 2004, the IARC (Doll et al., 2005) published a monograph on tobacco use and cancer which concluded that tobacco contributed to cancer in 15 different sites including lung, urinary tract, upper respiratory infection, pancreas, stomach and liver. In contrast, the pattern among females is consistent with the regional and global picture with breast cancer being the most common cancer. The incidence rate per 100,000 population of breast cancer in Qatar was very high (30.1) compared to other countries (Executive Board of the Health Ministers' Council, 2002); Oman (13), Jordan (18.7), Egypt (25.1), Israel (19.2), but similar to the rate of Cyprus (30.2). Breast cancer is the most common cancer among Egyptian, Palestinian, and Kuwaiti women (Kahan et al., 1997). Unlike other cancers, the incidence of breast cancer reached a maximum in women aged 55-64 in Qatar (235.5/100,000), then declined dramatically in the age group 65 years and above. A study done in Korea (Shin et al., 2002) found the peak in the age group (45-54) years of females, which decreased thereafter. The possible explanations for the difference in incidence rates

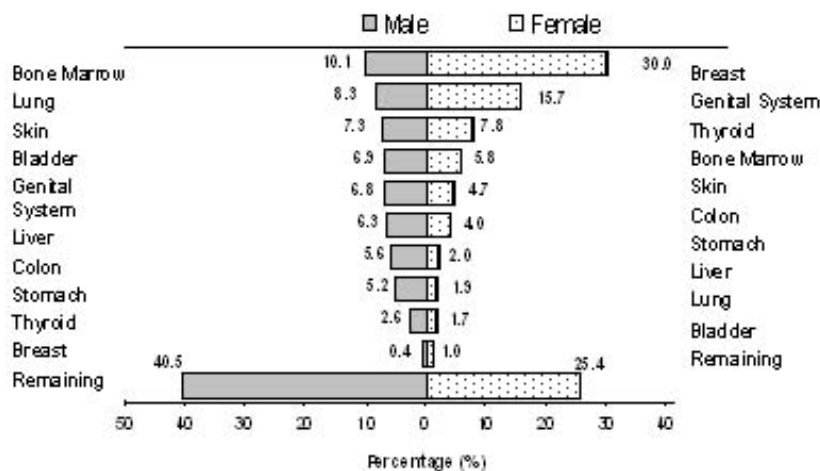


Figure 2. Top major cancer cases in Qatar during the period 1991 to 2006

include differences in diet, body size, physical activity and reproductive patterns. The high incidence of Breast cancer in Qatar could be due to the lack of knowledge and health awareness in women for early detection and treatment services.

The American Cancer Society (www.sciencedaily.com, 2007) reported that in economically developing countries, the three most commonly diagnosed cancers in men are lung, stomach and liver cancers. Among women, they are breast, cervix uterus and stomach. In contrast, in the present study Liver cancer ranked the 7th and Stomach cancer the 11th in men. Among women, cancers of breast and genital organs were the first two leading cancers, and stomach cancer ranked 10th. This is in line with the study done by Kahan E et al (1997) that stomach cancer ranked as the 10th most common cancer among men in Middle Eastern countries like Egypt and Gaza strip. A report (www.ncic.cancer.ca) on international variation in cancer incidence stated that stomach cancer has a very different international pattern, with high rates in Latin America, most of Asia and Eastern Europe and low rates in more Western areas. Stomach cancer incidence has been declining in the western world and this decline may be attributed to the reduced consumption of preserved meats and increased availability of fresh fruits and vegetables.

The major risk factors for cancer include tobacco use, occupational exposures, environmental contamination, infectious agents and lifestyle factors (Parkin, 2004). We believe that efforts are needed to target the major killing cancers in the State of Qatar namely lung, breast, female genital organs, connective tissue, skin and colon cancers. Public health measures should be taken to reduce the incidence and mortality of these diseases.

In conclusion, the present study revealed that incidence of cancer cases increased with the increasing age. The age incidence rate of all cancers was higher in all the age groups of women compared to men. Lung cancer was the most frequent cancer diagnosed in men and breast cancer was the most frequent in women. The incidence rate of breast cancer in Qatar was very high compared to other Middle Eastern countries. In conclusion, we believe that our results provide valuable clues for cancer research, and for the development of a cancer control program. More epidemiological studies to elucidate the patterns of cancer and the related risk factors are required.

References

- Bener A, Alwalsh R, Miller CJ, et al (2001). Knowledge, attitudes, and practices related to breast cancer screening: a survey of Arab women. *J Cancer Educ*, **16**, 215-20.
- Boyle P, Ferlay J, (2005) Cancer incidence and mortality in Europe, 2004, *Annal Oncol*, **16**, 481-88
- Cancer Research UK : Available at: <http://info.cancerresearchuk.org/cancerstats/incidence/site/?a=5441> Last access 8/11/2007
- Denic S, Bener A, Sabri S, et al (2005). Parental consanguinity and risk of breast cancer: a population-based case-control study, *Med Sci Monit*, **11**, 415-9.
- Doll R, Peto R, Boreham J, et al (2005). Mortality from cancer in relation to smoking: 50 years observations on British doctors, *Br J Cancer*, **92**, 426-29.
- El-Helal T, Bener A, Galadari I (1997). Pattern of cancer in the United Arab Emirates. *Annals of Saudi Medicine*, **17**, 506-9.
- Executive Board of the Health Ministers' Council, Cancer incidence report of Gulf Cooperation Counsel countries for the year 1998, Riyadh, Saudi Arabia, April 2002.
- International variation in Cancer incidence, 1993 – 1997, www.ncic.cancer.ca/ca/ncic/internet/standard (accessed on 8/11/2007)
- Kahan E, Ibrahim AS, El Najjar et al (1997). Cancer patterns in the Middle East. Special report from the Middle East Cancer Society. *Acta Oncology*, **36**, 631-6.
- King Faisal Specialist hospital and Research Center, National Cancer Registry, 1994 – 1996; available at www.kfshre.edu.sa/NCR/html/Cancer_incidence.html
- Landis S, Murray T, Bolden S (1998). Cancer statistics. *CA: Cancer J Clin*, **48**, 6-29
- Ma X, Yu H (2006). Global burden of cancer, *Yale J Biol Med*, **79**, 85-94
- Magrath I, Litvak J (1993). Cancer in developing countries: opportunity and challenge. *J Natl Cancer Inst*, **85**, 862-74.
- Middle East Cancer Consortium. Manual of standards for cancer registration.2005. Available at :http://mecc.cancer.gov/MECC_Manual_of_Standards.PDF
- New Report Estimates 12 Million Cancer Cases Worldwide in 2007. available at <http://www.sciencedaily.com/releases/2007>
- Parkin DM, Pisani P, Ferlay J (1999). Global cancer statistics, *CA: Cancer J Clin*, **49**, 33-64.
- Parkin DM (2004) International variation. *Oncogene*, **23**, 6329-40
- Quinn MJ, d'Onofrio A, Møller B, et al (2003). Cancer mortality trends in EU countries and acceding countries up to 2015, *Ann Oncol*, **14**, 1148-52.
- Quinn MJ (2003). Cancer trends in the United States--a view from Europe. *J Natl Cancer Inst*, **95** (17), 1258-61.
- Shin HR, Ahn YO, Bae JM, et al (2002). Cancer incidence in Korea, *Cancer Res Treat*, **34**, 405-8.
- Sikora K. Developing a Global Strategy for Cancer, Geneva, WHO, 1998.
- The World Health Report 1997, Conquering Suffering Enriching Humanity, Geneva, WHO, 1997
- www.werf-UK.org/report/preliminary (accessed on 12/11/2007).
- J Natl Cancer Inst*, **95** (17), 1258-61.