

## RESEARCH ARTICLE

# Incidence of Cancers in Kuzestan Province of Iran: Trend from 2004 to 2008

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### Abstract

**Background:** Cancer is an increasing cause of mortality and morbidity worldwide. Incidences of common cancers has been growing in different provinces of Iran in recent years but trends in Khuzestan which shares a border with Iraq and is located in south west of Iran have not been investigated. This study aimed to assess secular changes in incidences of common cancers in Khuzestan province from 2004 to 2008. **Materials and Methods:** Data were collected from Khuzestan cancer registry which is a branch of Iranian Ministry of Health Cancer Registry (<http://ircancer.ir>) for the period 2004-2008. Data were presented as incidence rates by site, sex, age, using the crude rate and age-standardized rate (ASR) per 10<sup>5</sup> persons. A direct method of standardization was applied according to the WHO guideline and data analysis was performed using the SPSS package. **Results:** During the 2004-2008 period, 14,893 new cases of cancer were registered in Khuzestan cancer registry. The age-standardized incidence rate of all cancers was 153.7 per 10<sup>5</sup> in males and 156.4 per 10<sup>5</sup> in females. The incidence was increased over the period of five years. The most incident cancers among males were skin cancer (ASR=18.7/10<sup>5</sup>), stomach cancer (ASR=13.8/10<sup>5</sup>), lung cancer (ASR=12.9/10<sup>5</sup>), leukemia (ASR=12.6/10<sup>5</sup>) and prostate cancer (ASR=12.4/10<sup>5</sup>). In females, the most incident cancers were breast cancer (ASR=41/10<sup>5</sup>), skin cancer (ASR=16.4/10<sup>5</sup>), colorectal cancer (ASR=10.0/10<sup>5</sup>), leukemia (ASR=8.1/10<sup>5</sup>) and lung cancer (ASR=6.9/10<sup>5</sup>). **Conclusions:** Incidences of various cancers are rising in Khuzestan. It is necessary to develop and implement comprehensive cancer control programs in this region which could be monitored and evaluated by the future trend data from Khuzestan cancer registry.

**Keywords:** Trend - incidence - cancer - epidemiology - Khuzestan

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### Introduction

Cancer is one of the most common causes of death worldwide. It is estimated that the incidence of cancer will increase by 45% in developing countries by 2025 (Parkin et al., 2005). In Iran, as a developing country, population growth has been considerable, life expectancy has increased and socioeconomic status has also changed (Colditz et al., 2005; Parkin et al., 2005). In some countries, cancer is the second leading cause of death while in Iran; it is still the third, after cardiovascular diseases and accidents (Mehrabani et al., 2008).

All cancer incidence is higher in Khuzestan, which shares border with Iraq and is located in south west Iran, compare to the neighboring provinces and also the average incidence rate of the country (155/10<sup>5</sup> vs 142/10<sup>5</sup>) (Balducci et al., 2005; Akbari et al., 2008). Geographic variations in the incidence of certain cancers have been investigated before (Safaei et al., 2011). To assess the influencing factors, it is important to evaluate trend of cancer incidence in different regions (Kamangar et al.,

2006). Based on new information of International Agency for Research on Cancer (IARC), deaths due to cancer were more than 7.6 million people in 2008 worldwide. It is likely to reach 13.1 million deaths per year by 2030, and developing countries will have the highest rate of increase i.e. 70% (Jemal, 2010).

Khuzestan province has faced a sharp increase in cancer incidence and mortality during the recent years. Major environmental changes due to the second war on Iraq in 2003 directly affected the province. Little is known about recent changes is the incidence of common cancers in this part of country. It is necessary to determine the pattern of cancers as a first step for planning and control (Mehrabani et al., 2008). This study aimed to assess trend of incidence of common cancers in Khuzestan province over the five years period from 2004 to 2008.

### Materials and Methods

This is a retrospective study using data from Khuzestan Cancer Registry which is a branch of Iranian Ministry of

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Health Cancer Registry for the period of 2004-2008. The study population were all cases of cancer diagnosed in the Khuzestan province during the period. Data were collected from 49 pathology centers, department of medical records in hospitals and death certificates registered in towns and villages of the province. Data were entered in the cancer registration software, prepared by the Iranian Ministry of Health, based on ICD-10. After data entry, all information including individual characteristics such as age, sex, cause of death, type of cancer, residence were arranged alphabetically, and duplicates were removed. To estimate incidence rates, people whose residence was in other provinces were excluded.

Crude cancer incidence rates were calculated in the different age and sex groups per 100,000 populations. Also age-adjusted rates (ASR) were obtained using the world standard population and the direct standardization method (Akbari et al., 2008). Khuzestan is located in southwestern Iran, with an area of approximately 63,212 km<sup>2</sup>, and share border with Iraq, Persian Gulf and also Lorestan, Chahar Mahale-Bakhtiari, Kohgiluyeh and Boyer Ahmad and Ilam provinces.

Data analysis was performed using SPSS (V. 21, SPSS, Inc., Chicago, IL, USA). To analyze, descriptive statistics was used, as well as linear regression to analyze trend of incidence of various cancers.

## Results

In this study, 2669 cancer cases were identified in men (53%) and 2406 cases in women (47%). The crude

incidence rate was 116/10<sup>5</sup> and 122/10<sup>5</sup> in men and women respectively. The age standardized rate (ASR) was 153/10<sup>5</sup> in men and 156/10<sup>5</sup> in women. Mean age was 59.4±19.1 at first diagnosis. The mean age was 62.1±18.7 in men and 56.2±19.1 in women. Tables 1 and 2 show organs affected by cancer, different age groups and crude and age-standardized incidence rates (ASR) for men and women. Table 3 demonstrates crude and age-standardized incidence rates per 100,000 person years (ASRs) for all cancer types for both sexes.

### Trend of cancer incidence rates

Trend of cancer incidence rates adjusted with world standard population has been changed during the five years and an increasing trend has been observed. On average, annual cancer incidence has increased by 65% in men, 2.5 fold, and 71% in women, 2.85 folds over the five years. Overall, the incidence rate in both sexes has risen 2.6 folds over the period (Figure 1).

Figures 1 and 2 show trend of the incidence rate of common cancer in both sexes. Findings demonstrated that the highest age-standardized incidence rate was related to breast cancer, skin cancer, and colorectal cancer in women, and skin cancer, stomach cancer and lung cancer in men. Most cases of cancer in men and women were in the age group 75-84 year, and the lowest incidence was observed in the age group below 15 years. The incidence of colorectal, leukemia, bladder, and neurological system cancers has increased in both sexes. Lung, stomach and skin cancers have been declining in men, but not in women.

**Table 1. Crude and Age-Standardized Incidence Rate (ASR) of Cancer in Men in Khuzestan Province, 2004-2008**

Age groups	0-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	Crude rate	ASR*
Primary site of cancer											
All sites	49.2	49.9	103.3	166.9	276	843	1343	4061	1044	122.5	153.6
Skin	0.33	0.98	9.2	18.9	78.6	110.1	172.7	570.4	153.5	14.2	18.7
Stomach	0	0	7.1	15.5	52.3	83.8	139.1	418.4	61.4	10.7	13.8
Lung	13.9	0.49	6.4	5.4	42.8	69.2	145.3	472	107.5	10.1	13
Leukemia	0	10.4	10.7	12	49.1	56.5	67.57	279.8	31	10.9	12.7
Prostate	1.1	0	1.34	0	15.1	59.9	182.2	682.4	153.5	10.1	12.4
Bladder	0.99	1.8	3.8	12.7	34.8	64.9	152	364	77	9.1	11.7
Colorectal	8.3	2.3	8.2	21.5	52.1	73	83.4	192	92.1	8.8	11.6
CNS & Brain	1.2	6.5	8.9	7.7	31.2	31.1	17	65.4	0	5.2	6.2
Liver	0	0	3.1	3.9	17.9	20.6	67.4	142.2	92.1	4.6	5.6
Laryngeal	0	0.49	0.67	2.5	23	45.2	31.5	111.1	46	3.4	4.5

\*Age-standardized rate

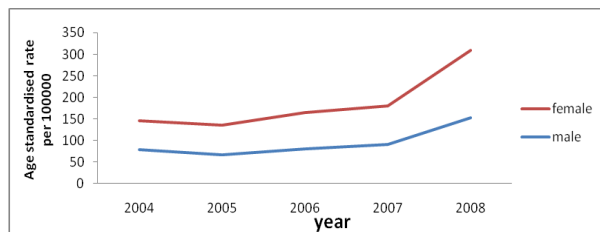
**Table 2. Crude and Age-Standardized Incidence Rate (ASR) of Cancer in Women in Khuzestan Province, 2004-2008**

Primary site	0-14	15-24	25-34	35-44	45-54	55-64	65-74	75-84	85+	Crude rate	ASR*
All sites	39.6	46	138.1	306	658	965	1104	2299	850	116.4	156.3
Breast	0.73	6	34.6	155.3	251.3	225	170.1	229.4	66.7	31.1	41
Skin	1.0	2.2	6.5	12.4	49.6	144	148.3	357	133.3	11.1	16.4
Colorectal	0.36	0.8	4.5	11.6	43.1	80.9	72.5	29.9	50	7	10
Leukemia	13.2	7.5	6.9	11.9	27.9	41.1	33	40.7	16.7	6.7	8.1
Lung	1.1	0	1.9	4.2	28.4	29.1	66.6	225.3	133.3	4.8	6.9
Bladder	0	0.46	0.61	0.8	12.9	30.1	63.8	198.1	83.8	3.5	5.1
Ovary	0	1.5	8.4	8.5	17.7	46.2	19.1	29.8	0	3.5	4.6
Liver	0	1.4	1.9	1.6	18.7	25.6	42.2	137.1	50	3.1	4.5
CNS & Brain	4.4	3.2	5.6	11.7	12.5	26.1	27.5	10.9	0	3.7	4.3
Thyroid	0	3.8	11.7	13.9	12.9	22.1	9.1	46.1	16.67	3.6	4.1

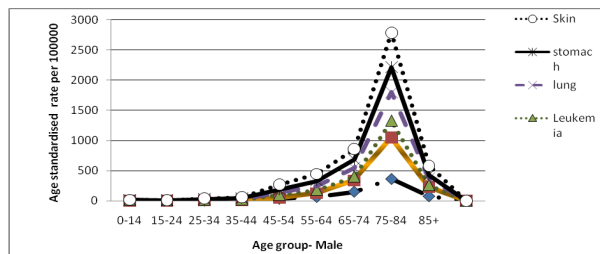
\*Age-standardised rate

**Table 3. Crude and Age-Standardized Incidence Rates per 100,000 Person Years (ASRs) for All Cancers in Men and Women Reported from 2004 to 2008 in Khuzestan**

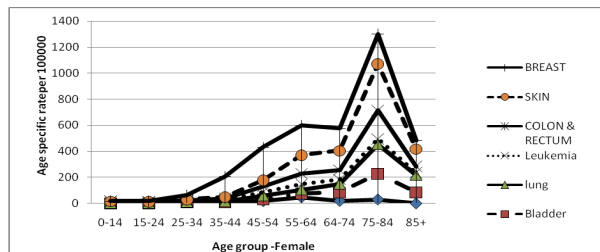
Year	Adjusted rate for		Crude rate for		Frequency rate
	Women/10 <sup>5</sup>	Man/10 <sup>5</sup>	Women/10 <sup>5</sup>	Man/10 <sup>5</sup>	
2008	156.3	153.4	116.4	122.5	5015
2007	88.05	91.3	66.25	71.82	2933
2006	82.36	81.31	62.62	64.62	2701
2005	67.75	67.08	51.06	55.02	2317
2004	66.87	79.01	40.81	49.1	1927



**Figure 1. Age-Standardized Incidence Rate of Cancers Per 100,000 Populations in Khuzestan Province, 2003-2008**



**Figure 2. Age-Standardized Incidence Rates of Common Cancers in Khuzestan Province in Men by Age Groups, 2004-2008**



**Figure 3. Age-Standardized Incidence Rates of Common Cancers in Khuzestan Province in Women by Age Groups, 2004-2008**

## Discussion

The total incidence rate of cancers in Khuzestan province was  $135.8/10^5$  in men and  $156.4/10^5$  in women, a significant increase was observed in the incidence rates of various cancers over the five years study period.

Age-standardized incidence rates of all cancers was  $98.4/10^5$  in men and  $75.7/10^5$  in women in Boyer Ahmad province,  $140.12/10^5$  in men and  $119.45/10^5$  in women in Lorestan,  $111.41/10^5$  in men and  $87.32/10^5$  in women in Chahar Mahale-Bakhtiari and  $148.75/10^5$  in men and  $135.80/10^5$  in women in all areas of Iran (Akbari et al., 2008). Our findings showed that skin cancer was the most common in men ( $ASR=18.7/10^5$ ), and the second most common in women. Other studies indicated that skin

cancer alone corresponds to 5.2% to 32.7% of all cancers in Iran (Arndt, 1996).

Semnan province has the highest rate of all cancers ( $ASR=30.73/10^5$ ), and Bushehr had the lowest ( $ASR=10.32/10^5$ ) (Akbari et al., 2008). Prevalence of skin cancer has been increasing in recent decades in Khuzestan. Since the main cause of skin cancer is exposure to sunlight, climate change including changes in the thickness of the ozone layer along with changes in personal and social habits may underlay the increase. Other studies showed that latitude is significantly associated with incidence of skin cancer. In other words, cases of skin cancer are more common in closer latitude to the equator (Goldberg et al., 1992; Arndt, 1996).

Stomach (7%), colorectal (7%), liver (3.75%), lung (6.3%) and laryngeal (3%), cancers had a significant increase in Khuzestan. These increases may be due to improving in data registration, increasing number of elders and geographical shifts of the population. In Iran, northern, central and western regions are considered low and moderate cancer prevalence areas and southern region is considered the high prevalence area (Sadjadi et al., 2007).

The highest age-standardized incidence of stomach cancer was observed in Semnan and Ardebil provinces respectively ( $26.8/10^5$  and  $26.3/10^5$ ) (Akbari et al., 2008). ASR for stomach cancer was  $24.1/10^5$  in Italy,  $14.7/10^5$  in China,  $11/10^5$  in Turkey (Bertuccio et al., 2009; Jemal et al., 2010). It was  $10.5/10^5$  in southern Iran like Khuzestan to China and Turkey as high-risk areas, and  $4.0/10^5$  in Bushehr (the lowest reported incidence in Iran). High incidence of stomach cancer is attributed to factors such as H-pylori infection, genetics, diet, environmental factors (Mikaeili et al., 2000; Atrkar-Roushan et al., 2013). Unlike a study in Ardabil which reported 50% of stomach cancers of cardiac type, in Kuzestan the highest incidence was observed in the non-cardiac type (Hajiani et al., 2006). Helicobacter pylori is not necessarily the main cause of stomach cancer in this area, and other factors such as excessive use of tobacco (especially cigarettes), high nitrate diet (Somi et al., 2006; Mohammad et al., 2014) and using homemade pickles, widely popular among locals, may be the cause (Mohammad et al., 2012; Atrkar-Roushan et al., 2013).

Worldwide, lung cancer is the most common cancer, but its geographical distribution shows obvious changes. It is more common in developed countries, especially in North America and Europe. In developing countries, particularly in Africa and South America, it is less common (Castellsague et al., 2002; Siegel et al., 2013). As lung cancer epidemic in developed world has declined but in developing countries shows a growing trend (Kleihues et al., 2000; Siegel et al., 2013).

Lung cancer is the most common cancer in Khuzestan province ( $ASR=10/10^5$ ), almost double the whole country ( $ASR=5.75/10^5$ ) (Akbari et al., 2008). This cancer is the third most common cancer in men and the fifth in women. The lowest age-standardized incidence rate of lung cancer was reported from Chahar Mahal Bakhtiari province ( $ASR=2.04/10^5$ ). This could be due to a range of agricultural activities, high levels of environmental toxins, industries and electricity generation plants i.e. strong

magnetic fields. Iraq has a long border with Khuzestan province, and has been contaminated by chemicals and nuclear materials, such as low dose uranium bullets during the recent wars with the US. Fine dust entered to this region from Iraq, may increase incidence of lung and other cancers (Mould, 2001). Also, the dust can be a cause to rising incidence of laryngeal cancer in the province, which may threaten other provinces and even the capital Tehran. The highest rate of laryngeal cancer (ASR=5.04/10<sup>5</sup>) was reported from Semnan province, 3.1/10<sup>5</sup> in Khuzestan, 2.67/10<sup>5</sup> in South Khorasan, and the lowest rate was reported in Ilam province (ASR=0.6/10<sup>5</sup>) (Akbari et al., 2008).

Colorectal cancer is highly incident in developed countries, particularly in North America, Northern and Western Europe and New Zealand (Tomatis, 1990; Nikbakht, 2013). This cancer has low rates in South America, Asia and Africa. However, it has recently increased in developing countries (Jemal, 2010; Edris, 2013).

The incidence of colorectal cancer in Khuzestan was 10.8/10<sup>5</sup> population, lower than western and central provinces such as Semnan and Tehran (Akbari, 2008). However, it has been rising in Khuzestan in recent decades in both sexes, probably because of dietary habits and lifestyle change. Several studies showed that high-fat diet, obesity, tobacco smoking and lack of physical activity are risk factors of it.

Breast cancer is the most common cancer among women. Highest rates were seen in North America and Western Europe, and lower rates observed in Japan (Aliasghar, 2014; Ramesh, 2014). Prevalence of this cancer is lower in Asian countries compared to developed countries, but it is increasing (Aliasghar et al., 2014; Slaoui et al., 2014). In Iran, the highest rate of breast cancer was observed in Tehran (55.8/10<sup>5</sup>) and Khuzestan (41/10<sup>5</sup>) provinces (Kaviani, 2011). The lowest incidence rate was 5.73/10<sup>5</sup> population in Sistan and Baluchistan province (Akbari et al., 2008). Factors influencing this increase are not clearly known, but can be western lifestyles, lower marriage rate and breast feeding, consumption of high-calorie foods, obesity and physical inactivity (Tehrani et al., 2010; Safaee et al., 2011).

This study has some limitations. The available data covers a short period of time, so it is difficult to draw secular trend lines. The quality of data collection and data coverage may vary across different regions of the province.

According to the results of this study, common cancers can be screened by screening tests such as colonoscopy, mammography, etc. It is recommended to perform screening tests in Khuzestan and other provinces with the high incidence of specific cancers by Ministry of Health of Iran, and conduct health programs to prevent and control common cancers in Khuzestan.

In conclusion, incidence of cancer in Khuzestan has increased over the study period. It is necessary to develop and implement comprehensive cancer control programs in this region. The cancer registry should be developed more and become population based to provide more reliable data for planning and evaluation of cancer control programs.

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