

Statistical Report

Cancer Statistics in Iran: Towards Finding Priority for Prevention and Treatment

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ABSTRACT

Cancer is the third leading cause of death in Iran following coronary heart disease and accidents. According to the estimate report from GLOBOCAN 2012, the age-standardized incidence rate (ASR) of cancers was 134 and 120 per 100,000 among males and females, respectively. The estimated mortality rate for cancer was 90.4 and 72.2 per 100,000 for males and females, respectively that shows an increase of 25.4 and 31.1 percent compared to the latest report from National Death Registry (NDR) in 2004. The most common cancer among men and women was stomach cancer (20.6%) and breast cancer (28.1%), respectively and the most common childhood cancer was leukemia. Up-to-date and accurate cancer registry data could be one of the major determinants to control, classify, diagnose and even in the treatment of cancer cases. However, since 2009 no up-to-date formal reports from the National Cancer Registry (NCR) of Iran have been announced. Information from the cancer registries regarding different regions of Iran have been published in different articles. In this article, we collected all available data through literature review and further, visualize them in a way that could be more understandable. Additionally, we have provided the expected numbers of new cancer cases and deaths in 2008 and 2012 in Iran based on GLOBOCAN. Our survey revealed that there is an urgent need for a comprehensive cancer statistics registration to guide cancer policy-makers and researchers to make informed decisions that will improve health care.

Keywords: Cancer statistics, Cancer therapy, Incidence, Mortality, Childhood

Cancer is a major public health problem in the world and responsible for 13% of all deaths. Currently cancer is the third leading cause of death in Iran after coronary heart disease and accidents based on latest reports from the Ministry of Health and Medical Education (MOHME) (1). By ageing the population and reducing the number of death

caused by accidents, cancer is becoming the second cause of mortality in Iran. Moreover, the incidence rate of almost all kinds of malignancies has alarmingly increased in the past two decades. It is estimated that more than 90,000 of new cancer cases occur annually in Iran, and it is assumed this number will double by the year 2020 (2).

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Having efficient cancer and death registration systems are the main foundation of cancer control programs and provide crucial information for policy makers to find out about cancer epidemiology in each, in order to set priority and design comprehensive cancer prevention plans (3). However, there is an absence of functional cancer registries in Iran. Only a few national programs according to the World Health Organization (WHO) guidelines for cancer screening and prevention are active in Iran (4).

The aim of this study is to provide the rather comprehensive and updated report of cancer incidence and mortality according to the available data. We also used GLOBOCAN (<http://globocan.iarc.fr>) to get the estimated result of cancer incidence and mortality for years 2008 and 2012 (5).

History of Cancer registry in Iran

Collecting information concerning the incidence, type, and location of cancers is of prime interest to control the cancer burden; and this is best done in the framework of cancer registries. Cancer Registry is the systematic collection, storage and analysis of data on cancer cases usually done in a certain region and a specified population (6).

The first cancer registry system in Iran was pathology based. Changes in the cancer registry system to a population based approach caused an increase of cancer registration.

The first population-based cancer registry was established by University of Tehran and collaboration with the International Agency for Research on Cancer (IARC) in 1969 and started its activity in Mazandaran province. However, their efforts were interrupted in the early 1980s due to the sociopolitical events in Iran. In 1984, a bill was passed by the Parliament mandating the report of all tissues “diagnosed or suspected as cancer tissue” to the Ministry of Health. In 1998, Tehran Population-Based Cancer Registry (TPBCR), also known as Tehran Metropolitan Area Cancer Registry (TMACR), started to collect data from cancer cases throughout the Tehran metropolis. In 1992, Digestive Disease Research Center (DDRC) was established in Tehran University of Medical Sciences. This center established a population-based cancer registry in 5 provinces namely Golestan, Ardebil, Kordestan, Kerman, and Khuzestan. These five provinces have a total population of roughly 10.8 million which is about 8% of the total population of Iran. All of these registries are now run by the local universities of medical sciences (7,8).

Trends in Cancer Incidence Rates

Incidence rate is the number of new cases in a defined period of time and in a specified population, which provides an approximation of the average risk of developing a cancer.

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Figure 1 illustrates increasing trends of cancer incidence rates for all cancers from 2004 to 2012 by sex. Trends in overall incidence are heavily influenced by the 4 major cancers includes stomach, breast, prostate, and colorectal (Figure 3a). These cancers will be more considered in section 6.

Some studies in different provinces of Iran reported significant increasing trend of cancer. For example, Vakili et al. reported the age standardized incidence rate (ASR) in female increase from 84.6 to 94.8 and in male from 85.9 to 113.8 during 2005 to 2009 (9).

In another study conducted in Isfahan reported an increasing incidence rate from 2005 to 2010. They

showed ASR changed from 107 in 2005 to 124.9 in 2010 (10). Rafiemanesh's study carried out to investigate the cancer trends in Sistan and Baluchestan province during 2004 to 2009 showed an increasing incidence rate from 22.20 to 35.29 for females and 18.95 to 35.99 for males (11). Increasing in rate of cancer incidence, may be due to aging, air pollution and cancer associated lifestyle such as stress, physical inactivity, and smoking. In addition, improvement of registry system could also be another reason for increasing rate of incidence over this time.

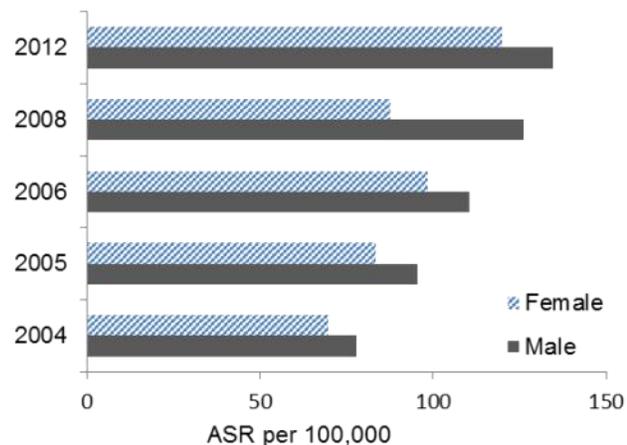


Figure 1: Trends in cancer incidence rates by sex, Iran. The reported data from 2004 to 2006 is based on the NCR (12) and for 2008 and 2012 are based on GLOBOCAN

Trends in Cancer Mortality

Mortality, the number of deaths occurring in a given period of time and in a defined population can be expressed as a rate per 100,000 persons per year.

In addition to the cancer registry, data from the death registry could provide important information regarding the cancer control status (3). There are no publicly available reports of mortality in the NCR of

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Iran, but the population-based cancer studies of five provinces took it into consideration (12). The National Death Registry (NDR) of Iran is in charge to register data on cancer death. However, due to lack of a computerized system for death registry and unique identification number, the cancer mortality reports presented among provinces in population-based cancer registry are inconsistent. (12). According to the reports from Kolahdoozan et al. the

estimated mortality rate for cancer was 41.1 and 65 per 100,000 for females and males in 2004 respectively (1).

Based on GLOBOCAN there is an increased mortality rate caused by cancer in females from 61.8 in 2008 to 72.7 in 2012. However, the estimated cancer death rate in males has been decreased from 98.3 in 2008 to 90.4 in 2012. Figure 2 shows a comparison of these data.

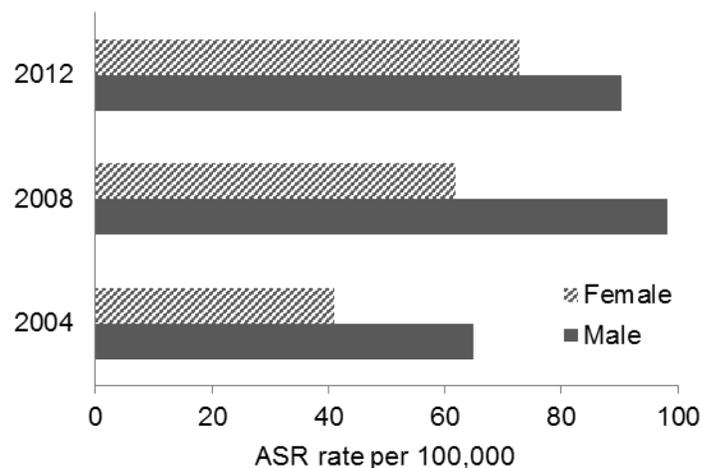


Figure 2: Trends in cancer mortality rates, by sex, Iran for 2004 from NDR (12), 2008 and 2012 based on GLOBOCAN

Estimated Number of Cancer Cases and Deaths in 2012

Over 14 million new cases and more than 8 million cancer deaths occurred in 2012 worldwide based on GLOBOCAN 2012. The contribution of developing countries was 56.9% for incidence and 64.9% for deaths. However, the future is more alarming. The total number of new cases is expected to increase by 29% in developed countries whereas, in developing

countries an increase of 73% is expected by 2020, as a result of changing dietary habits, ageing and urbanization (13). Among the cancers stomach, bladder, prostate, and colorectal cancers account for about one-half of all cases in men, while the most commonly diagnosed cancers in women are breast, colorectal, stomach, and esophagus, accounting for one-half of all cases in women. Breast cancer alone is expected to account for 24.5% of all new cancers

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in women (Figure 3a). Notably stomach cancer has the highest rate of incidence among men and third highest among women in Iran. Lung cancer has also lower incidence rate in both gender as compared to its global incidence statistics.

Figure 3b shows the expected numbers of deaths from cancer in 2012 in Iran. It was estimated that

about 53350 Iranian died from cancer this year, corresponding to about 146 deaths per day. The most common causes of cancer death are cancers of the breast, stomach, esophagus, and colorectal in women and cancers of the stomach, lung, esophagus, and prostate in men.

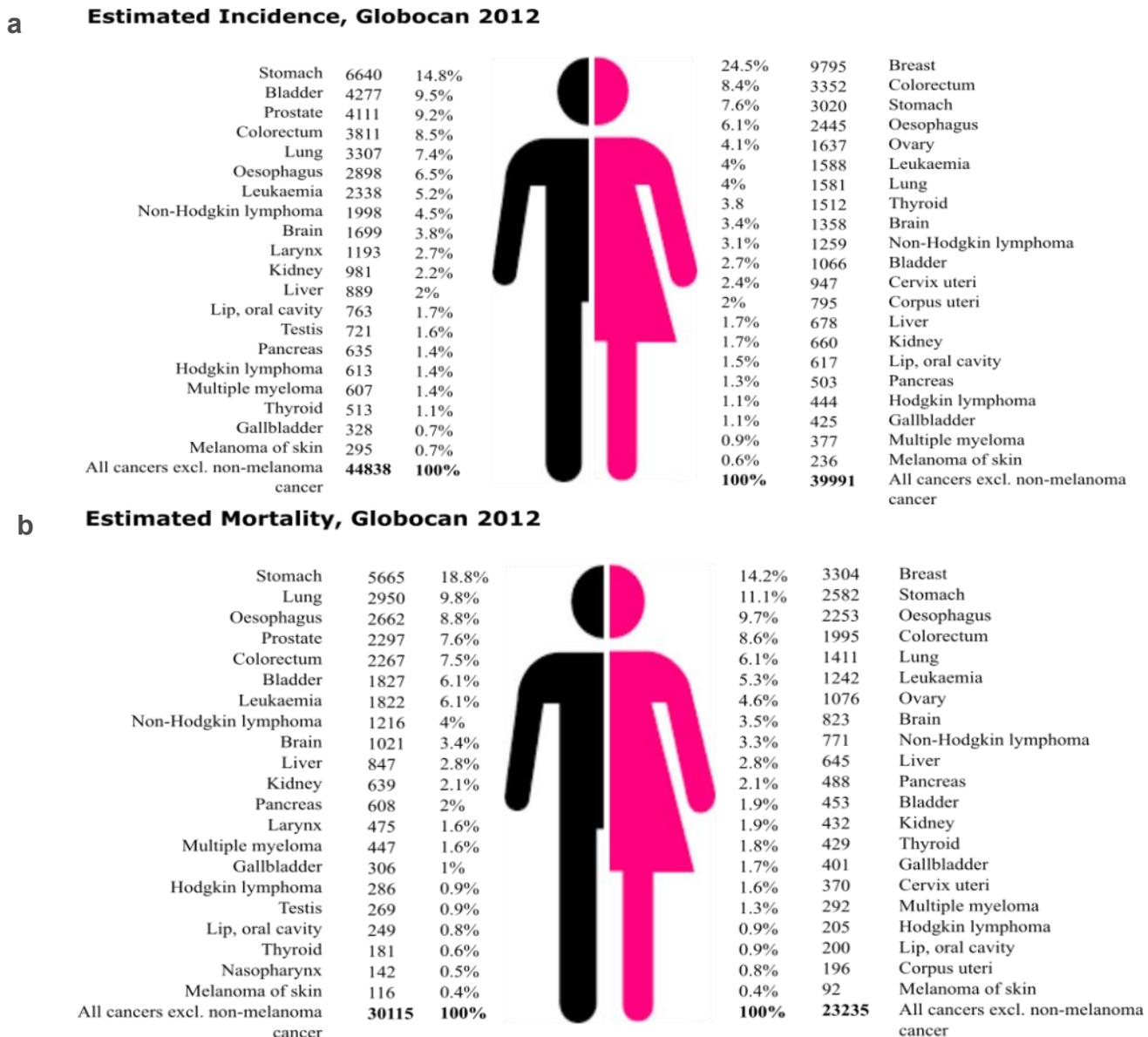


Figure 3 The estimated cancer cases and deaths by Sex. About 84,829 cancer cases and 53,350 cancer deaths were estimated in Iran, for the year 2012

Cancer in Children

According to American Cancer Society (ACS), cancer is the third main reason for children's mortality after injuries and unintentional deaths.

ACS estimated that in 2016, 10,380 children aged 1 to 14 years in the United States would be diagnosed with cancer and 1,250 children will die from the disease (14).

The first report of childhood cancer in Iran was published in 1974. The national pathologic-based cancer registry which has been developed since 1984 reported the incidence of childhood cancer about 60 per million in 2006 (12). Since 1998 the cancer research center of cancer institute has started to collect cancer data in Tehran Metropolis by a population-based approach. This center reported an incidence of 144 for childhood cancer from 1998 to 2001 (15). A population

based cancer registry in Ardebil province reported an incidence rate of 50 for childhood cancer from 1996 to 1999 (16).

Mosavi-Jarrahi et al. reported an overall incidence rate of 176 per 1000,000 childhood cancer in Tehran during 1998 to 2002 (aged 0-15 years) (17). According to Golestan Population-based Cancer Registry (GPCR) 5076 cancer cases were diagnosed in Golestan during 2004 to 2006. Of these, 139 (2.74 %) were under 14 years old. Moradi et al. reported that the ASR rates for childhood cancer were 119.8 and 78.3 per 1000,000 person-years in male and female children, respectively (18).

However, NCR reported 15.9 and 18.8 per million in females and males, respectively. This discrepancy might be due to many unreported diagnosed cancers cases by oncologists without sending the specimens to pathologic centers (12).

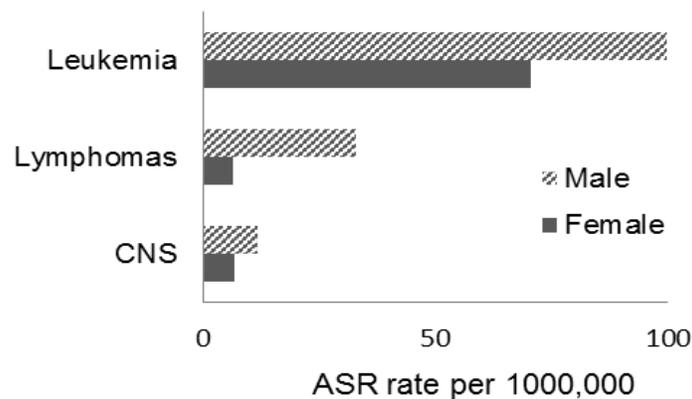


Figure 4: The most common childhood cancers in Golestan province/Iran (2004 - 2006)

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According to available data, the most common childhood cancer were leukemia, lymphoma, and central nervous system (CNS) (19). The data from GPCR also shows the same result (See figure 4). Unfortunately, no official report about childhood cancer statistics was disclosed by the authorities in recent years. Based on statistics announced by the Mahak Charity Organization before 2008, 9 out of every 100,000 children have been diagnosed with cancer, however, this statistics has been raised from 2008 onwards.

Most Common Cancers in Iran

Based on latest report from GLOBOCAN 2012, breast cancer in females and stomach cancer in

males are the most frequently diagnosed cancers and the leading cause of cancer death in Iran. Figure 5 indicates the most common cancers expected to occur in men and women in 2012 based on GLOBOCAN. However, the pattern of cancer incidence is different in various geographical regions, mainly due to the differences in risk factor. For example, according to statistical studies conducted in Khuzestan province (20), between 2002 and 2009, the top 5 highest ASRs in Iranian males were skin (16), bladder (10.7), prostate (7.64), stomach (7.17) and colorectal (6.32). These were breast (26.4), skin (13.6), colorectal (7.52), stomach (4.31) and bladder (4.07) in females (26).

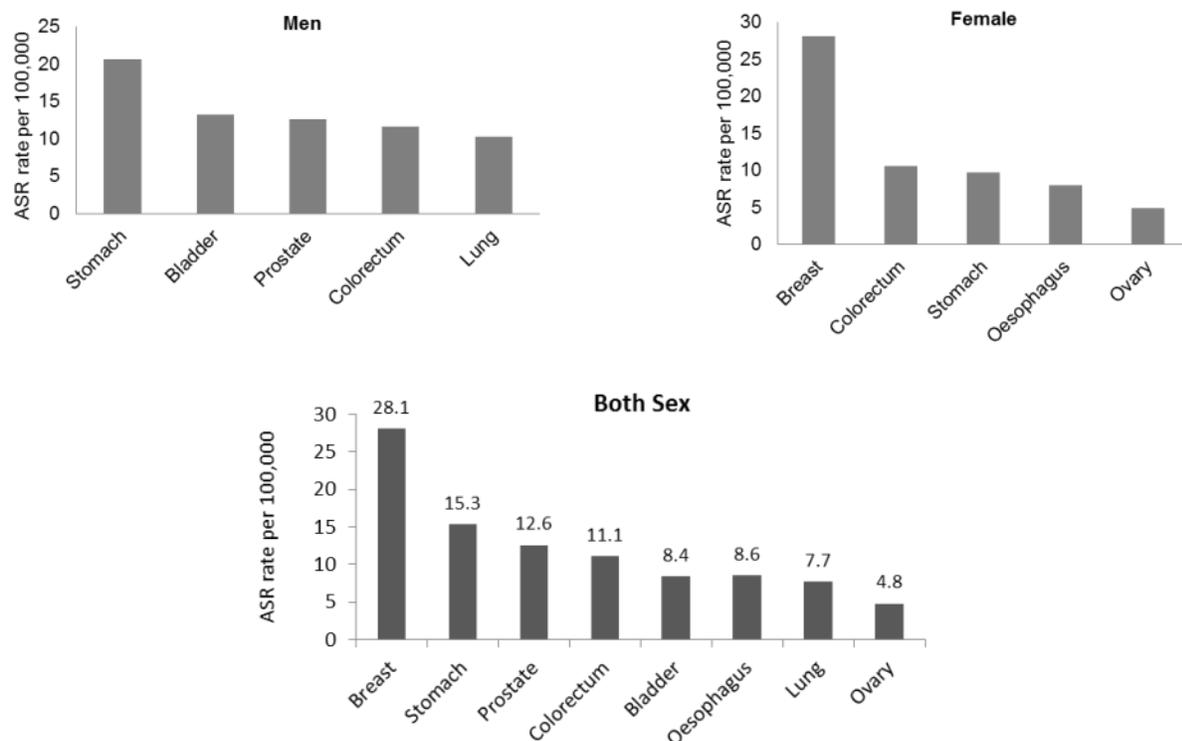


Figure 5: Most common cancer by sex in Iran, 2012

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Vakili et al. (2005 - 2009) indicated that the most prevalent cancers in Yazd province between 2005 to 2009 were skin, bladder, colorectal, stomach and prostate in males and breast, skin, colorectal, gastric and leukemia in females (21). Rafiemanesh et al. presented a study based on the average ASR during 2004 and 2009, and showed the most frequent cancers were gastric (3.72), skin (3.46), leukemia (2.24), esophagus (2.20) and bladder cancer (2.15) in males while the most common cancers in females were breast (4.77), esophagus (3.14), skin (2.95), colorectal cancers (1.91) and leukemia (1.53) (22) in Sistan and Baluchestan province. Of note, skin is one of the most common cancers in all mentioned studies. The main difference between the results reported in the present study with the previous studies mentioned above is skin cancer. Probably one of the most important risk factors for skin cancer is sunlight which is intense in Yazd, Khuzestan, and Sistan and Baluchestan.

Breast Cancer

Globally, breast cancer is the most common cancer afflicting women. Likewise in Iran, breast cancer is the most frequently diagnosed cancer and the leading cause of cancer death among females, accounting for 24.5% of the total cancer cases and 14.2% of the total cancer deaths in 2012 (Figure 3). The trends of breast cancer incidence and mortality in Iran can be seen in figure 6. However, there is largely variation in incidence rates of breast cancer

at international level which may be because of differences in reproductive patterns and hormonal factors and the availability of early detection services. Reproductive factors that increase risk include a long menstrual history, nulliparity, recent use of postmenopausal hormone therapy or oral contraceptives, and first childbirth at later ages (23). In addition, mammography screening can be another reason of increasing rate in breast cancer (24).

Colorectal Cancer

Colorectal cancer (CRC) is one of the most common cancer affecting 1.23 million individuals (9.7% of overall cancers) annually and is the fourth common cause of cancer deaths (8% of overall cancer deaths) worldwide (26).

According to the GLOBOCAN 2012, CRC in Iran is the fourth cause of cancer after stomach, bladder, and prostate in men and second cause after breast in women with about 7200 new cancer cases (7.4% of overall cancers) and 4300 deaths (8% of overall cancer death) estimated to have occurred in both sex. Recent studies have shown a rapid rise in the incidence of colorectal cancer (CRC) in Iran (26,27). The line graph (Figure 7) illustrates the rate of CRC mortality for both sexes. Although, there is not any report about CRC mortality from NDR during 2004 to 2012, based on the estimated data from GLOBOCAN 2012, the mortality trend is generally upwards.

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Changing in lifestyle and eating habits, consuming less dietary fiber and more animal fat may explain the increased incidence of CRC in Iran (28).

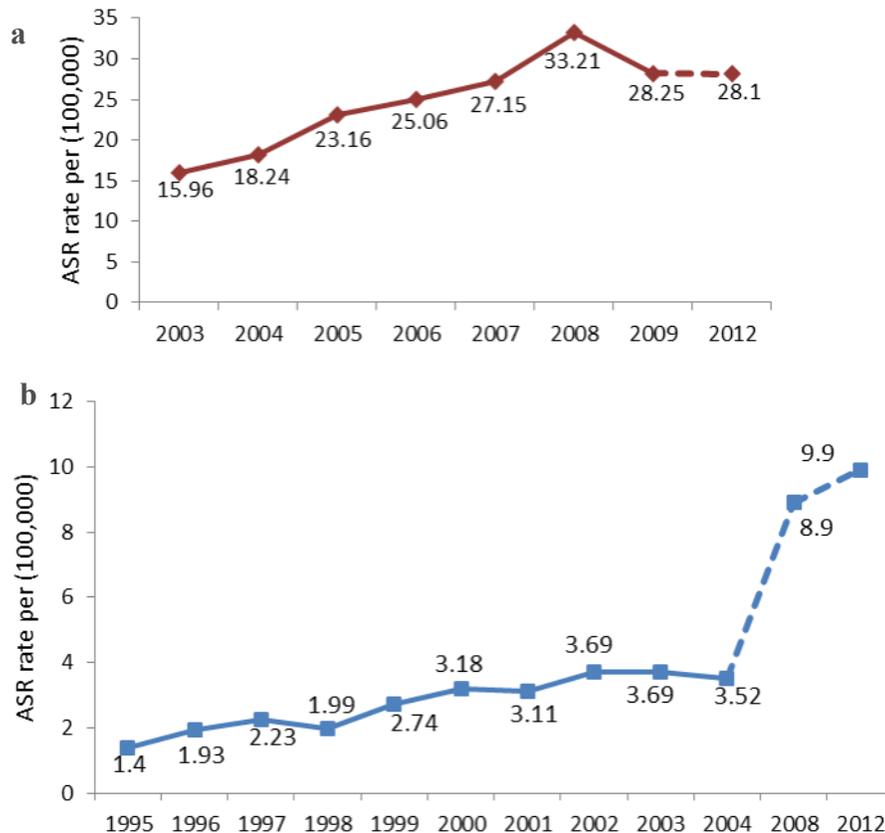


Figure 6: The trends of breast cancer incidence and mortality in Iran. The estimated data is shown by dash line. a. The data for trends of breast cancer incidence reported by Iranian annual National Cancer Registration from 2003 till 2009 (24). The data for 2012 was estimated by GLOBOCAN. b. Increasing trends of breast cancer mortality reported by the Iranian MOHME from 1995 to 2004 (25). The data for 2008 and 2012 is according GLOBOCAN estimation, shown by dash line

Stomach Cancer

Stomach cancer is the fifth most common cancer and the third leading cause of cancer death in the world (30). A total of 989,600 new stomach cancer cases

and 738,000 deaths are estimated to have occurred worldwide in 2012, accounting for 8% of the total cases and 10% of total deaths.

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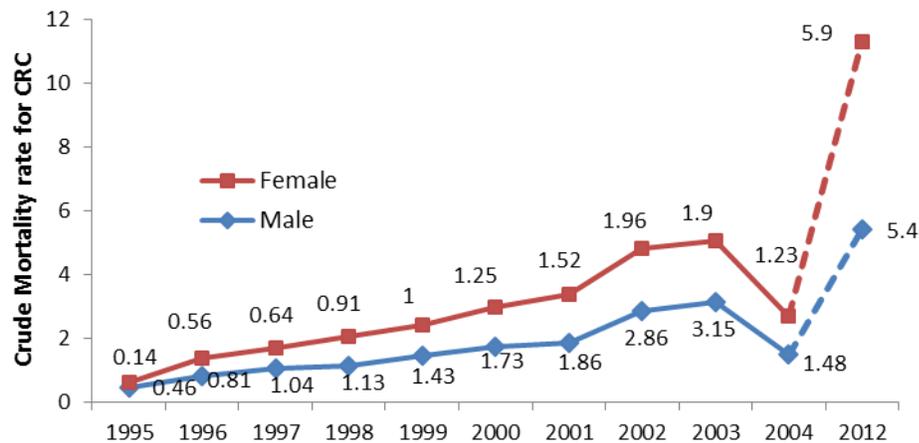


Figure 7: Crude mortality rate for CRC during the period 1995-2004 (29) and 2012 based on GLOBOCAN estimation by sex group per 100,000. The estimated data is shown by dash line.

Although stomach cancer incidence and mortality rates have decreased in developed countries (30), it shows a mild rising trend in Iran (Figure 8).

Availability of refrigeration, fresh fruits and vegetables, and a decreased reliance on salted and preserved foods are the reasons of substantially decrease in stomach cancer. Other major determinants for the favorable trends are reductions in chronic *H. pylori* infection in most parts of the world (31).

However, in Iran a couple of environmental factors, including smoking, air pollution, high salt consumption, diet with low levels of antioxidants may play a role in the pathogenesis of stomach cancer which requires further investigations (16).

The figure 8 shows the incidence rate of stomach cancer for both sexes during 2000 to 2012. As

shown, the incidence rate in men rises during 2000 to 2004; over subsequent years the trend till 2008 is steadily upwards. Afterward there is a slight decrease in the rate and from 2009 to 2010 leveled off. Since 2010 there is not any updated data based on the NCR of Iran, however, based on the estimated data from GLOBOCAN 2012, the incidence rate dramatically decreased to 20.6 from 42.9 in 2010. According to GLOBOCAN 2012, stomach cancer was the most common cancer in men (ASR = 20.6), and the third most common cancer in women (ASR = 9.7). Generally, stomach cancer rates are about twice as high in males as in females (Figure 3a).

According to published data (1) the north and northwest regions of Iran are at an increased risk of stomach cancer. Sadjadi et al. observed the highest incidence of stomach cancer in the province of Iran

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are at an increased risk of stomach cancer. Sadjadi et al. observed the highest incidence of stomach cancer

in the province of Ardebil with ASR = 49.1 and ASR = 25.4 in men and women, respectively (16).

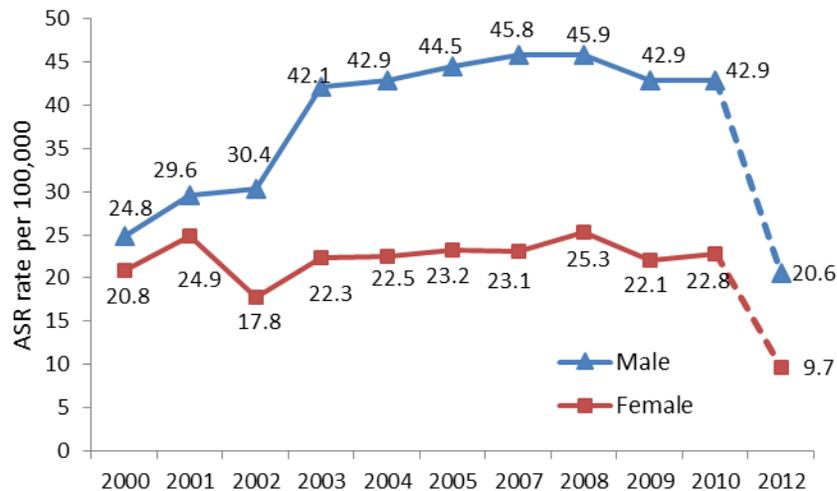


Figure 8: Incidence rate of stomach cancer in Iran from 2000 to 2010 (30). The data for 2012 was estimated based on GLOBOCAN, as shown by dash line.

Role of computational tools in cancer registry system

The massive amounts of biomedical data are stored in different formats and accessed through many interfaces. Data integration is a crucial task in cancer research, and data elements play a main role in this regard. Thus, the common data elements (CDEs) used in cancer research data capture and reporting need to be standardized. The CDEs included demographic data, clinical history, pathology data, and clinical outcome data including treatment, recurrence and vital status (32).

Developing a database of metadata for medical data to establish common classification of data elements using vocabulary standards, ontology and semantic

modeling methodology in cancer registry may improve cancer statistics reports to survey the incidence of cancer in Iran.

For example, the Taiwan Cancer Common Data Element Project (TCCDEP) developed 40 data elements to annotate the cancer registry data collected and to facilitate convergence towards a common metadata standard in Taiwan cancer registry data using a set of open source software and tools, such as the caCORE SDK and caGrid (33). The Specialized Program of Research Excellence (SPRE) is another bioinformatics-supported system to incorporate data from various clinical, pathological, and molecular systems into a single architecture based on a set of CDEs that provides

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semantic and syntactic interoperability of data sets (34,35). In order to optimize cancer registration system in Iran, it is essential to integrate it with proper information technology (IT) tools.

Conclusion

The data sources for this study were based on literature review and data presented in NCR and Globocan. Our study indicated that there is an increasing trend of cancer incidence in Iran. However, lack of high-quality data may affect the figures found in this study. Additionally, there is not a consistency between the results reported from different cancer registry systems. These differences may be result of different statistical and sampling methods, which are used. Since the prevalence of cancer risk factors such as aging, life style, food habits, pollution in Iran are high, it is expected that in the near future the numbers of cancer cases and burden of cancer will rise rapidly. Therefore, it is necessary to establish well-structured population-based cancer registries to develop a comprehensive national cancer control program as the first priorities for health policy makers. Otherwise, with seemingly and predictable increasing rate of cancer incidence the healthcare system could not overcome the demands regarding diagnosis and treatment. A considerable proportion of cancer burden may be prevented through implementing programs for air pollution control, national health services such as cancer detection in early stage, vaccination as well as health improvement programs regarding diet, physical activity, etc.

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