In Iran, a developing country in southwest Asia, an epidemiologic transition is underway from communicable to noncommunicable diseases. In Iran, cancer is the second largest group of chronic non-communicable diseases (NCDs) and the third most common cause of death following heart disease, accidents and other natural phenomena. There are some studies reporting an increasing trend in the incidence and mortality rate of a variety of cancers in Iran. Therefore, controlling and preventive interventions pertaining to cancers must be a main priority for health policy and it is recommended that the high-risk population receive earlier screening. In this review, incidence and mortality of colorectal, lung, liver, thyroid, and bladder cancers in Iran are reported.

Key words: Iran, cancer, incidence, mortality, risk factor.

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Review paper

A review of incidence and mortality of colorectal, lung, liver, thyroid, and bladder cancers in Iran and compared to other countries

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Introduction

Based on GLOBOCAN 2012, cancers have led to more than 14 million new cases and over 8 million deaths worldwide. The fraction of developing nations is estimated to be 56.9% for incidence and 64.9% for deaths from cancers [1]. Malignancy with 14% of total deaths among the Iranian population is the third cause of mortality; every day 98 people succumb to the disease in the country [2]. There are in excess of 90,000 new cancer cases yearly in Iran, and it is estimated that this figure will double by the year 2020. Depending on the Iranian national report of cancer registry in 2009, 55.58% of cancer patients in Iran were male. As a result, the sex ratio reached 1.25 [3].

To date, there are more than 200 types of cancer in the world, many of which are happily very rare. Trends in overall incidence and overall cancer mortality are heavily influenced by the rather common cancers [4]. The incidence of cancer in various countries is different. The five most common cancers (except skin cancer) in males in the world are lung, prostate, colorectal, stomach, and liver, but in females they are breast, lung, colorectal, cervix uteri, and stomach [5–7]. Also, "five common cancers (except skin cancer) in Iranian males were stomach, prostate, bladder, colorectal, and esophagus, and in females were breast, colorectal, stomach, esophagus, thyroid" [3].

The present study provides a rather comprehensive and updated picture of common cancer incidence and mortality based on the data available in Iran. Knowing what trend cancers have plays an important role in cancer control planning, implementation and evaluation of cancer-related intervention in scientific research.

Material and methods

In this review, the data were obtained from published metaanalyses, original research and review articles. The following terms were searched in databases: Iran, tumor, cancer, mortality, incidence, prevalence, colorectal, lung, liver, thyroid, and bladder. The data were collected from databases such as Google Scholar, Scopus, PubMed, Embase, and Web of Science. The included studies were published before 2019.

Results

Incidence and mortality of colorectal cancer

Morphologically, colorectal cancer (CRC) was classified into the multiple groups consisting of adenocarcinoma, carcinoma lymphoma, mucin and mucin producing, and other variants [8]. In a study, it was reported that in Iran, adenocarcinoma is the commonest histological type, after lymphoma and squamous cell carcinoma, and other types are uncommon [9].

Both inheritance and environment factors participate in the development of CRC, each to a various degree in different patients. It was reported that only 20–30% of CRC cases can be attributed to a determined inherited factor [10]. The remaining majority (70–80%) occur due to the life styles and environmental factors such as pattern of food consumption (low consumption of fruits and vegetables, daily drinking of alcohol and high intake of red meat), smoking and physical inactivity [11], family history, unfavorable socioeconomic conditions, obesity, cooking techniques [12], high body and abdominal fatness, hormone replacement therapy, consumption of eggs and nonsteroidal anti-inflammatory drugs [13]. In addition, polyps and syndromes of high bowel risk such as inflammatory bowel diseases, particularly ulcerative colitis, must be considered as a risk factor for this cancer in the general population [13]. Also, it was reported that ethnicity can have a significant etiological role in CRC in Asia [14]. It is notable that the pattern of food consumption in Iranians might demonstrate the rising incidence rate, since more recently, people instead of traditional foods consume more fat and fast food [11, 15].

CRC is the third most frequently diagnosed malignancy among males and the second among females worldwide [16]. Furthermore, it is the fourth most common causes of death associated with cancer across the world (8% of overall cancer deaths), which was calculated as more than 1000,000 new cases each year [17, 18]. The mortality rate of CRC is around two per 100,000 persons per year in the world [19]. The highest rates of CRC are in developed nations, such as the United States, Australia, Canada, and North-Western Europe. A low rate was found in countries of Asia, Africa, and South America while incidence rates are going up in countries previously having low incidence [14]. The incidence and mortality of CRC are increasing dramatically in Asia [18]. Westernized diet and lifestyle, especially excessive consumption of processed and red meat, low physical activity, and obesity have been claimed as the chief causes of increasing risk of CRC in lots of Asian countries [20].

In the first report in Iran, CRC was the third most frequent cancer among males (ASR [age-standardised rate] = 8.19–8.3) and the fourth among females (ASR = 6.5–7.56) [21]. According to the International Agency for Research on Cancer (IARC), the incidence rates of CRC among Iranian males and females were 8.7 and 6.4 per 100,000, respectively, in 2008. Also, a report from the Iran Cancer Registry (ICR) implies that CRC is the third most prevalent malignancy in Iranian women and the fifth malignancy in Iranian men [18]. In another study, it was reported that CRC is the fourth main cause of death linked to cancer in Iran [3]. In recent study by Rezaianzadeh *et al.*, it was reported that the highest and lowest ASRs were 3.4 and 2.6 in men and 11.42 and 10.56 in women, respectively [22]. These difference reports are because of distribution of registration centers and statistical methods as well as sampling methods [23]. Although the incidence of CRC in the Iranian population is low, the incidence has continually increased in Iranian people during recent years [20]. More accurate diagnosis of CRC, changing lifestyle, diet quality, and increase of median age of the Iranian population are the most likely contributing factors in the increase of CRC in Iran [16]. In addition, the western lifestyle including obesity and overweight, tobacco smoking, alcohol consumption, low fiber diets and low physical activity have been related to CRC; as recently there has been observed a tendency to a western lifestyle in the Iranian population [16]. These results demonstrate the requirement of paying more attention to CRC screening as a significant issue in health policy priorities [22].

The geographical distribution of CRC showed that its incidence is higher in the central and western areas of the Caspian Sea and the central area of Iran. This difference may be because of statistical methods, sampling methods, and distribution of registration centers [23]. In a report by Dolatkhah *et al.*, it was demonstrated that the highest ASR is from Tehran for men (16.4) and from Zahedan for women (13.25) [20]. In Tehran, the incidence of CRC is greater than the estimation of World Health Organization (WHO) for Iran [20]. In an ecological study conducted in all the 22 areas of Tehran, there was an association between CRC incidence and socioeconomic position, various food groups, and other risk factors such as smoking [20]. The crude incidence rates in both sexes were the lowest in Hormozgan province, with 1.2 and 1.10, for females and males, respectively [24], which may be due to nutritional habits, i.e. high consumption of fruits and vegetables, and genetic factors. In addition, due to weather conditions, date fruit (a strong antioxidant) is widely grown and consumed in this area of Iran and it can potentially reduce the mortality and incidence rates of most gastrointestinal tract malignancies [20]. There is a systematic review and meta-analysis on CRC incidence in Iran which can be referred to for detailed information on the prevalence of CRC in different provinces [20].

There are several reports about incidence and mortality of CRC in Iran [11, 19, 20, 25]. In a study by Abdifard *et al.* it was reported that CRC has a rising trend in the west of Iran. They concluded that the increased rate of CRC may be attributable to rising cancer risk factors [11]. In another study by Ahmadi *et al.*, it was reported that CRC patients' mortality rates were 96.9 and 83 person-years among men and women, respectively [25]. In another study by Dolatkhah *et al.*, ASR of CRC were 6.17 and 8.16 for females and males, respectively [20].

Incidence and mortality of lung cancer

According to a WHO report, primary malignancies of the lung are classified into eight major groups [26]; as roughly

88% of lung tumors are categorized in four cellular types: adenocarcinoma, squamous cell carcinoma (SCC), large cell carcinoma and small cell carcinoma [26]. In a study on epidemiology of lung cancer in Ardabil, Iran, it was reported that unlike developed countries, SCC was the most frequent lung cancer, and adenocarcinoma type was less frequent [27]. In another study in 2014, it was demonstrated that lung cancers in Iran were: SCC, adenocarcinoma and small cell carcinoma 52.7%, 14.8% and 13.3%, respectively [28].

Smoking is the major risk factor for lung cancer [29]. Although it is significant in all types of lung malignancies and there exists a strong relationship between smoking and the incidence of SCC and small cell carcinoma, the association of smoking with adenocarcinoma is lower [28]. Other risk factors consist of secondary contact with cigarette smoke, air pollution, environmental and occupational exposure to asbestos and radon, particular metals (especially cadmium, arsenic, and chromium), and radioactive materials or some organic chemical, genetic susceptibility (young people), coal smoke and the spread of many different kinds of fuels in the household [30, 31]. Also, it was suggested that lung diseases such as bronchitis, emphysema and asthma can lead to lung malignancy (particularly SCC in old age) [26].

Lung cancer is the commonest diagnosed cancer and the commonest cause of death related to cancer worldwide [32]. It is estimated that lung cancer will become the seventh cause of death and will include 3% of the total deaths by 2030 [31]. Poor prognosis and high incidence of lung cancer have led to lung cancer being a main health problem during past decades. Also, the most frequent age for incidence of lung cancer is 55–65 years [26]. The lowest incidence of lung malignancy was observed in central Africa and the highest in North America [33]. It is noteworthy that variations in lung cancer incidence rates and trends among various countries or between males and females of a country chiefly imply differences in grade and stage of the tobacco epidemic [33].

Lung cancer prevalence in Iran is lower than the USA and Europe [28]. Despite lower frequency of lung cancer in Iran, the patients have a short survival [28]. In Iran, lung cancer, the fifth most frequent cancer, has an incidence rate of 4.7–9.2 per 100,000 people [30]. In a study on estimation of lung cancer ASR in Iran, it was reported that the rate of this cancer ASR was 9.7 in 2014 and 27 in 2030 [34]. The reason for low incidence of lung cancer in Iran may be the lower rate of smoking and opiate abuse in the Iranian population in comparison to the world. Especially, it was shown that the proportion of females smokers in Iran was much lower than other countries [28].

According to the geographical distribution of lung cancer, it has been shown that this cancer is the most common in provinces of Kurdistan and West Azerbaijan. Dust and its distribution range may be considered for greater prevalence of lung cancer in the western regions of Iran. It is mentioned that the chief sources of dust in Iran are dry swamps and deserts of Iraq [23]. In another study in Golestan province, it was reported that the mean ASR for lung cancer is 11.55 (17.5 for males and 5.6 for females) [34]. According to results of a study in 2015, 14,403 cases of lung malignancy were recorded, of which 10 582 cases were in males and 3821 in females in Iran; the greatest incidence rates were found in the 80–84 age group. The above findings demonstrated that lung cancer incidence in Iran is rising and is higher in males. This conclusion is expected because the prevalence of smoking (as the main risk factor for this cancer) in males is higher than females [32]. According to results of another study, ASR of lung cancer for females and males increased from 0.3 and 0.8 per 100,000 people in 2000 to 1.5 and 4 in 2005, respectively, in Iran; the highest rate of lung cancer was found in the mountainous area, and the lowest rate was observed in the western provinces of the Caspian Sea area. However, their results showed that there is a rising trend in the incidence of lung cancer in all geographical regions. The reasons for increasing incidence of lung cancer in Iran may be the increasing rates of urbanization, smoking tendency, and environmental pollution in Iran [31].

Incidence and mortality of liver cancer

Hepatocellular carcinoma (HCC) is the most common type of liver cancer, which histologically arises from hepatocytes; it represents around 90% of primary liver malignancy and 7% of all malignancies [35].

The main risk factors of HCC are HBV/HCV infection, exposure to aflatoxin, alcohol, non-alcoholic fatty liver disease (NAFLD), obesity, diabetes, cirrhosis and smoking [36]. Globally, hepatitis B or C viruses (HBV/HCV) are risk factors for around 80% of HCC cases [37]. In Iran, 80% of cases of developed HCC type are positive for at least one of the HBV markers; this virus seems to be the most frequent cause of HCC in Iran [38]. Since most cases of HCC are due to HBV and this infection was lower common in Iran, the burden of HCC type is low in this country [38].

Liver cancer is amongst the most frequent malignancies in the world [39]; this malignancy is the sixth most frequent cancer and the second leading cause of death relating to cancer in the world [40]. The highest incidence rate of liver cancer is in sub-Saharan Africa and Southeast Asia, and it is also rising in Europe and North America, which may be because the HBV infection is endemic [41]. Mortality of liver cancer has been quickly rising since 1970, because over 85% of new cases of liver cancer occur in developing countries which do not have appropriate diagnostic and treatment facilities [42]. In 2013, the age-standardized death rates (ASDRs) per 100,000 population for liver cancer were 7 and 15 in developed countries and in developing countries and the ASDRs were 7 and 16 in developed countries and in developing countries [43]. The greatest mortality and incidence of liver cancer has been observed in the west region of the Pacific Ocean; the mortality and incidence of liver cancer are around 38 times higher than in the East Mediterranean Sea, with the lowest mortality and incidence rates [40]. It is notable that differences in the geographical distribution of hepatitis C and B, life pattern, genetic differences, and distribution of environmental carcinogens such as aflatoxin have led to differences in geographical distribution, time, and population of hepatic cancer in developing and developed countries [35].

Iran is located in a region of low risk having an annual incidence less than 5 per 100,000 [44], since Iran is classified as a low endemic country for hepatitis C and B infections (as the main risk factor of HCC) [45]. The mortality rates of liver malignancy per 100,000 population were from 4.78 in 2006 to 5.37 in 2010. The mortality rate of this cancer in the age groups studied demonstrated that liver cancer mortality increases with increasing age and most deaths were found in patients over 70 years old [46]. According to a study in 2016 on the incidence and trend of liver malignancy in Iran, 3584 cases of liver malignancies were recorded between 2003 and 2009, of which 1360 and 2224 cases were females and males, respectively. The results of the above study showed significantly rising trends ($p = 0.001$). The above study demonstrated that the lowest incidence rate (i.e. 256 cases) of liver cancer occurred in 2003 and the highest incidence rate (i.e. 950 cases) was in 2007 [35].

In a study by Farahmand *et al.*, it was reported that the ASR of liver malignancy between 2001 and 2008 demonstrates a 3.7-fold increase in the Fars province. Such increases of liver malignancy are partly due to the rising trend in the incidence rate of cancer during the period (real changes) and partly because of the various methods of collecting information (based on population), the conceivable changes in diagnostic techniques, justifying physicians, their increased knowledge, and the related institutes on the importance of reporting doubtful cases (unreal changes) [47]. According to data from 1999 to 2006, the ASR of liver malignancy was rising to 0.7 and 0.2 per 100,000 people in Kerman and all over cities of Iran, respectively. The lifestyle of its inhabitants, like their diet, increase of exposure to risk factors, and increase of life expectancy might increase the risk of HCC. For example, Kerman province generates more than 60% of pistachios of Iran, which used to be a major source of exposure to dietary aflatoxin [48]. In another study, it was reported that provinces such as Ardebil, Semnan, Fars, and Khuzestan had the greatest incidence of liver malignancy [35]. There are several reports on estimating the liver cancer incidence rate in some province of Iran [48–52].

According to data related to a study, the increased prevalence of liver malignancy may be because of increased average age, population and geographical distribution, and improving health and malignancy registry in Iran [35]. Hence, the program for the prevention and control of liver cancer must be a great priority for health policy makers as well as it being recommended that the high-risk population receive earlier screening and vaccination [35].

Incidence and mortality of thyroid cancer

There are 4 basic categories of thyroid cancers, papillary, follicular, medullary and anaplastic carcinoma, the first two of which are more curable compared to the others, but medullary and anaplastic thyroid cancer comprise around 3% of thyroid cancers [53]. The findings of a detailed study carried out in Iran indicated that thyroid papillary carcinomas included 79.7% of all cases. Follicular, anaplastic, and medullary types constituted only 8.8%, 7.9% and 3.6% of all cases, respectively [54].

A wide variety of studies have investigated the etiology of thyroid cancer. Some leading causes linked to thyroid cancer are: ionizing radiation exposure, goiter and benign nodules/adenomas. In addition, other factors contributing to thyroid cancer risk include sex (hormonal and reproductive factors), height and weight at diagnosis, environmental and lifestyle factors, such as dietary habits (fish consumption in endemic goiter areas, and cigarette smoking) and exposure to toxicants. The risk of thyroid cancer has also been associated with some conditions such as allergy, hypertension, and gallbladder disease [55]. In Iran, there is no comprehensive study on risk factors related to thyroid cancer. Iodine deficiency as a hyper-endemic condition in Iran contributes a rather increased incidence of thyroid cancer. However, the association of iodine deficiency with thyroid cancer is conflicting [56].

Thyroid cancer is the most frequent cancer concerning endocrine system in the world [57]. However, thyroid cancer is one of the less frequent ones, representing only 1–2% of all cancer types and its ASIR for more developed and less developed nations is 3.6 and 1.4 per 100,000 people, respectively [58]. This malignancy represents 2.1% of all new cancer cases in the world, 3.0% in the WHO Americas region, 2.4% in Iran, 2.2% in less developed regions, 2.1% in Asia, 2% in more developed regions, and 1.7% in the WHO Europe region [59]. A 2.3-fold growth in the thyroid cancer incidence has occurred in numerous countries across Asia, Europe, South America and Oceania, whereas some countries such as Norway, Sweden, and Spain have experienced a decline in thyroid cancer. Southern Australia with 177.8% malignancy incidence growth in men and 252.2% in women from 1973 to 2002 reported the highest increase in the thyroid cancer [60]. Thyroid cancer cases having been increasing worldwide during the past decades, such remarkable growth in its incidences stems mainly from early detection of even small tumors by advanced apparatus and methods [61]. The reason(s) behind the global rise in thyroid cancer are still elusive. There has been a lot of controversy about the determinants of the worldwide increase of thyroid cancer incidence. Diagnostic intensity is considered to be the leading factor responsible for the carcinoma incidence increase. Another major source of its increasing incidence is attributable to environment and lifestyle changes [61]. Its 5-year survival rate varying by patient age and stage of disease ranges from about 85 to 100% [53]. Taken together, 40,000 deaths from thyroid cancer occurred in 2012 worldwide. However, thyroid cancer mortality has declined over the last 10 years, due to variations in risk factor exposure, medical advances, diet enrichment and earlier detection [58]. Compared to most other adult cancers, thyroid cancer often occurs at younger ages. Meanwhile, some studies have revealed that no statistically significant difference has been found in the incidence of thyroid malignancy between young and adult patients [62]. According to statistics from GLOBOCAN 2012, thyroid cancer mortality is 0.5% worldwide. Thyroid cancer represents 0.4% of mortality in more developed regions, 0.6% in less developed regions, 0.5% in Asia, 1.1% in

Iran, and 4% in the WHO Europe and Americas region [59]. Thyroid cancer is much more common in women (230,000 new cases) than in men (70,000 new cases) [58].

Among the Iranian population, thyroid cancer is the 7th most frequent one in women, 14th in men and the 11th most common in both sexes [63]. In a study by Haghpanah *et al.*, the ASR for thyroid cancer was 1.289 (1.59 for females, 0.627 for males) [64]. According to a study in 2015 on the incidence rate and trend of thyroid cancer in the Iranian population, it was reported that there was an increase in incidence of thyroid cancer over 2003–2009. Furthermore, the ASR for males and females increased from 0.82 and 2.02 to 1.36 and 4.2 per 100,000, respectively [59]. Although enhanced detection is related to the increased thyroid cancer incidence during the past decades, it cannot entirely clarify the reason for the increase [59, 65]. In another study performed in 2016, the incidence rate of thyroid cancer was reported as 2.20 per 100,000 persons between 2004 and 2010 in the Iranian population [66]. The highest prevalence rate of thyroid cancer was among those aged 45 years at the time of diagnosis. Furthermore, a dramatic fall was observed in the rate of thyroid cancer among children less than 19 years old [66]. Mean age of Iranian patients at diagnosis is around 43 years, implying earlier occurrence of thyroid cancer in Iranians in comparison to most countries in the world [67]. In a study on thyroid cancer patients in Iran, the female to male ratio was 1.8, while it was 1.3 in anaplastic carcinomas due to its higher prevalence among men [67]. It was reported that one-, two-, three-, four- and five-year survival rates of thyroid cancer in Iran were 95%, 92%, 91%, 90% and 88%, respectively [68].

In a study on data of four Iranian provinces (Kerman, Mazandaran, Gilan and Golestan) during 1996–2000, it was found that the highest incidence rate of thyroid cancer is in Kerman (ASR of 1.643) and the lowest incidence rate in Golestan (ASR of 0.735) [64]. Mehrabani *et al.* examined the occurrence of thyroid cancer in Fars province (southern Iran). They reported that the ASR per 100,000 population was 0.52 and 0.83 in males and females, respectively [69]. In another study by Khayamzadeh *et al.*, the best survival in the patients with thyroid cancer was reported in the southwest area (Khuzestan), but the worst in northwest (Azarbaijan) [68]. Hajizadeh *et al.* investigating the ASR for thyroid cancer incidence (per 100,000) from all provinces in Iran revealed that in total Isfahan, East Azarbaijan, Fars, and Chaharmahalbakhtiari had the highest but Qom, Sistanbalochestan, and Semnan the lowest incidence rate in 2008 [59]. Ardakani *et al.* estimated survival of patients suffering from thyroid cancer in Yazd, Iran. Their findings revealed that survival rates at the end of 1, 3, and 5 years were 99%, 96%, and 91%, respectively. Furthermore, the lowest survival rate was observed in patients with the anaplastic type and stage IV of thyroid carcinoma [57].

Since many cases of thyroid cancer are curable successfully, diagnosis of this malignancy at early stages is expected. Moreover, attention to high-risk groups and public awareness programs are necessary to reduce the incidence of thyroid cancer in future. On the other hand, the use of radioactive iodine therapy can lead to increasing the survival rate in patients having thyroid cancer.

Incidence and mortality of bladder cancer

In terms of morphology, in developed countries, transitional cell carcinoma (TCC) is the commonest kind of bladder cancer (90%), following SCC (5%), and adenocarcinomas (2%). However, in developing countries, SCC is the most common type (75%) of bladder cancer [70]. In Iran, it was reported that bladder TCC, papillary TCC, adenocarcinoma, carcinoma, and SCC include 43.89%, 49.86%, 1.20%, 0.49%, and 1.14% of all cases, respectively [71].

Development of approximately half of all bladder cancers is attributable to smoking [72]. There are associations between risk of developing bladder cancer and occupational exposure to aromatic amines and polycyclic aromatic hydrocarbons. However, little is known about the impact of environmental pollution and diet on incidence of bladder cancers [73]. Other suspected risk factors reported to contribute to developing bladder cancer include high body mass index, behavioral elements, and genetic factors [74]. In a study on factors contributing to bladder cancer in Iranians, it was reported that pickles and vegetables had protective effects. In addition, histories of all evaluated diseases were accompanied by increased risks for bladder cancer. Cigarette smoking, opium use, history of excessive analgesic use and hair dye use had significant correlations with bladder cancer occurrence [75]. It is notable that since there are more than one million opium abusers in Iran, high use of opium and its derivatives among Iranian people has been known as the most important risk factor for bladder cancer incidence [76, 77].

Bladder cancer with an estimated 382,700 new cases (294,400 in males and 88,300 in females) and 150,300 deaths in 2008 is the 11th most common and the 14th main cause of cancer-related deaths worldwide [78]. Depending on the differences in risk factors, incidence and mortality rates of bladder cancer vary from one country to another [78]. The highest incidence rates of bladder cancer among men have been observed throughout southern, western and northern Europe, North America, and Oceania; relatively low rates are observed in Eastern Europe, Central America, South America, and a number of areas of Asia [79]. The findings of a study by Chavan *et al.* revealed that the maximum incidence rates belong to developed countries and some regions of Africa, while the highest mortality rates are in Middle Eastern nations and North African [80]. Recently, a downward or stable trend in bladder cancer incidence rates has been observed in many Western countries [81]. Furthermore, prevalence and incidence of bladder cancer rise with age, as the peak incidence is in the 7th and 8th decades of life [82]. The bladder cancer mortality rate is 10 per 100,000 for males and 2.4 per 100,000 for females [83]. It is notable that the stage of malignancy and development levels of a region have an impact on the mortality rate of bladder cancer [70]. Moreover, mortality patterns of bladder cancer have been declining or stable across most parts of Europe and China. The reduction in smoking prevalence has made a huge contribution to the fall of bladder cancer incidence [81]. Bladder cancer incidence is about 4 times higher in men than women. The difference in incidence according to gender has been esti-

mated to be largely attributed to the higher prevalence of tobacco smoking among men [84]. A comparison of bladder cancer between sexes has shown high male-to-female ratios in the northern African region (e.g. Egypt) and Western countries [80].

Bladder cancer is the sixth most frequent malignancy in the Iranian population with an estimated ASIR of 8.4 per 100,000 people and ranks as the second malignancy site among Iranian men [85]. This malignancy is also the main genitourinary malignancy, with an increase of ASR from 2.12 in 2003 to 3.28 in 2009 [86]. Hosseini *et al.* investigated the relationship between bladder cancer and opium consumption in an Iranian population. Their results showed that there is approximately a 5-fold surge in risk of developing this malignancy with opium consumption [77]. In a recent study, it was reported that the incidence rate of bladder cancer in the Iranian population is rising. This increase may be due to improvements in the cancer registration system, lifestyle, increase of life expectancy and other risk factors [87]. In another study, Mahdavi *et al.* evaluated mortality rates of bladder cancer per 105 persons and reported that the death rate from bladder cancer decreased from 1.12 to 1.09 over a five-year period (2006–2010). In addition, Mahdavi *et al.* reported that the mortality rates in men, during that time span, increased with age [88]. In a recent report on the histological and epidemiological trend of bladder malignancy in Iran, it was revealed that there is an increasing trend in ASIR of bladder cancer, so that the ASIR increased from 2.12 to 3.78 in females and from 8.35 to 14.42 in males per 100,000, which was significant for both sexes [71].

The geographical distribution map of bladder cancer in terms of ASIR in 2005 revealed that Yazd, Kurdistan, Gilan and Fars have the highest but Hormozgan, Hamedan, and Sistan-Baluchestan provinces the lowest incidence [23]. In a study, Talaiezadeh *et al.* reported bladder cancer incidence in Khuzestan province (Southwest of Iran). Their data indicated that bladder cancer is the fifth (with ASR of 4.07 per 100,000) and the second (with ASR of 10.7 per 100,000) most common malignancy in males and males, respectively [89]. In a study, Ahmadi *et al.* evaluated socioeconomic and epidemiologic status of bladder malignancy in Mazandaran province (northern Iran) and reported that bladder cancer is often observed in the elderly and the men to women ratio was 8. Furthermore, Ahmadi *et al.* showed that macroscopic hematuria is a remarkable symptom for detecting bladder cancer, likely urothelial tumor, that should be followed up in patients with transabdominal ultrasonography [83]. In another study by Ramezani *et al.* on clinicopathological and epidemiological features of bladder cancer in Kermanshah province (west Iran), it was found that bladder cancer is a common cancer often diagnosed in older adults, so that 90.5% of patients were aged over 40 years and 81.4% were older than 50 years [90]. Salehi *et al.* investigated the epidemiology of bladder cancer in Shiraz (southern Iran) and reported that opium and tobacco use were found in 34.1% and 65.3% of patients, respectively. Furthermore, transitional cell carcinoma (95.7%) was the most common type of bladder cancer [91]. Somi *et al.* reported a bladder cancer ASR of 3.68 and 15.72 for females and males during the years 2006–2007 in east Azerbaijan [92]. In a recent study on prevalence of bladder cancer in Isfahan Province, Iran, a 28.6% increase in the incidence rate of this cancer was reported over the years 2011–2015 [93]. Keyghobadi *et al.* evaluated the epidemiology and trends of bladder cancer in the province of Kerman (southeast of Iran). They reported that bladder cancer was the third most common cancer in both sexes during a six-year period (2004–2009) and the second most prevalent cancer in males and its incidence increased between 2004 and 2009 (from ASIR of 7.73 in 2004 to 14.66 in 2009) [94].

Given the growing trend in bladder cancer incidence, it is recommended that health policies should be adopted in order to prevent the respective risk factors such as tobacco and harmful industrial materials. In addition, the use of hematuria home screening can lead to decreasing mortality from bladder cancer. Furthermore, it is necessary to be given public education related to the long-term side effects of opium abuse as well as screening for bladder cancer among opium and tobacco abusers at younger ages.

Conclusions

Colorectal cancer (CRC) is the fourth most common cause of cancer-related deaths worldwide. The incidence of CRC remarkably differs based on the geographical areas. In addition, there is a considerable divergence in the mortality and incidence rates of CRC between various racial and ethnic groups. There is an increasing trend in CRC incidence in low-risk countries such as Iran. Earlier screening and change in the life-style can be effective methods to reduce the burden of CRC. Generally, it is recommended that onset of screening programs for CRC at age 50 for average-risk individuals would be appropriate, while for those at high risk, earlier screening is suggested.

Globally, lung cancer is the most commonly diagnosed cancer and the commonest cause of cancer-related death in the world. It is known as one of the costliest illnesses. Poor prognosis and also high incidence have made lung cancer a main health problem in the world over the past decades. The lung cancer incidence in men more than women is likely due to the smoking pattern. The lung cancer prevalence in Iran is lower than in the USA and Europe. The increasing lung cancer incidence rate in Iran is occurring along with increasing environmental pollution, rates of urbanization, and smoking tendency. Therefore, implementation of policies related to effective tobacco control can be a way of reducing lung cancer prevalence.

Liver cancer is amongst the most frequent malignancies in the world. The highest incidence rates of liver cancer are in sub-Saharan Africa and Southeast Asia, and the rates are also rising in Europe and North America, which may be due to HBV infection being endemic. Iran is located in a region of liver cancer low risk, owing to a low endemic prevalence of hepatitis C and B infections. The ASIR of liver cancer in Iran is increasing, which may be due to increasing average age, population and geographical distribution, as well as improving cancer registry. Therefore, HBV vac-

cination and earlier screening are needed for preventing liver cancer in the high-risk population.

Thyroid cancer is one of the less frequent cancers, representing only 1–2% of all cancer types. A 2.3-fold growth in the thyroid cancer incidence has occurred in numerous countries across Asia, Europe, South America and Oceania. Among the Iranian population, thyroid cancer is the 11th most common in both sexes. The thyroid cancer incidence increased during the past years. Mean age of Iranian patients at thyroid cancer diagnosis is around 43 years, implying earlier occurrence of thyroid cancer in Iranians in comparison to most countries in the world. So, diagnosis of thyroid cancer at early stages is expected. Furthermore, radioactive iodine therapy can lead to increasing the survival rate in patients with thyroid cancer.

Bladder cancer is the 11th most common and the 14th main cause of cancer deaths in the world. Depending on the discrepancy in risk factors, incidence and mortality rates of bladder cancer vary from one country to another. Bladder cancer is the sixth most frequent malignancy in the Iranian population and ranks as the second malignancy site among Iranian men. It was reported that the incidence rate of bladder cancer in the Iranian population is rising. There is approximately a 5-fold surge in risk of developing bladder cancer with opium consumption. Therefore, it is necessary to provide public education related to the long-term side effects of opium abuse as well as screening for bladder cancer among opium and tobacco abusers at younger ages.

The authors declare no conflict of interest.

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