



Prevalence of the Common Cancers by Gender using GIS System in Razavi Khorasan Province

Behrouz Fathi ¹, Vahid Alinejad ², Samad Moslehi ^{3*}, Parviz Marouzi ⁴

¹Department of Health Policy and Management, School of Management and Medical Informatics, Tabriz University of Medical Sciences, Tabriz, Iran.

²Ph.D. student in Biostatistics, Faculty of Medical Sciences, Tarbiat Modares University, Tehran, Iran.

³Ph.D. Student, Department of Biostatistics, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran.

⁴Department of health information technology, school of paramedical sciences, Mashhad University of Medical Sciences, Mashhad, Iran

*Corresponding author: Samad Moslehi, Address: Hamadan University of Medical Sciences, Hamadan, Iran,

Email: s.moslehi@edu.umsha.ac.ir, Tel: +989147102206

Abstract

Background & Aims: Cancer is one of the most important causes of death and disability worldwide. In most cases, cancer is not caused by inherent biology, but by the environment where a person lives. The present study aimed to assess the prevalence of the common cancers by gender using GIS system in Razavi Khorasan Province, Iran.

Materials & Methods: In this cohort study, all the cancer reports, based on gender, in Razavi Khorasan Province were collected annually from 2011 to 2014. The study variables included the number of people diagnosed with cancer, type of cancer, and gender. The GIS software was employed to draw a geographic map for the prevalence of cancer separately by gender in Razavi Khorasan Province. A geographical map was drawn for breast cancer in women and colon cancer in men in 20 cities of the above-mentioned province.

Results: The results showed that the prevalence of breast cancer in women and stomach cancer in men was higher than other cancers. Also, breast cancer in women and stomach cancer in men was the highest in the capital of the province (Mashhad), which was equal to 4,623 and 2,770 cases, respectively, during the years 2011-2014.

Conclusion: Considering the high prevalence of three types of breast cancer in women and colon cancer in men in Razavi Khorasan Province, especially Mashhad city, it is highly recommended to take necessary measures to prevent these diseases. Drawing a geographic map for breast (women) and intestine (men) cancers for 20 cities of Razavi Khorasan province could be useful for future planners.

Keywords: Breast cancer, Colon cancer, GIS, Prevalence

Received 15 November 2022; accepted for publication 03 January 2023

Copyright © 2023 Journal of Health Science Monitor

This is an open-access article distributed under the terms of the Creative Commons Attribution-noncommercial 4.0 International License, which permits copy and redistribute the material just in noncommercial usages as long as the original work is properly cited

Introduction

Cancer is one of the most important causes of death and disability in the world, especially in developing countries. In most cases, cancer is not caused by a person's inherent biology, but by the environment where a person lives. Cancer is one of the most dangerous malignancies caused by environmental and genetic factors and causes unredeemable damage, i.e. death, to patients and their families every year (1, 2). Air pollution, poor diet, lack of physical activity, smoking and alcohol consumption, infections, and many other factors are among the substantial environmental factors leading to cancer. From the genetic point of view, more than 12 different genes involved in the occurrence of cancer have been identified, and in different types of cancer, certain genes are responsible for changes (3, 4). The symptoms caused by cancer are the rapid growth of cancer cells and the destruction of the space at the site of the conflict. By metastasizing, cancer cells involve different organs of the body, thereby increasing the severity of the disease (5). It is expected that the growing trend of cancer incidence will continue, especially in low- and middle-income countries, particularly those located in South America and Asia. According to published reports, more than 14 million new cases of cancer occur annually, and most of these cancers happen in developing countries. Predictions by 2030 have disclosed that cancer will become the most important and the first cause of human death (6, 7).

Different strategies and plans are being carried out in most countries to control and prevent death and money loss caused by cancer. The most significant plan is promoting public awareness and screening the early diagnosis of the disease. The results obtained from various studies in developed countries have shown that cancer screening programs can be very effective in raising the survival rate (8, 9).

Iran is a middle-income country in West Asia, and cancer is the third leading cause of death and disability after cardiovascular diseases and traffic injuries in the country (10). Considering the high prevalence of cancer in Iran, the screening program could be critical

for the early diagnosis of this disease (11). Cancer incidence patterns are different in various populations and are associated with occupational, environmental, social, cultural, ethnic, geographical, and nutritional factors, as well as other unknown factors (12, 13). In studies conducted in Iran, the distribution of cancer rates in various provinces has been demonstrated to be different. The prevalence of cancer in Ardabil, Mazandaran, and Kurdistan is higher than in other provinces (13-15).

GIS is one the effective instruments for investigating and understanding the epidemiology and diversity of cancer around the globe (16, 17). The information and results provided by the GIS on cancer could be helpful in the policies and plans of society and reduce the burden caused by this disease. Using GIS, accurate, concrete, and localized descriptive and analytical data could be extracted (16, 18). Given the increasing prevalence of cancer across the globe and Iran and the irreparable complications of this disease on patients, by this time, no study has fully investigated the incidence of different types of cancer in Razavi Khorasan Province of Iran. The present study aimed to evaluate the prevalence of common cancers by gender using GIS system in Razavi Khorasan Province between 2011 and 2014.

Materials & Methods

In this cohort study, the entire cancer cases were annually collected from the Cancer Registration Center (Razavi Khorasan Province, Iran), owned by the Vice President of Medical Affairs of Mashhad University of Medical Sciences. The collected data included all cancers by gender from the first of 2011 to the end of 2014. The study variables entailed the number of people diagnosed with cancer, the cancer type, and gender.

According to the population and housing census of 2005, the population of Razavi Khorasan Province was 5,593,079, consisting of 2,809,403 men and 2,783,676 women (19). Based on the geographical map, the province has 20 cities named Dargaz, Quchan, Kalat, Chenaran, Sarakhs, Torbat-e-Jam, Taybad, Khvaf,

Ghaenat, Gonabad, Ferdos, Khalilabad, Bardaskan, Sabzevar, Neishabour, Mashhad, Fariman, Torbat-e-Heydarieh, Roshtkhar, and Kashmar. The central city of this province is Mashhad, its northern cities include Dargaz, Quchan, Kalat, Chenaran, Sarakhs, Neishabour and Sabzevar, and its southern cities comprise Torbat-e-Jam, Taybad, Khvaf, Ghaenat, Gonabad, Ferdos, Khalilabad, Bardaskan, Fariman, Torbat-e-Heydarieh, Roshtkhar, and Kashmar.

In order to extract the distribution map of cancer cases, the Kriging interpolation technique was applied to generate independent raster layers for cancer cases. The raster calculator function was also used to overlay each layer to make maps of seasonal averages. The regions having high-value and low-value cancer cases were highlighted by four-dimensional stretch approach and classified by color signifying method. Cancer cases

were higher in red region than in the yellow region. GIS software version 10 was employed to draw a GIS map for the prevalence of three common cancers in women and also frequent cancer in men in Razavi Khorasan Province.

Results

Descriptive statistics of research variables based on the prevalence of 14 types of cancer studied in Razavi Khorasan province from 2011 to 2014 are given in [Table 1](#). According to this Table, the prevalence of breast and stomach cancers in women and men, followed by skin cancer, were higher than other cancers, To have a better view, [Figure 1](#) was provided to show the trend of 14 types of cancer in men and women in the whole province of Razavi Khorasan Province for four successive years.

Table 1. Prevalence of cancers in Razavi Khorasan Province from 2011 to 2014 by gender

Gender	Year	Bladder	Brain&Dental nervous	Breast	Colon&analcanal	Corpus uteri	Leukemia&Blood	Lung bronchus&Trachea	Oesophagus	Other Cancer	Ovary	prostate	Skin	Stomach	Thyroid gland
Women	2011	89	20	1412	313	6	208	132	292	1472	130	0	359	293	155
	2012	54	47	779	155	1	35	42	152	695	60	0	230	129	93
	2013	85	161	1391	298	5	174	152	278	1395	123	0	439	282	232
	2014	83	10	1041	290	5	118	178	207	1450	140	0	345	326	195
	Total	311	238	4623	1056	17	535	504	929	5012	453	0	1373	1030	675
Men	2011	383	50	39	340	0	314	245	19	1691	0	344	563	854	57
	2012	256	88	91	214	0	50	88	205	898	0	251	364	380	47
	2013	355	210	36	371	0	250	315	330	1524	0	395	734	832	78
	2014	308	9	21	357	0	174	283	255	1542	0	419	484	704	80
	Total	1302	357	187	1282	0	788	931	1209	5655	0	1409	2145	2770	262

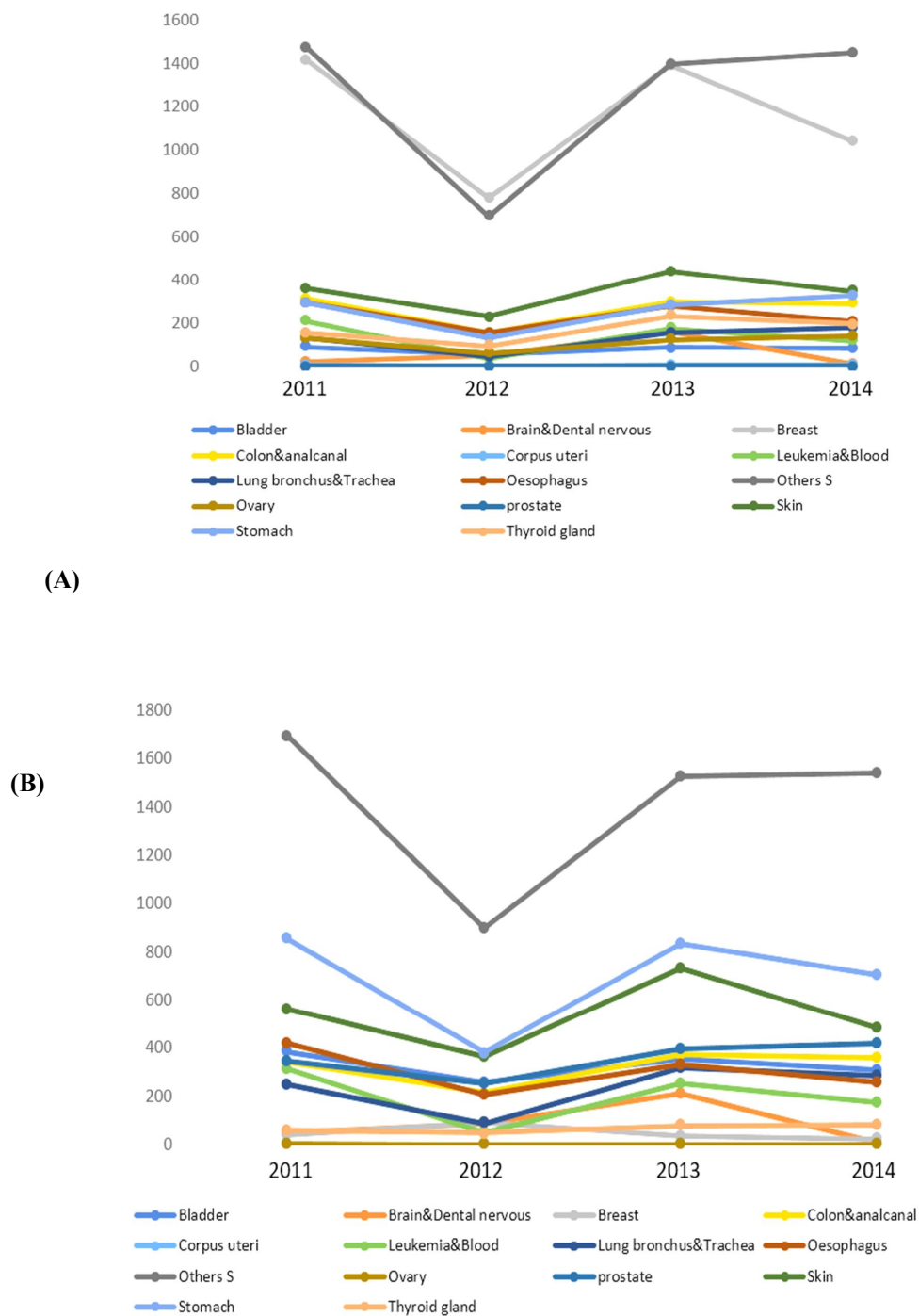


Fig. 1. Cancer trends in (A) women and (B) men in Razavi Khorasan Province for four successive years.

The geographical map of breast cancer in women and stomach cancer in men, reported as common

cancers based on Table 1, was drawn for 20 cities of Razavi Khorasan Province (Figures. 1 and 2).

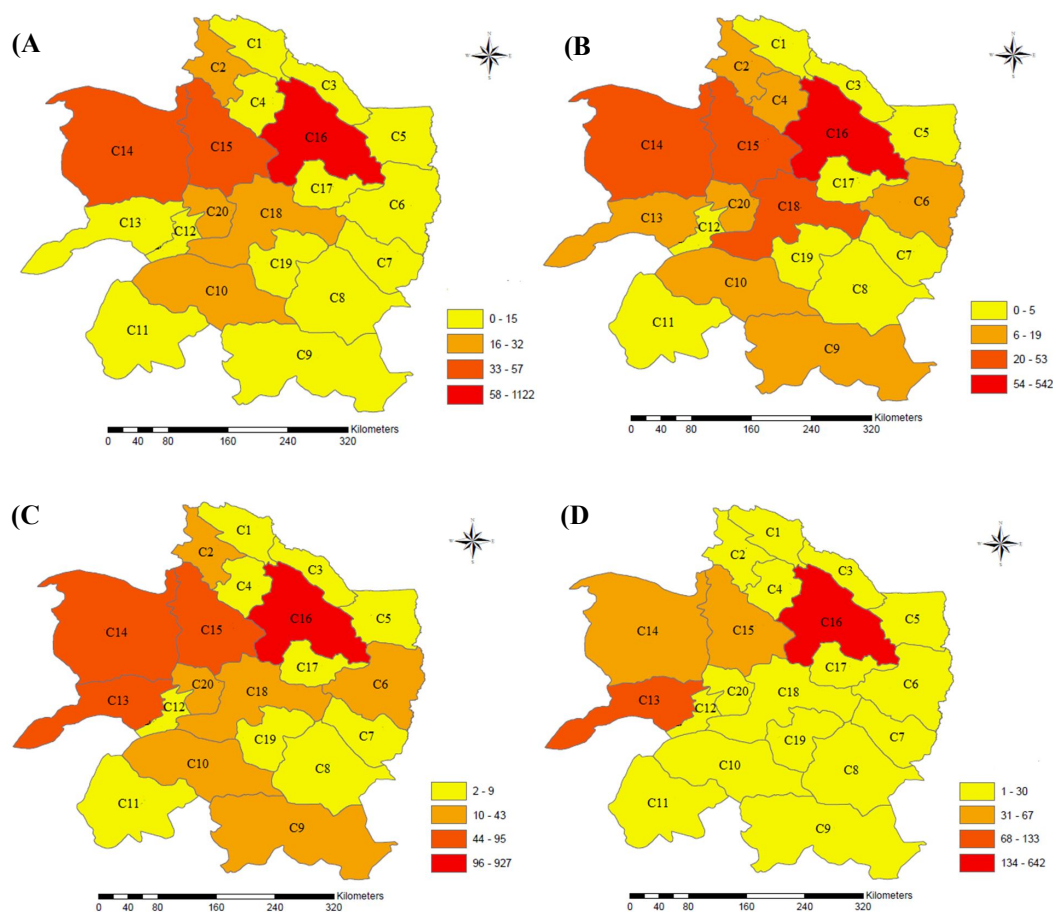


Fig. 2. Prevalence of breast cancer in women by cities of the Razavi Khorasan Province in (A) 2011, (B) 2012, (C) 2013, and (D) 2014. The city names are represented as follows: Dargaz (C1), Quchan (C2), Kalat (C3), Chenaran (C4), Sarakhs(C5), Torbat-e-Jam (C6), Taybad (C7), Khvaf (C8), Ghaenat (C9), Gonabad (C10), Ferdos (C11), Khalilabad (C12), Bardaskan (C13), Sabzevar (C14), Neishabour (C15), Mashhad (C16), Fariman (C17), Torbat-e-Heydariieh (C18), Roshtkhar (C19), and Kashmar (C20).

Figure 1 shows that the prevalence of breast cancer in women in 2011-2014. As depicted in Figure 1A, the highest incidence of breast cancer was observed in the center and capital of the province (Mashhad), followed by the cities of Neishabour and Sabzevar. Alternatively, in Gonabad, Torbat-e-Heydariieh, Kashmar, and Quchan cities, the number of breast cancer in this year was between 16 and 32 cases. Based on Figure 1B, the highest breast cancer prevalence was found in the center of the province (Mashhad),

followed by Neishabour, Sabzevar, and Torbat-e-Heydariieh cities. However, the number of breast cancer cases in 2012 was between 6 and 19 cases in Gonabad, Qaenat, Torbat-e-Jam, Kashmar, Bardaskan, Chenaran, and Quchan cities. The prevalence of breast cancer in women in 2013, as indicated in Figure 1C, was the highest in the central city of the province (Mashhad), followed by Bardaskan, Neishabour, and Sabzevar cities. Moreover, in Kashmar, Torbat Heydariieh, Torbat Jam, Gonabad, Qaenat, and Quchan cities, the

number of breast cancer cases was between 10 and 43 cases. The incidence of breast cancer in women in 2014 showed to be the highest in the central city of the province (Mashhad) and was higher in Bardaskan city

than the rest of the cities. In addition, the number of breast cancer cases in Neishabur and Sabzevar cities was between 31 and 67 cases (Figure 1D).

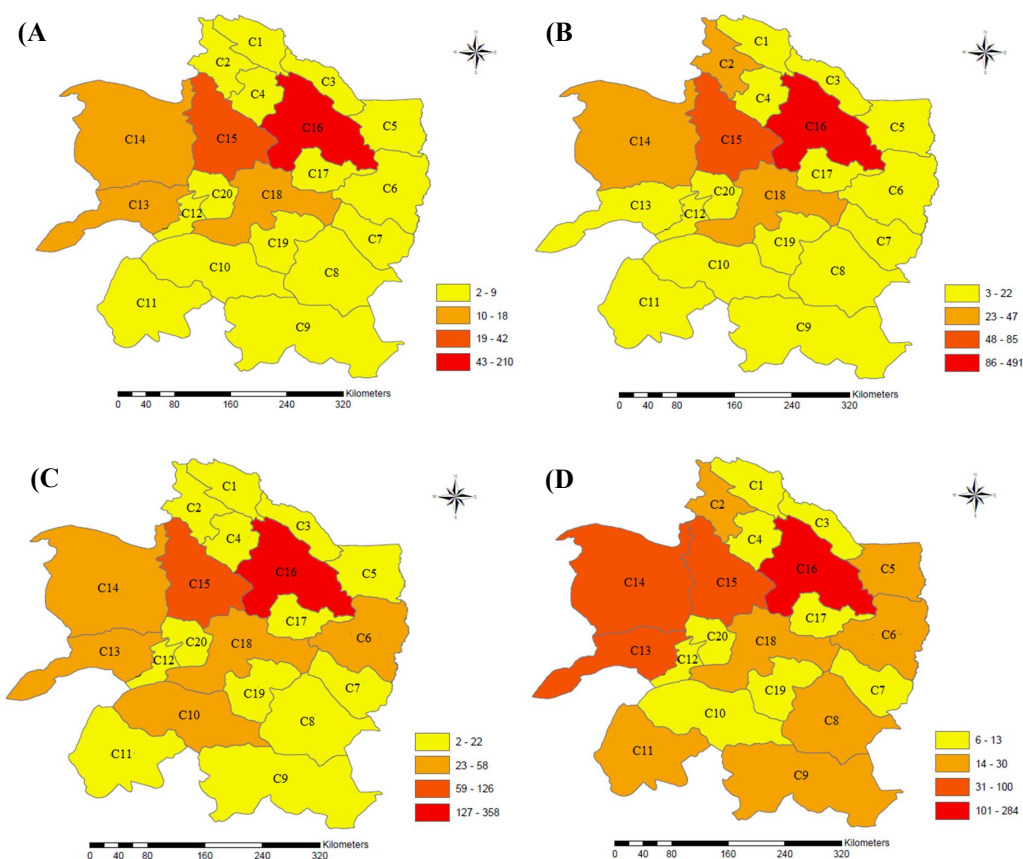


Fig. 3. Prevalence of stomach cancer in men by cities of the Razavi Khorasan Province in (A) 2011, (B) 2012, (C) 2013, and (D) 2014.

The prevalence of stomach cancer in men between 2011 and 2014 is represented in Figure 3. The highest incidence of breast cancer was detected in the central city of the province (Mashhad), followed by Neishabour city (Figures 3A, 3B, and 3C). The number of stomach cancer was between 23 and 48 cases in Sabzevar and Torbat-e-Heydarieh cities (Figure 3A), while it was between 10 and 18 (Figure 3A) in Bardaskan, Sabzevar, and Torbat-e-Heydarieh cities (Figure 3B). Moreover, in Gonabad, Bardaskan,

Sabzevar, Torbat-e-Heydarieh, and Torbat-e-Jam, the number of stomach cancer was between 23 and 58 cases (Figure 3C). The incidence of stomach cancer in men in 2014, as illustrated in Figure 3D, was the highest in the center of the province (Mashhad), followed by Neishabour city, Sabzevar, and Bardaskan cities. Besides, the number of stomach cancer cases in Qaenat, Ferdous, Khvaf, Torbat-e-Heydarieh, Torbat-e-Jam, Sarakhs, and Quchan cities was between 14 and 30 cases in this year.

Discussion

According to the results obtained from the present study, the prevalence of two types of breast cancer in women and colon cancer in men was higher than other cancers in Razavi Khorasan Province. In a similar study conducted by Baeradeh et al. (20), the epidemiology of common cancers was evaluated on 5,617 patients in the same province. Based on their results, skin, stomach, breast, esophageal, and colorectal cancers had the highest frequency. The results of that study on the high prevalence of breast cancer are in line with our study.

The prevalence of cancer varies in different geographical regions, but in general, according to the presented statistics, the most common cancers in the world in men include lung, prostate, colorectal, stomach, and liver cancers, and in women entail breast, colorectal, lung, cervix, and stomach cancers (20, 21). Based on studies, in Iran, the five most common cancers in both sexes are skin, breast, stomach, colorectal, and bladder cancers, respectively. Studies conducted in different provinces of Iran have displayed that skin, stomach, and esophageal cancers are common in Kurdistan Province, stomach, skin, and bladder cancers in East Azerbaijan Province, and breast, skin, and colorectal cancers in Mazandaran Province (14, 20, 22).

The results obtained from the present study showed that breast cancer (in women) in Mashhad, Neishabour, and Sabzevar cities in 2011, Mashhad, Neishabour, Sabzevar, and Torbat-e-Heydarieh cities in 2012, Mashhad, Neishabour, Bardaskan, and Sabzevar cities in 2013, and Mashhad and Bardaskan cities in 2014 had the most prevalence, respectively. Colon cancer (in men) in Mashhad and Neishabour cities in years 2011, 2012, and 2013 had the most prevalence. In 2014, Neishabour, Sabzevar, and Bardaskan cities had the highest prevalence rates of colon cancer in men. In all the studies conducted in Mashhad city on all types of cancers over the years, breast cancer in women and intestine cancer in men had the most prevalence. A similar study was conducted by Rohani Rasaf et al. (23) using GIS; they investigated the prevalence

distribution of different cancers in the neighborhoods of Tehran, which was supported by the Tehran University of Medical Sciences (Tehran, Iran). Based on their results, the highest rate of cancer in men was identified in the cities Abbas Abad, Qaim Maqam, and Gandi, and in women in Argentina, Sai, and Shiraz. Moreover, the highest prevalence of cancer was related to breast, colorectal, prostate, stomach, and skin cancers, respectively. In that study, similar to our study, the prevalence of breast cancer was high (23). In another study conducted by Rahimi Pordanjani et al. (24) with the aim of investigating the distribution of the prevalence of cancers, the epidemiology and the occurrence rate of colon cancer, and its risk factors in Iran, the mentioned cancer (colon) was identified as one of the most common cancers in the country. These results are consistent with our findings.

Conclusion

According to the results obtained from the present study, the prevalence of breast and stomach cancer is higher than other cancers in Razavi Khorasan Province. The prevalence of breast cancer (in women) and colon cancer (in men) in 2011-2014 were the highest in the central city of the province (Mashhad). Considering the high incidence of breast and stomach cancers in women and men, respectively in Razavi Khorasan Province, especially in Mashhad city, it is recommended to take necessary measures to prevent and treat these diseases. Geographical map drawn in this study for breast and stomach cancers for 20 cities of Razavi Khorasan Province could be very helpful for future planning.

Acknowledgments

We appreciate the close cooperation of the staff and officials in this study.

Conflict of interest

According to the authors, there is no conflict of interest between the contents and results of this article and the authors.

Ethics approval and consent to participate

The present study was proposed and approved by the Research Committee of Tarbiat Modares University, Tehran, Iran in 2015.

Data availability

The raw data supporting the conclusions of this article are available from the authors upon reasonable request.

References

- Gholipour M, Islami F, Roshandel G, Khoshnia M, Badakhshan A, Moradi A, et al. Esophageal cancer in Golestan Province, Iran: a review of genetic susceptibility and environmental risk factors. *Middle East Journal of Digestive Diseases*. 2016;8(4):249.
- Landi S. Genetic predisposition and environmental risk factors to pancreatic cancer: A review of the literature. *Mutation Research/Reviews in Mutation Research*. 2009;681(2-3):299-307.
- Popa C-M, Lungulescu C, Ianoși SI, Cherciu I, Schenker M, Săftoiu A. Molecular Profiling of EGFR Status to Identify Skin Toxicity in Colorectal Cancer: A Clinicopathological Review. *Current health sciences Journal*. 2019;45(2):127.
- Tsai H-J, Chang JS. Environmental risk factors of pancreatic cancer. *Journal of clinical medicine*. 2019;8(9):1427.
- Alizadeh AM, Shiri S, Farsinejad S. Metastasis review: from bench to bedside. *Tumor biology*. 2014;35(9):8483-523.
- Kimura T, Egawa S. Epidemiology of prostate cancer in Asian countries. *International Journal of Urology*. 2018;25(6):524-31.
- Tsoi KK, Hirai HW, Chan FC, Griffiths S, Sung JJ. Predicted increases in incidence of colorectal cancer in developed and developing regions, in association with ageing populations. *Clinical Gastroenterology and Hepatology*. 2017;15(6):892-900. e4.
- Kessler TA. Cervical cancer: prevention and early detection. In *Seminars in oncology nursing* 2017 May 1 (Vol. 33, No. 2, pp. 172-183). WB Saunders.
- Schiffman JD, Fisher PG, Gibbs P. Early detection of cancer: past, present, and future. *American Society of Clinical Oncology Educational Book*. 2015;35(1):57-65.
- Ahmadi A, Soori H, Mehrabi Y, Etemad K, Samavat T, Khaledifar A. Incidence of acute myocardial infarction in Islamic Republic of Iran: a study using national registry data in 2012. *Eastern Mediterranean health journal*. 2015;21(1):5-12.
- Majidi A, Majidi S, Salimzadeh S, Khazaei-Pool M, Sadjadi A, Salimzadeh H, et al. Cancer screening awareness and practice in a middle income country; A systematic review from Iran. *Asian Pacific journal of cancer prevention: APJCP*. 2017;18(12):3187.
- Yin L-K, Sun X-Q, Mou D-Z. Value of combined detection of serum CEA, CA72-4, CA19-9 and TSGF in the diagnosis of gastric cancer. *Asian Pacific Journal of Cancer Prevention*. 2015;16(9):3867-70.
- Ahmadi A, Ramazani R, Rezagholi T, Yavari P. Incidence pattern and spatial analysis of breast cancer in Iranian women: Geographical Information System applications. *East Mediterr Health J*. 2018;24(4):360-7.
- Norouzi Nejad F, Ramezani Daryasar R, Ghafari F. Epidemiology of cancer in Mazandaran province 2006. *Journal of Mazandaran University of Medical Sciences*. 2009;19(72):61-5.
- Esmail Nasab N, Moradi G, Zareie M, Ghaderi E, Gheytasi B. Survey of epidemiologic status and incidence rates of cancers in the patients above 15 years old in Kurdistan province. *Scientific Journal of Kurdistan University of Medical Sciences*. 2007;11(4):18-25.
- Tabatabaeian M, Moazam E, Tavazohi H. Geographic distribution of cancer cases in Isfahan province/2006-2010. 2017.
- Brewer CA. Basic mapping principles for visualizing cancer data using geographic information systems (GIS). *American journal of preventive medicine*. 2006;30(2):S25-S36.
- Ahmadi A, Soori H, Mehrabi Y, Etemad K. Spatial analysis of myocardial infarction in Iran: National report from the Iranian myocardial infarction registry. *Journal of Research in Medical Sciences: The Official Journal of Isfahan University of Medical Sciences*. 2015;20(5):434.

19. Statistical-information [Internet]. Statistical-information. 2005 [cited 2022 Jul 16]. Available from: <https://amar.org.ir/statistical-information>
20. Baeradeh N, Zamani M. Epidemiology of prevalent cancers in Khorasan Razavi province in 2008. *medical journal of mashhad university of medical sciences*. 2015;57(8):926-31.
21. Rafie M, Akbari ME, Alizadeh M, Eshrati B, Hatami H. Geographical distribution and survival rate of cancers among elderly Iranians. *Payesh (Health Monitor)*. 2012;11(5):603-9.
22. Koosha A, Farahbakhsh M, Hakimi S, Abdolahi L, Golzari M, Farshad MS. Epidemiologic Assessment of Cancer Disease in East Azerbaijan 2007. *Medical Journal of Tabriz University of Medical Sciences*. 2010;32(4):74-9.
23. Rohani Rasaf M, Rohani Rasaf M, Rahimi F, Mehrazma M, Golmohammadi A, Motiedoost R, et al. Distribution of cancer incidence in districts and neighbourhoods of a number of Tehran districts in 2007. *Razi Journal of Medical Sciences*. 2011;18(89):34-45.
24. Rahimi Pordanjani S, Baeradeh N, Lotfi MH, Pourmohammadi B. Epidemiology of colorectal cancer: incidence, mortality, survival rates and risk factors. *Razi Journal of Medical Sciences*. 2016;23(144):41-50.