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Original Article

Disability-Adjusted Life Years (DALY) for Cancers in Iran, 1990 to 2016: Review of Findings from the Global Burden of Disease Study

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Abstract

Background: Cancer with 13% of all deaths is the third leading cause of mortality in Iran. We aimed to assess the burden of cancer in Iran by acquiring data from the Global Burden of Disease (GBD) study.

Methods: This study was conducted on the DALY approach to examine the cancer burden in Iran from 1990 to 2016. A list of all cancers was extracted using the International Classification of Disease, tenth revision (ICD-10). Then, the cancer burden was assessed based on the type of cancer. The Percentage change (PC) by Daly's number and age-standardized DALY rate (ASDR) was estimated. The cause of PC on the DALYs number from cancer was analyzed, and the share of every variable was determined.

Results: In 2016, cancer caused 781.5 and 564 thousand DALYs for men and women, respectively. In all years, the DALYs number of cancer is higher in men than women. From 1990 to 2016, leukemia, stomach, tracheal, bronchus and lung (TBL) cancers were among the leading causes of cancer burden in Iran. The highest increase in PC of cancer DALYs from 1990 to 2016 happened by multiple myeloma with 302.4% and breast with 283.7%. The lowest increase occurred by Hodgkin lymphoma (-2.1%) and leukemia (18.2%).

Conclusion: Cancers have grown more than doubled in terms of DALYs from 1990 to 2016. The majority of DALYs were due to Years of Life Lost, suggesting the need for prevention, early detection, and screening programs.

Keywords: Disability adjusted life years; Global burden of disease; Iran; Cancer

Introduction

In Iran, cancer with 13% of all deaths is the third leading cause of mortality. According to Globocan 2018, cancer caused 110,115 and 55,875 deaths in men and women, respectively in Iran (1).

The cancer burden study provides a comprehensive evaluation of incidence, mortality, and disability for all cancers in order to prioritize and developing specific policies and programs, it is a tool for helping policymakers and health managers to make better decisions. Various indicators are used to estimate cancer burden, including prevalence rate, incidence rate, mortality rate, and disability-adjusted life-years (DALYs) (2, 3).

DALY is a key tool for assessment of cancer burden because it seeks to quantify the burden of

disease in terms of both morbidity and mortality by combining years of life lost due to premature death (YLL) with years lived with disability (YLD) due to the disease for a specific cause (4). The Institute for Health Metrics and Evaluation (IHME) is an independent global health research center at the University of Washington. One of the goals of IHME is to estimate the Global Burden of Disease (GBD), injuries, and risk. The GBD studies generate a comprehensive assessment of epidemiological data, including, incidence, mortality, and disability for all major diseases and injuries at the regional and national levels from 1990 to 2016 (5).

The cancer burden studies help policymakers to plan for a national cancer control program. Many studies in Iran examine the cancer burden via mortality, incidence rate and prevalence rate, but it does not exist any study which assessed the cancer burden with the DALY indicator at the national level.

Therefore, the present study was conducted to report the burden of cancers in Iran from 1995 to 2016 by acquiring data from the GBD study. Furthermore, we aimed to describe the burden of cancer via the DALY approach, to introduce the GBD methods and also it is helpful for health policymakers because cancer burden studies are potentially important in public health decision-making to detect improvements in information systems and cost-effectiveness studies.

Methods

This study was conducted on the DALY approach to report the cancer burden in Iran from 1990 to 2016. Data were collected from the GBD studies. This data was published by the IHME. DALY was used to compute the burden of cancers. It was developed by WHO to measure, compare and analyze the burden of various diseases. The DALY combines the time lost through premature death and living time in a status less than optimal health. This metric includes two components of YLLs and YLDs. A DALY is equal to the loss of one year of healthy life obtained from the combination of impacts of mortality and disability (5, 6).

This study was designed in three steps. First, a list of all cancers was extracted based on ICD-10. The YLLs and YLDs obtained for all cancers on the GBD study from 1990 to 2016. Then, the cancer burden was assessed based on the type of cancer. Cancers were ranked according to Daly's number in 1990 and 2016. The Percentage change (PC) by Daly's number and age-standardized DALY rate (ASDR) was estimated for 1990 and 2016. These estimates were done to determine the change of trend on cancer burden between 1990 and 2016. Second, the cause of PC on the DALYs number from cancer was analyzed, and the share of every variable was determined. These changes included population growth, age structure and rate of DALY. To calculate the effect of population growth on the variation of the cancer Daly's number, we utilized the population size of 2016 onto the rate, sex and age structure of 1990. Since the population of Iran increased by 44.6% between 1990 and 2016, it was assumed that 44.6% of the DALYs number in each cancer was to be due to population growth in this scenario. To estimate the effect of aging on the DALY numbers we applied the age structure of 2016 onto the rate, sex distribution, and population size of 1990. To estimate the effect of changing incidence rate on the cancer Daly's number we applied the ASDR for 1990 onto the population size and age structure of 2016. Third, the top3 cancers were selected in terms of the DALYs number in 2016. These cancers included stomach, TBL and leukemia. The burden of these cancers is explained in more detail from 1990 to 2016. We used the STATA package, version 13 for our analysis.

Results

In 1990, cancer caused 367.2 and 283.6 thousand DALYs for men and women, respectively. There were 781.5 thousand DALY for men and 564 thousand for women in 2016. Table 1 shows the DALY number and its components for cancers in Iran during 1990-2016.

Table 1: The DALY number (thousand) for 27 cancers group in Iran, during 1990 to 2016

Year	*YLL*		*YLD*		*DALY*	
	Male	Female	Male	Female	Male	Female
1990	362.7	279.7	4.5	3.9	367.2	283.6
1995	422.7	320.9	5.5	4.8	428.2	325.7
2000	480.9	375.4	6.8	6.1	487.7	381.5
2005	549.2	405.8	8.5	7.4	557.8	413.3
2010	639.1	475.9	10.7	9.7	649.8	485.6
2016	767.6	551.3	13.9	12.7	781.5	564.0

Table 2 describes the cancers rank based on the DALYs number in Iran from 1990 to 2016. Between 1990 and 2016, leukemia, stomach and TBL cancers were among the leading causes of cancer burden in Iran.

Table 2: Cancers ranked in Iran for both sexes by DALY number between 1990 and 2016

Rank	*1990 Cancer (codes*)*	*2016 Cancer (codes*)*	*Change in DALY number (%)*	*Change in DALY ASR (%)*
1	Leukemia(C91-C95)	Stomach(C16)	63.4	-28.9
2	Stomach(C16)	TBL(C34)	175.8	19.5
3	TBL(C34)	Leukemia(C91-C95)	18.2	-9.7
4	Brain and nervous system(C70-C72)	Brain and nervous system(C70-C72)	99.1	30.3
5	Liver cancer(C22)	Breast(C50)	283.7	58.6
6	Esophageal(C15)	Colon and rectum(C18-C20)	257.8	56.1
7	Breast(C50)	Liver cancer(C22)	118.5	0.3
8	Colon and rectum(C18-C20)	Esophageal(C15)	64.3	-27.7
9	Non- Hodgkin lymphoma(C85)	Prostate(C61)	222.9	32.9
10	larynx(C32)	Pancreas(C25)	258.4	53.9
11	Prostate(C61)	Non- Hodgkin lymphoma(C85)	163.4	45.7
12	Pancreas (C25)	larynx(C32)	126.1	-1.4
13	Hodgkin lymphoma(C81)	Bladder(C67)	179.3	17.1
14	Cervical(C53)	Ovarian cancer(C56)	266.8	56.6
15	Gallbladder and biliary tract(C23-C24)	Kidney(C64-C65)	138.5	48.0
16	Bladder(C67)	Gallbladder and biliary tract(C23-C24)	65.8	-27.5
17	Kidney(C64-C65)	Cervical(C53)	57.7	-32.2
18	Ovarian cancer(C56)	Multiple myeloma(C90)	302.4	76.0
19	Lip and oral(C00-C14)	Hodgkin lymphoma(C81)	-2.1	-45.1
20	Mesothelioma(C45)	Mesothelioma(C45)	186.0	24.5
21	Malignant skin melanoma(C43-C44)	Lip and oral(C00-C14)	111.1	-10.1
22	Multiple myeloma(C90)	Uterine(C57)	221.4	38.9
23	Uterine(C57)	Thyroid cancer(C73)	179.8	24.1
24	Thyroid cancer(C73)	Malignant skin melanoma(C43-C44)	109.7	-8.5
25	Nasopharynx(C11)	Non-melanoma skin cancer(C43-C44)	238.4	45.6
26	Non-melanoma skin cancer(C43-C44)	Nasopharynx(C11)	99.1	-3.1
27	Testis(C62)	Testis(C62)	178.6	26.0

*the codes are based on ICD-10

In 1990, the first, second and third ranks are related to cancer of leukemia, stomach and TBL, whereas the first rank in 2016 is related to stomach cancer. The highest increase in PC of cancer cases between 1990 and 2016 happened by multiple myeloma with 302.4%, breast with 283.7%, and ovarian with 266.8%. The lowest increase occurred by Hodgkin lymphoma (-2.1%), leukemia (18.2%) and cervical (57.7%). Between 1990 and 2016, multiple myeloma, breast and ovarian cancer have the highest PC in ASDR with 76%, 58.6% and 56.6%, respectively. The lowest PC by ASDR happened in Hodgkin lymphoma with -45.1%.

Table 3 shows DALY number and ASDR per 100,000 population for cancers between 1990 and 2016. In 1990, there were 367,242 and 283,556 DALYs for men and women, respectively. Meanwhile, the DALYs number for men and women increased to 781,497 and 564,026 in 2016, respectively. The ASDR per 100,000 population for all cancers was 251.3 at men and 157.7 on women in 2016. For men in 2016, the leading cause of cancer based on DALY was stomach, TBL and leukemia cancers by 17.4%, 15.3% and 13.3%, respectively. The breast, stomach and leukemia cancers were the most common cause of cancer burden with 18.9%, 11.9% and 11.2% for women, respectively.

Table 3: DALYs number and age-standardized DALY rate for cancer in Iran from 1990 to 2016

Cancer	***1990***				***2016***			
	Men		Women		Men		Women	
	DALY (%)	ASDR per 100,000	DALY (%)	ASDR per 100,000	DALY (%)	ASDR per 100,000	DALY (%)	ASDR per 100,000
Bladder	7135.9 (1.9)	62.5	1871.0 (0.7)	17.1	20243.2 (2.6)	74.1	4914.8 (0.9)	19.3
Brain and nervous system	34207.6 (9.3)	146.0	26329.9 (9.3)	106.5	70279.1 (9)	190.5	50255.5 (8.9)	139.1
Breast	457.7 (0.1)	3.2	27651.6 (9.8)	184.0	1139.7 (0.1)	3.5	106702.8 (18.9)	292.0
Cervical	-	-	9880.6 (3.5)	66.9	-	-	15583.1 (2.8)	45.1
Colon and rectum	14368.4 (3.9)	106.0	12148.1 (4.3)	91.0	55541.0 (7.1)	179.0	39330.9 (7)	128.6
Esophageal	18544.2 (5)	149.3	12952.1 (4.6)	102.6	31906.8 (4.1)	111.5	19844.2 (3.5)	70.7
Gallbladder and biliary tract	3648.9 (1)	29.7	5798.0 (2)	44.9	7025.2 (0.9)	24.2	8636.4 (1.5)	29.7
Hodgkin lymphoma	7469.3 (2)	34.2	4606.6 (1.6)	20.9	7336.0 (0.9)	18.9	4486.0 (0.8)	11.5
Kidney	4343.9 (1.2)	23.4	3393.6 (1.2)	15.3	12092.1 (1.5)	37.8	6360.5 (1.1)	19.5
Larynx	10228.0 (2.8)	78.3	4110.2 (1.4))	30.1	24480.0 (3.1)	80.9	7936.1 (1.4)	26.1
Leukemia	72936.3 (19.9)	278.6	68894.3 (24.3)	234.8	104273.3 (13.3)	287.7	63316.2 (11.2)	174.9
Lip and oral	2865.8 (0.8)	21.4	1988.3 (0.7)	15.3	5893.4 (0.8)	18.8	4355.2 (0.8)	14.3
Liver cancer	23985.4 (6.5)	173.6	17582.2 (6.2)	127.1	55511.1 (7.1)	183.1	35309.1 (6.3)	118.8
Malignant skin melanoma	1725.7 (0.5)	12.3	1543.4 (0.5)	10.5	3916.6 (0.5)	12.2	2938.9 (0.5)	8.7
Mesothelioma	3171.8	22.9	535.4	3.3	9207.6	28.7	1394.8	4.0

	(0.9)		(0.2)		(1.2)		(0.2)	
Multiple myeloma	1875.5 (0.5)	13.7	1361.3 (0.5)	10.2	7887.2 (1)	25.4	5138.1 (0.9)	16.8
Nasopharynx	1358.6 (0.4)	8.0	461.9 (0.2)	2.8	2694.9 (0.3)	7.7	929.9 (0.2)	2.8
Non-Hodgkin lymphoma	9475.6 (2.6)	47.8	5357.6 (1.9)	27.7	24641.5 (3.2)	69.0	14427.0 (2.6)	41.3
Non-melanoma skin cancer	1118.2 (0.3)	9.1	363.9 (0.1)	2.9	3709.1 (0.5)	13.0	1306.9 (0.2)	4.6
Ovarian cancer	-	-	6049.7 (2.1)	42.0	-		22189.2 (3.9)	65.4
Pancreatic cancer	7694.0 (2.1)	60.1	4600.8 (1.6)	37.7	27656.6 (3.5)	93.0	16404.4 (2.9)	57.7
Prostate	13707.4 (3.7)	141.9	-	-	44257.7 (5.7)	187.3	-	
Stomach	81545.8 (22.2)	649.0	42773.9 (15.1)	330.6	135749.4 (17.4)	468.4	67387.3 (11.9)	229.2
Testicular	1180.4 (0.3)	6.2	-	-	3288.6 (0.4)	7.9	-	
Thyroid cancer	1101.3 (0.3)	7.6	1388.0 (0.5)	10.4	2841.1 (0.4)	8.9	4123.7 (0.7)	13.4
TBL	43097.1 (11.7)	333.4	18903.5 (6.7)	143.9	119926.5 (15.3)	402.0	51080.7 (9.1)	169.7
Uterine	-	-	3010.5 (1.1)	23.0	-	-	9674.7 (1.7)	31.7
Total	367242.8 (100)	288.2*	283556.3 (100)	167.7*	781497.9 (100)	251.3*	564026.5 (100)	157.7*

*weight mean calculated for 27 group cancers

Table 4 shows the decomposition analysis for PC of DALYs number for cancers in Iran between 1990 and 2016. In all cancers, the PC due to population growth was 44.6%. The PC due to ASDR was the maximum for multiple myeloma, breast and ovarian cancers, including, 76%, 58.6% and 56.6%. Hodgkin lymphoma, cervical and stomach cancers have the minimum PC for ASDR, by -45.1%, -32.2% and -28.9%, respectively.

Top 3 cancers (ranked by the highest DALYs number in 2016)

Stomach cancer

In 2016, there were 203,136 DALYs of stomach cancer. Stomach cancer caused 17.4% of the cancer DALYs in men and 11.9% in women in 2016 (Table 3). It has increased from the second leading cause for cancer DALYs in 1990 to the first leading cause in 2016, with a 63.4% increase in DALYs number (Table 2). If the rates of DALY, sex distribution and population size had remained the same in 2016 as it was in 1990, DALY number would have increased by 47.8% due to age structure (Table 4). Among males, stomach cancer has the highest trend for crude and ASDR in all years, the trend of crude DALY rate is increasing, but ASDR is decreasing. Among women, the crude DALY rate has a substantially trend, while ASDR has a decreasing trend (Fig. 1,2).

Tracheal, bronchus and lung cancer

TBL cancer caused 15.3% of the cancer DALYs among men and 9.1% among women in 2016 (Table 3). TBL cancers has increased from the third leading cause for cancer DALYs in 1990 to the second leading cause in 2016, with a 175.8% increase in DALYs number (Table 2). An increase in ASDR between 1990 and 2016 with stable population size and age structure would have resulted in a 19.5% increase in DALY number. If the rates of DALYs, sex distribution and population size had remained the same in 2016 as

it was in 1990, DALY number would have increased by 111.8% due to age structure (Table 4).

Table 4: Decomposition analysis of cancer trends in DALY number, both sexes, 1990 to 2016

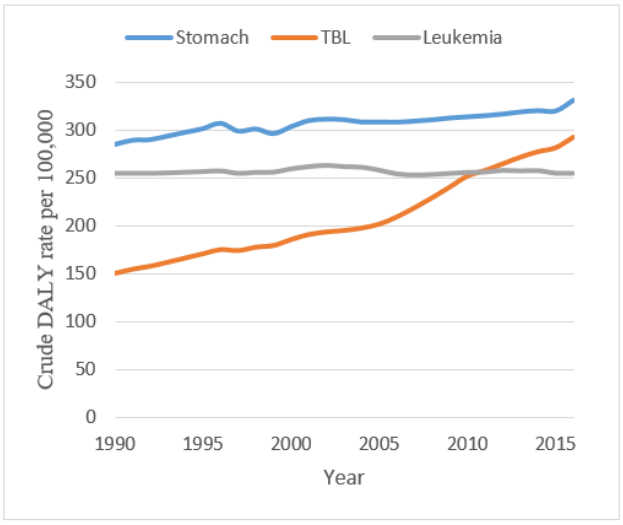
Cancer	*DALY number*		*Chang in DALYs number, 1990 to 2016 (%)*		
	1990	2016	Due to population growth	Due to change in age structure	Due to change in DALYASR
Bladder	9007.0	25158.0	44.6	117.7	17.1
Brain and nervous system	60537.5	120534.5	44.6	24.2	30.3
Breast	28109.3	107842.5	44.6	180.5	58.6
Cervical	9880.6	15583.1	44.6	45.3	-32.2
Colon and rectum	26516.5	94871.9	44.6	157.1	56.1
Esophageal	31496.3	51751.1	44.6	47.5	-27.7
Gallbladder and biliary tract	9446.9	15661.6	44.6	48.7	-27.5
Hodgkin lymphoma	12075.9	11822.0	44.6	-1.6	-45.1
Kidney	7737.6	18452.6	44.6	45.9	48.0
Larynx	14338.3	32416.2	44.6	83.0	-1.4
Leukemia	141830.5	167589.6	44.6	-16.7	-9.7
Lip and oral	4854.1	10248.6	44.6	76.7	-10.1
Liver cancer	41567.6	90820.2	44.6	73.6	0.3
Malignant skin melanoma	3269.0	6855.5	44.6	73.6	-8.5
Mesothelioma	3707.2	10602.4	44.6	117.0	24.5
Multiple myeloma	3236.7	13025.3	44.6	181.9	76.0
Nasopharynx	1820.5	3624.8	44.6	57.6	-3.1
Non-Hodgkin lymphoma	14833.1	39068.6	44.6	73.1	45.7
Non-melanoma skin cancer	1482.1	5015.9	44.6	148.3	45.6
Ovarian cancer	6049.7	22189.2	44.6	165.6	56.6
Pancreatic cancer	12294.8	44061.0	44.6	159.9	53.9
Prostate	13707.4	44257.7	44.6	145.4	32.9
Stomach	124319.7	203136.7	44.6	47.8	-28.9
Testicular	1180.4	3288.6	44.6	108.0	26.0
Thyroid cancer	2489.3	6964.8	44.6	111.1	24.1
TBL	62000.6	171007.2	44.6	111.8	19.5
Uterine	3010.5	9674.7	44.6	137.9	38.9
All cancers	650799.1	1345524.4	44.6	78.4	-16.2

Among men, the crude DALY rate has risen dramatically, from 150 DALY per 100,000 population in 1990 to 292 DALYs per 100,000 in 2016. ASDR per 100,000 has a substantial trend to 2005 and has risen slowly to 2016 (Fig. 1, 2).

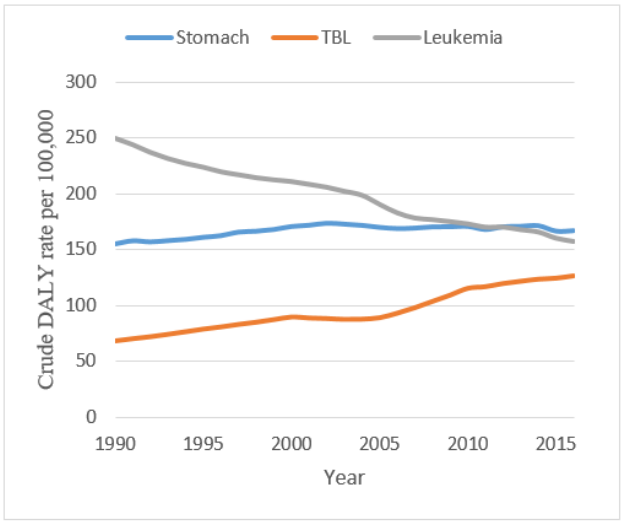
Leukemia

Leukemia caused 167,589 DALYs in 2016, with 104,273 DALYs occurring in men, and 63,316 DALYs for women. It led to 13.3% of the cancer DALYs among men and 11.2% among women in 2016 (Table 3). Leukemia has declined from the first leading cause for malignancy DALYs in 1990 to the third leading cause in 2016, with an

18.2% increase in DALYs and a 9.7% decrease in ASDR (Table 2). The major part of the PC on Daly's number for leukemia is due to population growth (44.6%). If the rates of DALY, sex distribution and population size had remained the same in 2016 as it was in 1990, DALY number would have decreased by 16.7% due to age structure (Table 4). Crude DALY rate and ASDR show diverging results between men and women, with the trends stable in men but decreasing in women.

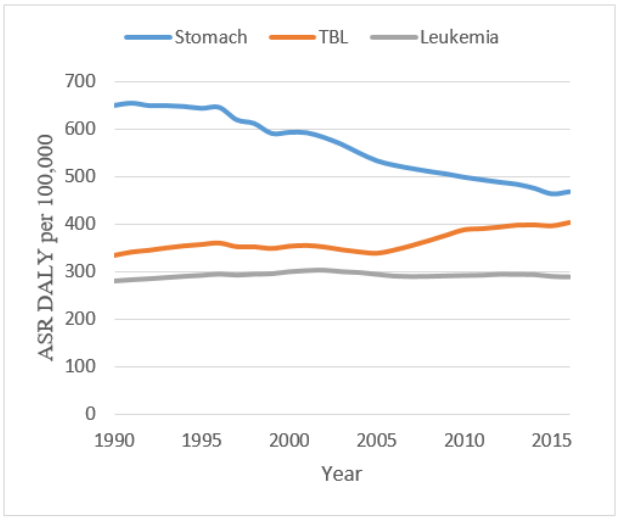


A: Male

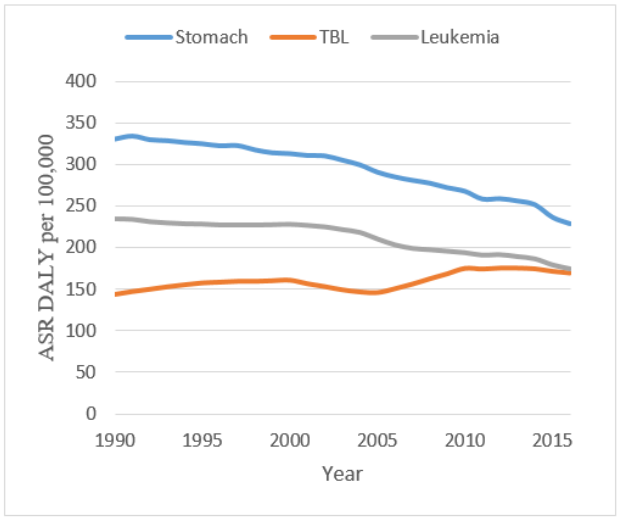


B: Female

Fig. 1: Trends in crude DALY rate per 100,000 people for top 3 cancers, 1990-2016



A: Male



B: Female

Fig. 2: Trends in ASDR per 100,000 people for top 3 cancers, 1990-2016

Discussion

Although many studies have been done on cancer in Iran, these are limited to only specific cancer or have used mortality indicators. This study was based on the GBD findings from 1995 to 2016 for all ages and both genders. Moreover, the present study is the first comprehensive effort to

report the burden of cancers in Iran via the DALY approach.

Our findings showed that cancer caused 650.8 (thousands) and 1,345.5 (thousands) DALYs in 1990 and 2016, respectively. The cancer burden in Iran has more than doubled between 1990 and 2016. The burden of cancer is significantly higher in men than women, whereas the DALYs number was 781.5 (thousands) for men and 564 (thousands) for women in 2016. Furthermore, ASDR due to all cancers was 251.3 per 100,000 population by men and 157.7 on women in 2016. The number of DALYs due to cancers in Iran was responsible for 6.5% and 3% of total DALYs in 2016 and 1990, respectively. Cancers burden in Iran is lower than some other countries and global average. For instance, the cancer DALYs number in Australia consists of 17% of all DALYs in 2015 (7). Cancer caused 208.3 million DALYs worldwide in 2015, including 9% of all DALYs number at global (8). ASDR for all cancers was 2,553 for men and 1,853 for women in East Asia and it was 2,479 and 2,388 respectively, in North America (9).

In line with previous studies, our results indicated that YLLs are the main contributor to Daly's calculations. In all years, YLLs include more than 96% of DALYs. For example, there were 1135.4 thousand DALYs in 2010, of which 1,115 thousand (98.2%) came from YLLs and 20.4 thousand (1. 8%) came from YLDs. The leading cause of the cancer burden was related to premature death rather than disability. For instance, in Japan, the YLLs was contributed to 90% of the DALYs for all cancers (10). YLLs accounted for 96% of the cancer DALY in Africa and 84% in North America (9). The YLLs for all cancers were responsible for 88% and 85% of cancer DALYs for men and women, respectively (11). That result reflected despite cancer treatment has improved, but cancer prevention and access to cancer care should be taken into consideration to reduce the burden of diseases, especially in Iran with young population (12). Some economic studies on the cervical cancer prevention in Iran showed that implementing prevention programs are cost-effective (13, 14).

The present study showed that there was a specific pattern of the cancer burden in Iran. Between 1990 and 2016, the most common cancer burden was due to leukemia, stomach and TBL cancers. In 2016, the first, second and third rank is related to cancer of stomach, TBL and leukemia. Then the fourth and fifth rank is followed by brain and nervous system and breast cancer. Furthermore, among men in 2016, the main contributors to DALYs number were stomach, TBL and leukemia cancers by 17.4%, 15.3% and 13.3%, respectively. The leading cause of cancer DALYs for women were breast with 18.9%, stomach with 11.9% and leukemia cancer with 11.2%. Compared to similar studies, a study that assessed the global burden of cancer in 188 countries, using the data of the GBD study, showed the first, second and third rank of cancer burden in term of YLLs, associated with TBL, liver and stomach cancer (15). The fourth and fifth rank of cancer burden were related to colon, rectum and breast cancer in 2016 (16). This difference attributed to the data used in the studies. The mentioned studies reported the cancer burden at the global level, but our study was done at the country level. Stomach cancer has a lower rank in developed countries and a higher rank in developing countries. For instance, it ranked 8th in Australia and first rank in Costa Rica and Colombia in terms of the number of deaths (8, 17).

The calculations in this study revealed notable differences in the trend of cancer burden between 1990 and 2016. The DALYs number for every cancer increased (increasing ranging from 18.2% for leukemia to 302.4% for multiple myeloma), but it declined for Hodgkin lymphoma by 2.1% (Table 2). The DALYs number in each cancer increased by 44.6% due to population growth. The highest increase for cancer DALYs number has occurred in multiple myeloma with 302.4%, of which 76% was due to increasing ASDR, 181.9% to changing population age structure, and 44.6 to a growing population. The second increase in DALYs number happened in breast cancer by 283.7%, has moved from the seventh rank in 1990 to the fifth rank in 2016, the leading cause of DALY number is due to the

age structure (180.5%) and ASDR (58.6%). Moreover, our results supported the continuing epidemiological transition, noted a double cancer burden in Iran, the burden of cancer has increased for cancers such as breast, stomach, TBL, colon and rectum, prostate and pancreatic and it is significant for cancers of leukemia, brain and nervous system, liver and esophageal.

A detailed analysis of the PC for Daly's number showed considered the cancer burden based on cancer type. For example, the increase of DALYs from the cancer of Hodgkin lymphoma and leukemia is due to population growth. In leukemia, the PC of DALYs number increased 18.2%, a growing population with 44.6% has contributed a large proportion to this increase, and however the age distribution and ASDR have declined. Between 1990 and 2016, the DALY number is increased due to population growth, age structure and ASDR for cancers in bladder, brain and nervous system, breast, colorectal, mesothelioma, multiple myeloma, non-Hodgkin lymphoma, non-melanoma skin, ovarian, pancreatic, TBL and prostate. Another reason was related to the population growth and aging, resulting in a large number of DALYs, but part of this increase is offset by falling ASDR. The cancers such as cervical, stomach, esophageal, gallbladder and biliary tract, lip and oral, nasopharynx and malignant skin melanoma are in this group.

There are some limitations in the study. First, the estimates of the GBD study depend on the quality and quantity of the available data sources, because of the lag time for data reporting. The burden of cancers could not be estimated for countries where do not have a comprehensive system for registering and reporting of cancers. For example, studies have shown that in some regions of Iran, incidence and prevalence of esophageal cancer are much higher than estimates of GBD study (18, 19). Another limitation of this study was the lack of data for economic burden of cancer to aggregate with the GBD for better interpretation of results. However, there are some limited studies in Iran in which the economic burden of especial cancers was calculated and the authors in these studies showed the increase of economic burden in these cancers (20, 21).

Conclusion

Between 1990 and 2016, cancers have grown more than doubled in terms of DALYs. The majority of cancer DALYs were due to YLL, suggesting the need for prevention, early detection, and screening programs. The PC of DALYs number is due to population growth, aging and increasing in ASDR, and in each cancer one of these are the leading cause that should be in attentions. The burden of cancer is higher due to population growth and age structure, on the other hand, Iran's population is young, and therefore, health policymakers need to design a comprehensive plan for population growth.

Ethical considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interest.

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