

RESEARCH ARTICLE

Expected Years of Life Lost Due to Adult Cancer Mortality in Yazd (2004-2010)

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Abstract

The number of deaths is often measured to monitor the population health status and priority of health problems. However, number of years of life lost (YLL) is a more appropriate indicator in some cases. We have calculated the YLL of adult cancers and its trend over the past few years in Yazd to provide planners with baseline data. Data obtained from death registration system were used to calculate the YLL, based on each individual's age at death, and the standardized expected YLL method was applied with a discount rate of 0.03, an age weight of 0.04, and a correction factor of 0.165. All data were analyzed and prepared in Epi6 and Excel 2007. A total of 3,850 death records were analyzed. Some 550 patients in Yazd province aged ≥ 20 die annually due to cancer (male: female ratio 1.3). The average ages at death in lung, CNS, breast cancer and leukemia cases were 68.5, 59, 58.7 and 61, respectively. The age group of 40-59 with 21 % had the highest cancer mortality percentage. Premature cancer deaths have caused 40,753 YLL (5,823 YLL annually). Females lose on average more life years to cancer than do men (11.6 vs 9.8 years). Lung cancer (12.1%), CNS tumors (11.7%) and leukemia (11.4 %) were the leading causes terms of YLL due to all cancers in both sexes. From 2004 to 2010, cancer-caused YLL as a fraction of all YLL increased from 12.8 to 15.2 %. This study can help in the assessment of health care needs and prioritization. Cancer is the major cause of deaths and the trend is increasing. The use of YLLs is a better index for measurement of premature mortality for ranking of diseases than is death counts. Longer periods of observation will make these trends more robust and will help to evaluate and develop, better public health interventions.

Keywords: Years of life lost - cancer – mortality - Iran

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Introduction

Despite achievements in controlling and preventing infectious diseases in recent decades, the incidence of chronic diseases, especially cancer, follows an increasing trend due to aging of populations, changes in lifestyle, increased smoking, immobility, and poor diet, which will double the burden of the disease (Etemadi et al., 2008; Thun et al., 2010; Keyghobadi et al., 2015; Zahedi et al., 2015). Therefore, studies on the incidence of cancer and cancer-induced mortalities in different geographical areas with different cultures can help in identification of factors affecting the incidence of cancer.

A total of 14.9 million new cases and 8.2 million deaths from cancer occurred in 2013, and 196.3 million Disability-Adjusted Life Year (DALY) of people's life was lost. Developing countries contribute to 62% of cancer-induced mortalities and 70% of years of life lost (YLL) (Lozano et al., 2012; Fitzmaurice et al., 2015). Cancer is the second and the third cause of death in developed countries and the world, respectively. Despite improved preventive measures and the development of diagnostic and therapeutic procedures, it has risen by more

than 10% in 113 countries from 1990 to 2013 (Thun et al., 2010; Fitzmaurice et al., 2015). In Iran, more than 30,000 cancer-induced mortalities per year have been reported. Cancer is the third most common cause of death of Iranians and estimates suggest its rise up until 2020 (Zeinalzadeh et al., 2012; Fateh and Emamian, 2013; Khorasani et al., 2015). Therefore, preventive measures should be concentrated through increased support of government for allocating more resources, in addition to increased access to health care services.

Cause-specific death rate is an essential indicator of health systems assessing the health status of a community. Regarding cancer, its trend may reflect the effectiveness of screening programs, early diagnosis, and treatment as well as the contribution of environmental risk factors in development and control of cancer.

However, this traditional index is not suitable to prioritize programs for resource allocation purposes (Carter and Nguyen, 2012), because it may not show the importance of prevention or early diagnosis of certain diseases at younger ages because of the influence of common causes in the elderly. But measuring YLL due to death can better help policy-makers to prioritize health problems and to design

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health interventions (Burnet et al., 2005; Aragon et al., 2008). Including or not including the value of age in definition of YLL due to premature death has resulted in different opinions for calculation of the difference between age at death and standard life expectancy (Gardner and Sanborn, 1990; Lee, 1997).

Given the high lethality of most cancers, previous studies have shown that YLL accounts for 90% of burden of the disease (DALY), and about 10% of DALY in cancers is related to Years Lived with Disability (YLD) due to cancer (Naghavi et al., 2009). Therefore, cancers YLL can well show the appearance of cancer in a region and it can be accounted as a criterion for rating their impacts on health.

Given that similar studies in the province have been performed on certain types of cancer, or YLL has been estimated in one year, the present study aimed to calculate cancer-induced YLL over a period of 7 years by the type of cancer in Yazdi adults in order to describe the current situation and to provide the average years of life lost (AYLL) for each type of cancer. These baseline data can be offered to decision-makers to help them prioritize and allocate resources for the health system.

Materials and Methods

The study population included all people aged over 20 years in Yazd Province from 2004 to 2010. The number of deaths from cancer in people 20 and older was obtained using the death registration system of provincial health center. In International Classification of Diseases (ICD 10), cancers are classified under the C00-C97.

Death registration data were derived and recorded based on the standard death certificate form obtainable from all usable sources for diagnosis such as hospitals, cemeteries, forensic medical centers, civil registration, and health centers throughout the city. Those deceased whose residence was registered out of Yazd province were excluded. Specific standardized death rate was calculated by the direct method for age groups.

To maintain comparability, the methodology used in the main study of global burden of diseases was used in this study. To calculate YLL due to early death, the standardized lost life expectancy method was used with discount rate of 0.03 for the future, age weight of 0.04 for different years of life, and constant correction factor of 0.1658 for age weight (Naghavi et al., 2009). The average YLL was calculated by dividing YLL to the number of patients deceased due to that specific cancer. The populations of Yazd in 2004-2010 were estimated, using the census from 1996 and 2005 and 2011 conducted by Statistics Centre of Iran and its estimation according to population growth rate for years before and after census (Mirzadeh et al., 2015). The collected data were analyzed using Epi 6 and Excel 2007.

Results

Of total deaths from 2004 to 2010, cancer was the third most common cause of death in Yazd with 3850 deaths (13.1%) (M/F: 1.3). An annual average of 311 men and

Table 1. Cancer Mortality & Years of Life Lost by Sex & Year

Year	Total Number	Sex		Years of Life Lost	
		Male	Female	Cancers	Cancers/All Causes %
2004	496.0	290.0	206.0	5,319.0	12.8
2005	495.0	282.0	213.0	5,429.0	12.8
2006	504.0	290.0	214.0	5,054.0	12.5
2007	590.0	337.0	253.0	6,384.0	15.6
2008	578.0	305.0	273.0	5,992.0	14.8
2009	595.0	338.0	257.0	6,610.0	16.9
2010	592.0	337.0	255.0	5,970.0	15.2
Total	3850.0	2179.0	1671.0	40,758.0	14.3

239 women have lost their lives due to cancer (Table 1). Crude death rate from cancer in men and women is 92.7 and 77.1 per 100,000 people, respectively. The incidence of death from cancer has changed from 86.8 to 85.2 deaths per 100,000 people from 2004 to 2010 with a very mild slope ($r^2=0.01$, $y=-0.158x+84.6$). Lung cancer, stomach cancer, leukemia, liver cancer, and CNS tumors with a frequency of 13.5%, 11%, 8.9%, 8.7%, and 8.6%, respectively, accounted for half of cancers leading to death. The incidence of death from cancer increased in Yazdi adults as age increased, so that according to reports, cancer-induced mortality was 28.6 and 448 per 100,000 in individuals aged <60 and 60 years and older, respectively.

A total of 284,517 years of life was lost due to premature death in the age group of 20 years and older during the study period where cancers account for 40,758 years (annual average of 5,823 years) i.e. 14.3% (52.6% in men and 47.4% women).

Lung cancer with 4919 years (12.1% YLL due to cancer), as the most common cause of cancer death, followed by CNS tumors (11.7%) and leukemia (11.4%) had the highest contribution in the years of life lost. Lung cancer in men with 14.5% and breast cancer in women with 17.7% were the first cause of cancer-related YLL. Figure 1 shows the most common cause of YLL due to Cancer Mortality by type in both Sexes.

In terms of YLL, lung cancer, CNS tumors, leukemia, stomach cancer, and breast cancer are the five most common cancers led to death with an average age of 68.5, 59, 61.1, 70, and 58.8 years, respectively (Table 1). The highest (75.5 years) and the lowest mean (54.6 years) belonged to prostate cancer and lymphoma, respectively. More than half of the deaths from leukemia, lymphoma, and CNS tumors occurred in the age group of < 50 years with the greatest effect on YLL. Figure 2 shows most common cause of YLL due to Cancer Mortality in adults of different age groups in both sexes. Among the most common cancers, lymphoma, breast cancer, CNS tumors, leukemia, and colorectal cancer had the highest YLL average with a value of 16.7, 14.6, 14.4, 13.5 and 10.1, respectively (Table 1). AYLL was 10.6 years for all types of cancers in both sexes ranging from 4.9 years (prostate cancer) to 16.7 years (lymphoma) (Table. 2). On average, women with a mean of 11.6 had lost more years due to

Table 2. Average Age of Death & YLL of 10 Most Frequent Cancer Types

Cancer (C00-97)	Total	Sex		Average Age of Death(Year)		Average Years Life Lost (AYLL)	
		Male	Female	Male	Female	Male	Female
Lung (C32-C34)	521	338	183	68.4	68.7	9.2	9.80
Stomach (C16)	424	269	155	70.6	69.0	8.3	10.0
Leukaemia (C91-C95)	345	201	144	61.3	60.8	13.3	13.7
Liver (C22)	335	173	162	69.9	71.8	8.6	8.20
CNS tumour (C70-C72)	330	164	166	58.2	59.8	14.4	14.4
Prostate (C61)	249	249	--	78.3	--	4.90	--
Breast (C50)	237	5.00	232	67	58.6	11	14.7
Colorectal (C18-C21)	236	138	98	67.3	67.8	10	10.2
Pancreas (C25)	140	89	51	68.9	72.0	8.9	7.80
Lymphoma (C81-C85)	128	87	41	56.2	51.1	15.6	18.9

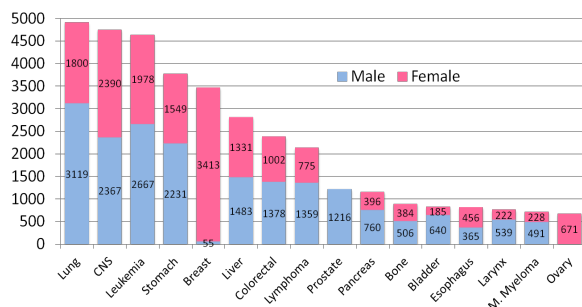


Figure 1. Most Common Cause of YLL Due to Cancer Mortality by Type in Both Sex

cancer compared with men (9.8 years).

Discussion

The estimated YLL due to premature death from cancer was about 6,000 years on annual basis in this study implying that every type of cancer reduces averagely a few years of Yazd patients with cancer. Knowing this index is one of the first steps in identifying the final effectiveness of cancer prevention and control programs. Cancer has lost 10.6 years of Yazd people on average, though there were significant differences in this index between various cancers associated with factors such as the prevalent age of each cancer, age at diagnosis, and treatment facilities of every region.

The ratio of YLL due to deaths from cancer to total number of deaths rose from 12.8% to 15.2% within 7 years; and it seems that this rise is mainly originated from improved diagnostic capabilities in early stages of cancers, i.e. at younger ages of the province patients, and improved system for recording death events. Given the increased incidence reported in the region (Vakili et al., 2014), policy-makers need to study changes in lifestyle leading to inactivity, overweight, exposure to risky environmental factors such as smoking, and environmental and occupational exposures, and their relationship with changes in the incidence of various cancers in community. Aging is associated with an

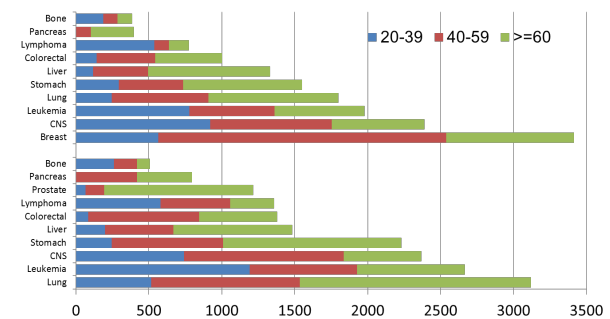


Figure 2. Most Common Cause of YLL due to Cancer Mortality by Type and Age Group, Both Sexes, Yazd 2004-2010

increased incidence of cancer and Yazdi people had the highest number of deaths from cancer in the seventh decade of life (29.3%).

Despite more cases of men with various cancers (93 per 100,000) compared with women (77 per 100,000) in Yazd, women averagely lost more years of their life than men due to premature death (11.5 versus 9.8). Higher life expectancy in women can partly explain this difference, but higher percentage of cancer death in women aged <60 compared with men of the same age range (32.4% versus 26.3%) shows that women experience cancer and death at younger ages. This difference is observed in other similar studies (Liu et al., 2013; Brustugun et al., 2014).

Lung cancer, CNS tumors, leukemia, and stomach cancer, among the most common cancers leading to death, account respectively for loss of more years of life among Yazd population (Figure 2) and account for about 50% of total YLL. The above order differs from that of previous similar studies performed in Iran, where stomach cancer ranked the first national cause of YLL, and lung cancer ranked the third provincial and the fourth national cause (Naghavi et al., 2009).

The higher percentage of death from lung cancer in men (the first cause with 15.5%) and women (the second cause with 11%) in Yazd and its difference with national results necessitates studies for monitoring the use of tobacco products as well as probable side effects of other factors, such as exposure to radon gas (Pirsaheb

et al., 2013; Hadad and Mokhtari, 2015) environmental exposure to tobacco smoke, especially in women with smoker spouses (Mojibyan et al., 2013), given the role of these factors in lung cancer (Khan, 2000; Pirsahab et al., 2013). Evaluation of the accuracy of the issued death certificates in terms of possible misclassification and report of pulmonary metastases as a cause of death is also recommended.

The prevalence of CNS tumors in childhood and adolescence (Mirzadeh et al., 2015), a rate of 11.7% for YLL due to CNS tumors in Yazd adults, a mean age of 59 years at the time of death and an average rate of 14.4 YLL due to each type of cancer imply the need for evaluating the risk factors of CNS tumors in this active age group of Yazd Province. Given the lack of age-sex differences as well as high AYLL due to brain tumors up to age 20, indicated in other studies (Yalla et al., 2013; Rouse et al., 2015), and limitations of diagnostic and therapeutic methods for increasing the survival rate of patients, it seems that YLL indicator will not change in the future years. Therefore, the assessment of health interventions in this group of cancers would be practiced through measuring the amount of disability and quality of life of patients.

Leukemia is a common cancer in children with an increasing incidence in adulthood unlike childhood (Fazeli et al., 2013). With 345 deaths in Yazd, leukemia is the third cause of death and life loss of adults due to cancer (11.4%). This agrees with national status for all ages and disagrees with the declining trend in other countries (Imamura and Mizuno, 2005; Fazeli et al., 2013). However, it is the seventh cause of YLL due to premature death in the world (Fitzmaurice et al., 2015). Increased incidence of leukemia is attributable to risk factors such as obesity and smoking (Varadarajan et al., 2010; Chu et al., 2011) both being common risk factors in Yazd (Namayandeh et al., 2011), although further analysis is required to identify other risk factors in the region.

Gastric cancer is the second cause of cancer-induced mortality and the fourth cause of YLL due to all types of cancer in Yazd. The higher frequency of this cancer in men compared with women in Yazd agrees with the results of other studies. Gastric cancer is the first cause of YLL due to death from different cancers in Iran. Geographic differences may be originated from diet, smoking, and perhaps genetics (Malekzadeh et al., 2009; Naghavi et al., 2009; Khajedaluae et al., 2014; Khorasani et al., 2015). However, the survival of Yazdi patients with gastric cancer, especially of women, is better than the rest of the country (Baeradeh et al., 2015), but the increasing trend of the growth of stomach cancer in the last decade and its diagnosis at an advanced stage in at least 80% of patients (Malekzadeh et al., 2009) will result in a significant share of YLL due to premature death, especially in Yazdi men.

With an annual loss of 487 years, breast cancer is the first cause of death from cancer and YLL due to cancer in women. It is higher than Iran (Naghavi et al., 2009) and lower than the world (Vakili et al., 2014) when compared to similar estimations, which is a result of the existence of higher levels of risk factors in Yazd Province (Lotfi and Shobairi, 2008). Lower age of women with breast

cancer, diagnosis at the advanced stages of the disease (Harirchi et al., 2005; Miller et al., 2015), and a survival rate of 5 years in 70% of cases (Fallahzadeh et al., 2014) have led to higher YLL due to premature death from breast cancer in Yazdi women. Given resource constraints, therefore, the disease can be detected at early stages through training self-examination and screening by trained general physicians (Hassan et al., 2015). This, in turn, can be effective in reduced YLL of the most common cancer of women, and the effectiveness of the intervention can be measured by this index.

With regard to the death registration system in the province, the possibility of undercounted deaths seems unlikely. However, physicians' failure in recording the correct cause of death and misclassification of the underlying cause of death based on issued death certificates are possible limitations of the present study.

The YLD component of DALY was not calculated in this study due to its lower contribution to cancers DALY and its limited certainty.

Among several factors such as smoking, consuming alcohol, exposure to ionizing radiation or ultraviolet radiation, air pollutants, soil and water contaminants, infectious agents, and diet, one or more factors play a role in the incidence of some types of cancers (Anand et al., 2008). Nevertheless, one third of cancers can be prevented by modifying lifestyle (smoking cessation, high-fiber, low-fat diet, weight loss, and physical activity) (Kushi et al., 2012). It is essential to pay more attention to screening processes to diagnose cancers in early stages and to develop therapeutic services in the province.

In Conclusion, cancer is the third cause of mortality. Given its increased incidence in recent years, the evaluation of risk factors, including geographical differences, seems essential. By representing the image of cancer-induced death, this study helps public health policy-makers to assess the health needs and to prioritize them for allocation of resources. The index of YLL due to premature death better ranks diseases, especially cancers as compared to the number of deaths. Periodic calculation of this index and evaluation of its trend can better assess the effectiveness of health interventions on increased healthy life expectancy (HLE), in addition to describing cancer status.

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