

## ORIGINAL RESEARCH

## The Most Important Causes of Death in Iranian Population; a Retrospective Cohort Study

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### Abstract

**Introduction:** Health care providers and health policy managers need updated and valid information regarding causes of death (COD) for development the health care facilities, directing primary prevention, assigning funds, and promoting public health. The major causes of death and its burden have not been yet appropriately identified in Iran. Although several studies had been carried out in this area, most of them were local or performed in the past years and need to be update. Thus, the present study aimed to address the major causes of death and its burden in Iran. **Methods:** The present cross-sectional study was performed on graduate students and their families from February to March 2014. Through a two-stage random sampling procedure, data on 11315 subjects were obtained. The corresponding age of death, gender, and calendar year of death were inquired. All causes of death were categorized in nine groups including major cardiovascular disease, cancers, motor vehicle accidents, unintentional injuries, intentional injuries, stroke, lower respiratory infections, diabetes, and other reasons. Years of life lost (YLL) and person years of life lost were computed as the burden of diseases. **Results:** Totally, 11315 (50.4% male) subjects were studied. The results regarding death of relatives revealed that 360 deaths occurred (66.9% male). COD in 95 cases (26.4%) was cardiovascular diseases, 64 (17.8%) motor vehicle accidents, 41 (11.4%) cancers, 23 (6.4%) unintentional injuries, 22 (6.1%) intentional injuries, 10 (2.8%) stroke, 8 (2.2%) lower respiratory infections, 6 (1.8%) diabetes, and 91 (25.3%) other reasons. The average YLL due to all COD was 34.4±18.5. YLL for motor vehicle accidents and injuries (unintentional and intentional) were higher than cardiovascular diseases ( $p<0.001$ ). In addition, person years of life lost for motor vehicle accidents were 2613.1 years. Cardiovascular diseases (2159.4 years), cancers (1321.0 years), and unintentional injuries (990.4 years) were in the next ranks. **Conclusion:** Based on the findings, it seems that cardiovascular diseases, motor vehicle accidents, cancers, intentional and unintentional injuries are the major causes of death in Iranian population. Most of years of life lost were due to motor vehicle accidents, cardiovascular diseases and cancers, intentional and unintentional injuries, respectively.

**Key words:** Cause of death; mortality; life expectancy; cardiovascular diseases; traffic accidents

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### Introduction:

Health care providers and health policy managers need updated and valid information regarding causes of death (COD) for development the health care facilities, directing primary prevention, assigning funds, and promoting public health (1). However, due to a high prevalence of deaths and its variation

in different geographical regions (2), it is not easy to identify the COD precisely. Based on World Health Organization (WHO), Non-Communicable Diseases (NCDs) will be accountable for 70% of all deaths in 2030. Cardiovascular diseases (CVDs), cancers, diabetes and chronic lung diseases are the first four causes of death in worldwide (3). The recent WHO report showed that ischemic



heart disease (11.2%), brain stroke (10.6%), lower respiratory tract infections (6.7%), obstructive pulmonary disease (5.8%), diarrhea (4.7%), and HIV/AIDS (3.01%) are the most important causes of mortality globally. Also, this report revealed that bronchus and lung cancer (2.7%), diabetes (2.6%), and traffic accidents (2.2%) have the ranks of seventh to ninth, respectively (4). However, the COD in many countries is different from WHO reports. For example, trauma and poisoning in Iran are in the second rank and traffic accident is in the third (1). There are many reasons for such variations and one of the most important of these diversities is the dissimilarity among risk factors of death in different countries. For instance, in Sub-Saharan Africa malnourishment, domestic air pollutants arising from fuels, and suboptimal breastfeeding are the health problems (5) while, in developed countries obesity, high blood cholesterol, and inappropriate dietary habits are the main health problems (6). Therefore, regional and national identification of COD has a high priority. As a result, WHO has developed some facilities in recent years to evaluate the COD in national, regional, and global scales (7).

Years of life lost (YLL) is used to determine the burden of fetal diseases and the effect of it on quality of life. YLL along with years lived with disability (YLD) are suggested by WHO and World Bank to display the burden of diseases and health priorities (8). These tools let health policy-makers to determine the priorities to control of diseases and evaluate the effectiveness of preventive programs. The major causes of death and its burden have not been yet appropriately identified in Iran. Although several studies had been carried out in this area, most of them were local or performed in the past years and need to be update. Thus, the present study aimed to address the major causes of death and its burden in Iran.

#### **Methods:**

##### **Study design and setting**

The present cross-sectional study was performed on graduate students and their families with the goal of finding the main causes of mortality among them from February to March 2014. The target population was all the men and women graduate students of Tehran University of Medical Sciences, Tehran, Iran and their families. This university as the largest university in the country has accepted students from all the country. Thus, determining the cause of mortality among these students and their families is a good representative of COD from whole country. The present study was approved by Ethical Committee of Tehran University of Medical Sciences.

##### **Participants**

All graduate students of Tehran University of Medical Sciences who were studying during 2014 were taken to this study. The lack of consent was considered as the exclusion criteria.

Two hundred graduate students were enrolled into this

study through a two-stage random sampling procedure. In first step, one of the ten faculties was randomly selected and then from the list of students, 200 ones were selected using computer-generated random numbers. In this study, the data on parents, spouse and her/his family, children, brothers and sisters, uncles, aunts and their children were asked from each student. Based on our pilot study, it was estimated that by interview with each student, the information of about 50 persons of his/her relatives could be obtained. Consequently, by studying 200 students it was expected to provide the information of about 10000 individuals. Finally, data on 11315 subjects were obtained. To decrease the potential recall bias, the information of close relatives was only asked.

##### **Data collection**

In this study, studied subjects were asked to state any death happened to their relatives. The corresponding age of death, gender, and calendar year of death were inquired. In a pilot study, the validity of questionnaire was verified by expert panel, the reliability of it confirmed through a test-retest from 15 students, and the agreement on answers found to be 93.3%.

##### **Statistical analysis**

All causes of death were categorized in nine groups including major cardiovascular disease, cancers, motor vehicle accidents, unintentional injuries, intentional injuries, stroke, lower respiratory infections, diabetes, and other reasons. Multinomial logistic regression was used to assess significant differences among the frequency of death in various causes of death. To calculate the YLL for each person, age of death was subtracted from his/her life expectancy derived from the life table of Iranian population. Also, for computing person years of life lost, the number of death was multiplied to average YLL for each COD. One-way analysis of variance was performed to compare mean YLL and person years of life lost among CODs.  $p < 0.05$  was considered as significant.

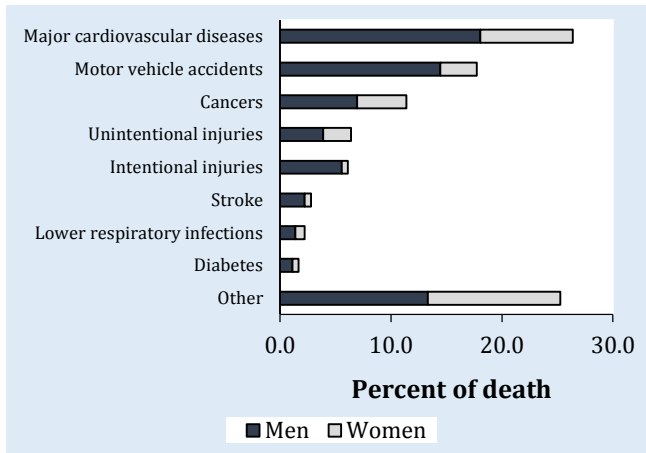
##### **Results:**

In the present study by interviewing 200 graduate students, the data on 11315 subjects were collected of whom 5700 (50.4%) were male and 5615 (49.6%) female. The findings on death of relatives revealed that totally 360 deaths occurred because of various reasons, that 241 (66.9%) were male and 119 (33.1%) female.

110 specific causes of death were classified into nine groups as shown in Table 1. COD in 95 cases (26.4%) was cardiovascular diseases, 64 (17.8%) motor vehicle accidents, 41 (11.4%) cancers, 23 (6.4%) unintentional injuries, 22 (6.1%) intentional injuries, 10 (2.8%) stroke, 8 (2.2%) lower respiratory infections, 6 (1.8%) diabetes, and 91 (25.3%) other reasons. As Table 1 and Figure 1 show, cardiovascular diseases has the first rank ( $p < 0.001$ ).

Figure 2 displays the percentage of death in each age group according to COD. Motor vehicle accidents are the





**Figure 1:** The most common causes of death in the studied population

major cause of death in ages younger than 45 years. While in older than 45 years, cardiovascular diseases are the main cause of death. Multinomial logistic regression showed that in adults (aged 25-74 years), cardiovascular deaths were significantly higher than deaths due to motor vehicle accidents ( $p < 0.001$ ).

The average YLL and its 95% confidence interval are shown in table 2 for male and female of different CODs. The sverage YLL due to all COD was  $34.4 \pm 18.5$ . The YLL had significant difference among various CODs (df: 8, 344;  $F=9.9$ ;  $p < 0.0001$ ). Bonferroni post hoc analysis showed that YLL for motor vehicle accidents and injuries (unintentional and intentional) were higher than cardiovascular diseases ( $p < 0.001$ ).

Total person years of life lost were 12394.8 years. Person years of life lost for motor vehicle accidents were 2613.1 years. Cardiovascular disease (2159.4 years), cancers (1321.0 years), and unintentional injuries (990.4 years) were also in the next ranks. However, intentional injuries (931.7 years), lower respiratory tract

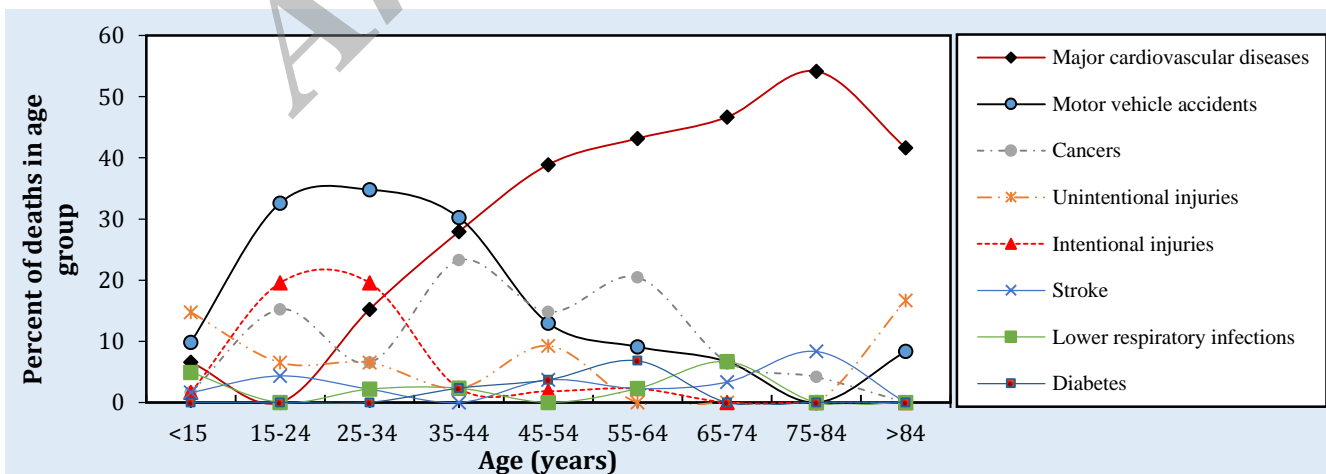
infections (312.0 years), stroke (283.3 years), and diabetes (150.2 years) had the least person years of life lost.

### Discussion:

The present study showed that cardiovascular disease, motor vehicle accidents, cancers, intentional and unintentional injuries are the major causes of death in Iranian population. Also, the motor vehicle accidents deaths had the highest person years of life lost followed by cardiovascular disease, cancers, intentional and unintentional injuries, respectively.

Like other countries, cardiovascular diseases, motor vehicle accidents, cancers, intentional and unintentional injuries, lower respiratory tract infections, and stroke are the most important causes of mortality in Iran. Based on WHO reports, cardiovascular diseases were accounted as the major COD and led to 11 million deaths in 2011. In East Asia the burden of cardiovascular diseases has the second rank, too (4). Similarly, in this study cardiovascular diseases have the first rank of COD and the second highest burden of death by YLLs. This issue arises from changing in Iranian lifestyle, which leads to increase the risk factors of cardiovascular diseases.

Smoking, hypertension, alcohol consumption, weight gain, high blood cholesterol, lower consumption of fruits, and sodium rich foods are the most important risk factors of cardiovascular diseases which have a high prevalence in Iranian population (9-13). The primary level of prevention is the most critical strategy for controlling these risk factors. Additionally, primary care could provide an easy access to new treatment and medical interventions to control some of these risk factors like hypertension and high blood pressure. Applying such proceedings could remarkably reduce the deaths arisen from cardiovascular diseases (14); consequently, these policies have decreased the burden of cardiovascular diseases in developing countries.



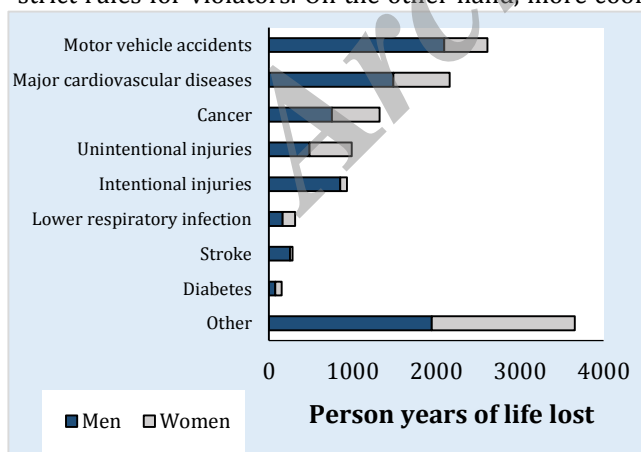
**Figure 2:** Age-specific causes of death in the studied population



**Table 1:** Cumulative incidence of death in the studied population

Cause of death	Frequency			Cumulative incidence of death (%)					
				In dead cases (n=360)			In samples (n=11315)		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
Cardiovascular diseases	65	30	95	18.1	8.3	26.4	0.57	0.27	0.84
Motor vehicle accidents	52	12	64	14.4	3.3	17.7	0.46	0.11	0.57
Cancers	25	16	41	6.9	4.4	11.4	0.22	0.14	0.36
Unintentional injuries	14	9	23	3.9	2.5	6.4	0.12	0.08	0.20
Intentional injuries	20	2	22	5.6	0.6	6.1	0.18	0.02	0.19
Stroke	8	2	10	2.2	0.6	2.8	0.07	0.02	0.09
Lower respiratory infections	5	3	8	1.4	0.8	2.2	0.04	0.03	0.07
Diabetes	4	2	6	1.1	0.6	1.7	0.04	0.02	0.05
Other	48	43	91	13.3	11.9	25.2	0.42	0.38	0.80
<b>Total</b>	<b>241</b>	<b>119</b>	<b>360</b>	<b>66.9</b>	<b>39.8</b>	<b>100</b>	<b>2.13</b>	<b>1.05</b>	<b>3.18</b>

Motor vehicles accidents have the second rank of COD in this study line with Frouzanfar et al. They demonstrated that the death rate due to motor vehicle accidents is higher than twice of the global average. Since most of the motor vehicle accidents deaths (81.25%) happen under the age of 45, the rank of its burden is the highest (1, 15). The preventive measures are suggested to improve the road safety, quality and safety of vehicles, and establish strict rules for violators. On the other hand, more coor-



**Figure 3:** Gender- specific person years of life lost stratified by cause of death

fire stations, and emergency departments could improve the service delivery to victims. This management leads to reduce the arrival time to the scene and provide critical interventions faster.

Cancers are the third cause of mortality and the burden of diseases. In the study of Frouzanfar et al cancers has the second rank of COD (1). Smoking has a key role in developing cancers as the major risk factor. In addition, household air pollution from solid fuels, urban air pollution caused by fossil fuels, exposure to occupational pollutants, drug usage, and inappropriate diet are other risk factors of cancers (16-18). Today, such factors have been dramatically increased in urban areas. Therefore, preventive policies should be taken to decrease these risks. Moreover, cancer-screening programs could help in early diagnosis, which leads to better treatment response. Stomach, lung, and breast cancers are the leadings in Iran (19). As a result, increasing the free access to diagnostic tools such as mammography is one of the best screening and preventive interventions, economically. In addition, smoking and inappropriate diet are two critical risk factors that their combination exacerbates the disease status. Unfortunately, the prevalence of these two risk factors is high in the country. Thus, it is suggested to implement educational programs to improve the nutritional status and smoking cessation.

dination among different units such as police stations,



**Table 2:** Mean years of life lost (95 % confidence interval) according to gender

Cause	Men	Women	Total
Cardiovascular diseases	22.9 (19.3-26.5)	22.4 (17.4-27.4)	22.7 (19.8-25.6)
Motor vehicle accidents	40.3 (36.8-43.8)	43.1 (34.7-51.5)	40.8 (37.6-44.0)
Cancers	30.1 (24.8-36.0)	35.5 (29.5-41.5)	32.2 (27.9-36.5)
Unintentional injuries	34.6 (24.9-44.2)	56.3 (47.0-65.6)	43.1 (35.0-51.2)
Intentional injuries	42.7 (39.9-45.4)	39.2 (4.3-82.7)	42.4 (38.5-46.2)
Stroke	31.2 (14.5-47.4)	16.9 (7.2-26.6)	28.3 (15.0-41.2)
Lower respiratory infection	32.5 (8.3-56.8)	49.8 (33.6-66.1)	39.0 (22.4-55.6)
Diabetes	19.1 (15.0-23.2)	36.9 (28.5-45.2)	25.0 (16.9-33.1)
Other	40.6 (34.3-46.9)	39.8 (32.5-47.0)	40.2 (35.5-44.9)
<b>Total</b>	<b>33.5 (31.3-35.8)</b>	<b>36.3 (35.6-40.0)</b>	<b>34.4 (32.5-36.4)</b>

In the present study lower respiratory infections as the only communicable diseases were the main CODs in Iran. However, its rate is lower than other diseases. Since 1990 the prevalence of communicable diseases like diarrhea, lower respiratory infections, and tetanus has decreased (4). Although Iran is a low and middle income country, in recent years effective changes has been made in health promotion which cause to shift disease pattern in the society from communicable diseases to non-communicable diseases, similar to developed countries (15). The present study had some limitations one of the most important of which is the lack of calculating the lived years with disability. If evaluation of this factor was possible, calculating the disability-adjusted life year (DALY) would be conceivable, which is critical in finding the burden of diseases. Another limitation was recall bias; although complete removing of recall bias in observational studies is not possible, in the present study it decreased noticeably by confining the information of close relatives.

#### Conclusion:

Based on the findings, it seems that cardiovascular diseases, motor vehicle accidents, cancers, intentional and unintentional injuries are the major causes of death in Iranian population. Most of years of life lost were due to

motor vehicle accidents, cardiovascular diseases and cancers, intentional and unintentional injuries, respectively.

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#### Conflict of interest:

None

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#### Authors' contributions:

All authors passed four criteria for authorship contribution based on recommendations of the International Committee of Medical Journal Editors.

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