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## The burden of road traffic accidents in Kermanshah province (2010)

Neda Izadi<sup>1\*</sup>, Farid Najafi<sup>2</sup>, Seyed Saeed Hashemi Nazari<sup>3</sup>, Ardeshir Khosravi<sup>4</sup>, Hamid Soori<sup>3</sup>

1. Treatment Deputy, Kermanshah University of Medical Sciences, Kermanshah, Iran.

2. Department of Epidemiology, Research Center for Environmental Determinants of Health (RCEDH), Kermanshah University of Medical Sciences, Kermanshah, Iran.

3. Department of Epidemiology, Safety Promotion and Injury Prevention Research Center, School of Health, Shahid Beheshti University of Medical Sciences, Tehran, Iran.

4. Iranian Ministry of Health and Medical Education, Non-communicable Diseases Research Center, Tehran University of Medical Sciences, Tehran, Iran.

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**\*Corresponding Author:**

Shahid Beheshti Blvd, Building No.2, Treatment Deputy, Kermanshah University of Medical Sciences  
Tel: +989187286481

**Email:** neda.izady@yahoo.com

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### Abstract

**Introduction:** Disabled-adjusted Life Year (DALY) makes it possible to calculate the time and duration of the disease and its non-fatal consequences along with the time lost due to premature death. This study was aimed to estimate the burden of Road Traffic Accidents (RTA) in Kermanshah Province.

**Methods:** To determine the mortality related to road-traffic accidents as well as Years of Life Lost (YLL) due to premature death and to calculate the incidence of non-fatal injuries and Years Lost due to Disability (YLD), the data from National Death Registration and Forensics Medicine were used. The causes of death and nature of non-fatal injuries were classified using International Classification of Diseases 10 codes (ICD-10) and Global Burden of Diseases 2010 (GBD-2010). The YLL, YLD and DALY were estimated according to the guidelines of GBD 2010, and age and sex composition was taken from the National Statistical Center for the year 2010.

**Results:** The mean age of the patients was 34.2±18.2 years. Overall, 70.8% of the subjects were male and the rest were female. The mortality and non-fatal injury rates of RTAs in Kermanshah province were 51.3 and 283.6 per 100,000 population, respectively. The YLLs due to premature death were 46613 years (24.5 per 1000) and the YLDs were found to be 3404.9 years (1.7 per 1000). The DALYs were found to be 50017.9 years (26.2 per 1000) in both genders. The highest DALY rate in both genders was reported for the age group 30-34 (32.4 per 1000). More than 93% of DALYs were related to YLL (24.5 per 1000).

**Conclusion:** Given the DALY >50000 years attributed to RTAs, the share of more than 93% YLL in the DALY rate, and the fact that most RTAs occur in the men and age group 15-44 years, it is necessary to implement all effective and multisectoral preventive measures, especially for this group, such as use of helmet and seatbelts, speed limit enforcement, better road design, and manufacturing of high quality cars.

### Introduction

Road traffic accidents are a serious threat to humans all around the world and one of the most important health challenges that has endangered the health of human being. Traffic accidents cause 1.2 million deaths annually and over 50 million injuries worldwide. It is the ninth cause of the loss of useful years of life and one of the leading causes of mortality and disability around the world, taking 5.8 million lives a year (1).

Although road traffic accidents can influence all areas of the universe, their frequency in low- and middle-income countries is higher than high-income countries, so most of the victims of these accidents live in the countries experiencing life automation (2, 3).

Also, the mortality due to traffic accidents is quite diverse in various areas, but in general, the regional mean for the low- and middle-income countries is much higher than that of industrialized countries (4). According to the World Health Organization (WHO) report, the mortality due to road traffic accidents is 21.5 per 100,000 population in low-income countries and 19.5 per 100,000 population in middle-income countries (5). The results of studies conducted in Iran indicate that mortality due to traffic accidents is 32 per 100,000 population, whereas it is estimated to be 22.6 per 100,000 population in the world. On the other hand, 15 out of 100 people injured in road traffic accidents die, while this amount is reported to be about 10 deaths in the developed countries (6, 7). Further, Bahadori

reported the deaths due to traffic accidents to be 31.1 per 100,000 population in Iran in 2010 (8).

According to Global Burden of Diseases study 2010 (GBD 2010), the rank of mortality due to road traffic accidents in the world has declined from 10 in 1990 to 8 in 2010 (9). In a study performed in Southern Khorasan, Iran, the years lost due to traffic accidents were reported to 7456 years (10). Also, the DALY rate in Isfahan was found to be 23.36 per 1000 (11). The burden of diseases makes it possible to show the length of time and duration of disease, or external injury and its nonfatal consequences according to the severity of disability per new cases (incidence) or old and new cases (prevalence) along with the years lost due to premature death resulting from the same disease or injury as a parameter indicating different levels of community health. WHO regularly encourages the countries to estimate the burden of diseases at national level as gold standard for correct policymaking in the healthcare system. Provincial or regional calculation of burden of diseases is a good strategy to determine priorities, policymaking and planning in various provinces. Kermanshah province, with two million population and 24998 km<sup>2</sup> area, is the path for millions of passengers, pilgrims and vehicles every year. The statistics of the deputy of health in Kermanshah show that road traffic accidents are the second leading cause of death in this province after cardiovascular diseases. This ranking for traffic accidents can be different based on other indices like YLL, YLD and DALY and can be attributed a higher rank, i.e. first rank. Therefore, the current study was aimed to evaluate the burden of road traffic accidents in Kermanshah province.

### Materials and Methods

The present study was a Burden of Disease Study whose data were collected in a cross-sectional manner. DALY included the sum of years lost due to premature death and disability, as follows:

$$DALY = YLL + YLD$$

The years of life lost due to premature death were calculated by the following formula:

$$YLL = \sum N \times L$$

N=number of deaths in a certain age and gender

The data were obtained from Death Registration Department of Ministry of Health, which is recognized as the gold standard for the causes of mortality, and Forensics Medicine (Kermanshah province), which is the gold standard for the mortality due to traffic accidents. The use of two sources of data was for the sake of obtaining more accurate estimation of death due to traffic accidents. For the deaths caused by traffic accidents based on ICD-10 classification, the codes V01-V99 were determined as the underlying cause of death.

L=Standard life expectancy of the dead in the same age and gender

In this study, new standard life expectancy, which was used in GBD 2010 for separate age groups, was used for comparison with the idea state and estimation of the distance between them. New standard life expectancy is characterized by the absence of differentiation of males from females and considering

the maximum life expectancy to be 86.02 years (12).

**Garbage codes:** these codes included Y10-Y34 and Y87.2 based on the latest international classification of diseases (ICD-10). The deaths registered with the given codes were obtained from the Death Registration Department of Ministry of Health (about 34 cases), and considering the ratio of deaths due to traffic accidents (812 cases) to the deaths caused by all the accidents in the province, including intentional and unintentional accidents (1915 cases), these codes (15 cases for traffic accidents) were redistributed on the deaths due to traffic accidents according to the age and gender of the people (and the ratios obtained).

Years of life lost due to disability were calculated by the following formula:

$$YLD = \sum I \times DW \times L$$

I=incidence rate of a disease or injury during a certain time

### 1. The data related to Forensics Medicine

These data were used for calculation of the incidence of injuries and YLD, including 100070 cases for Kermanshah province and 5737 cases for Kermanshah city in 2010. Owing to availability of data and files of Kermanshah city, the data of the city were used in this study. Using a pilot study carried out on 50 files of forensics medicine and considering the minimum proportion obtained from among different injuries (spinal fracture=0.05) in the pilot study, the sample size was estimated to be 3213 cases.

Having collected the data according to age, gender and nature of injury, 3213 samples were calculated for the whole province. Also, since 4683 out of 100070 injured people had small injuries like bruise, swelling, abrasion, etc., and these injuries were not included in GBD classification (without burden), to calculate the incidence rate and YLD, these people were excluded from the study and calculations were performed on 5387 people.

### 2. The data of the emergency departments of hospitals, available at treatment deputy of ministry of health (data of article 92 in 2010)

These data included 1259 cases of injury due to traffic accidents in Kermanshah province, whose use for calculation of YLD would result in a lower estimate than actual rate. Therefore, these data were utilized only for classification of the data of forensics medicine into inpatient and outpatient groups.

DW=disability weight of the disease or complication

According to GBD 2010, injuries are classified into 23 groups in two major categories of hospital admission (inpatient) and other healthcare (outpatient) based on the nature of injury, i.e. the codes related to S00-T98 of ICD-10. These weights exist for each of the injuries mentioned for separate age groups and for the treated and untreated groups. In this study, it was assumed that all the samples used the health services (13-15).

L=average period in which a person recovers or dies (year)

The data for this part were obtained from GBD 2010, which estimates the recovery time based on the nature of injury. According to GBD 2010, the injuries, in terms of duration, are divided into short-term or temporary disability and long-term or long-life or permanent

disability based on the nature of injury. The data of the possible long-term duration of each injury were obtained from the same study (16).

In this study, to calculate the duration, according to the age group, the standard life expectancy of the same group (mean of life expectancy was used for age groups) was subtracted from the age of the individuals and the long-term duration was computed. In the end, for the injuries due to traffic accidents based on the disability weight of the short- or long-term duration as well as gender, YLD was calculated and total YLD was obtained from the sum of these YLDs (Figure 1).

**3. Age and gender composition of population in Kermanshah province**

The data for age and gender composition in 2010 were obtained from the Iranian Statistical Center. DALY was calculated by adding up YLL and YLD in Excel software. To compare the figures and indices obtained, Age Standardized Rates (ASRs) were calculated. Also, based on GBD 2010 methodology, the age value and discount rate were not used (12, 17).

**Results**

The mean age of the samples was 34.2±18.2. Of them, 70.8% were male and the rest were female. The registered cases at Death Registration Department of Ministry of Health comprised of 812 deaths and those of Forensics Medicine were 628 deaths in 2010. Using these two sources and 15 cases of garbage codes, a total of 976 registered deaths due to road traffic accidents were investigated. Crude and standardized mortality rates of traffic accidents in Kermanshah province were

found to be 51.3 and 54.05 per 100,000 population.

Because 4683 out of 10070 injured people had small injuries like bruise, swelling, abrasion, etc., and these injuries were not included in GBD classification (without burden), to calculate the incidence of injuries and YLD, these people were excluded from the study. The incidence rate of injuries due to traffic accidents in Kermanshah province was reported to be 284.6 per 100,000 population and standardized incidence rate was 286.7 per 100,000 population. Based on 974 deaths and 5387 cases of inpatient and outpatient injury, the ratio of death to inpatient and outpatient injuries was found to be 1:5.5 (Table 1).

To compute YLL, the cases related to garbage codes, which included 15 deaths (10 in men and 5 in women), were added to 974 deaths, yielding a total of 989 deaths.

The years of life lost (YLLs) due to premature death were 38345 (40 per 1000) in men, 8268 (8.7 per 1000) in women and 46613 (24.5 per 1000) in both genders. The maximum years of life lost due to premature death in both genders were found for the age group 30-44 (Table 2). The largest number and years of life lost due to premature death based on external cause of death in both genders were reported for passenger cars, with 19036 years and 10 per 1000 population, respectively (Table 3).

The YLDs were found to be 2365.96 (2.46 per 1000) in men, 1039.01 (1.1 per 1000) in women and 3404.97 (1.79 per 1000) in both genders. The maximum years of life lost due to disability in both genders were observed in the age group 15-29 (Table 4 and 5).

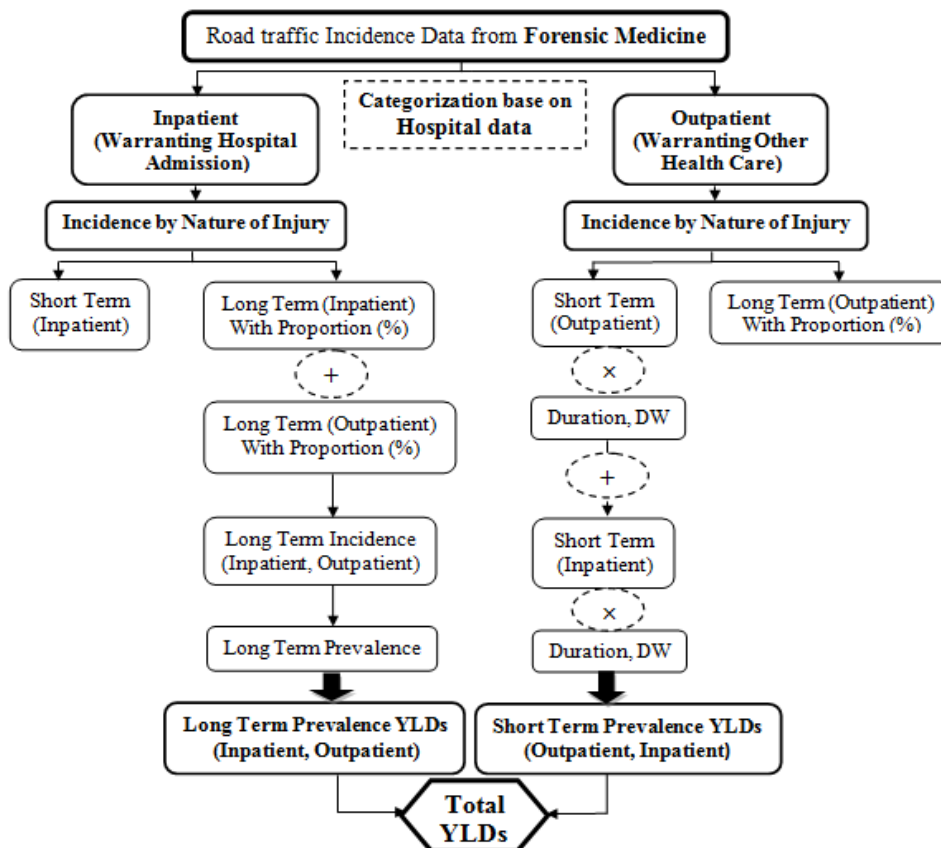


Figure 1. Different stages for calculation of YLD

**Table 1.** Mortality and injury numbers and rates (per 10,000 populations) according to age groups in Kermanshah province (2010)

Age groups	Death		Injury (outpatient)		Injury (inpatient)		Total	
	Number	Rate	Number	Rate	Number	Rate	Number	Rate
0-4	30	18.8	56	35.05	56	35	142	88.88
5-14	57	21.8	207	79.17	198	75.73	462	176.71
15-29	289	44	1209	184	986	150	2484	378
30-44	258	61.4	692	164.61	634	150.81	1584	376.79
45-59	164	63.5	383	148.21	476	184.2	1023	395.88
60-69	66	86.4	142	185.91	96	125.68	304	398
70-79	65	135.8	105	219.37	52	108.64	222	463.81
+80	45	248	43	237	52	286.62	140	771.69
Total	974	51.3	2837	149.36	2550	134.25	6361	334.9

**Table 2.** Number and rate of YLL due to traffic accidents according to age and gender in Kermanshah province (2010)

Age groups	YLLs (year)			YLL (per 100,000 population)		
	Male	Female	Total	Male	Female	Total
0-4	1675	839	2513	20.3	10.8	15.7
5-14	3131	1205	4336	23.2	9.4	16.6
15-29	15774	2701	18474	47.4	8.3	28.1
30-44	11259	1494	12753	53.7	7	30.3
45-59	4484	1197	5681	35	9.1	22
60-69	1045	481	1526	29.7	11.7	20
70-79	710	257	968	27.6	11.6	20.2
+80	267	94	362	26.2	11.8	19.9
Total	38345	8268	46613	40	8.7	24.5

**Table 3.** Number and rate of YLL due to traffic accidents according to cause and gender in Kermanshah province (2010)

Cause (ICD-10)	YLLs (year)			YLL (per 10000 population)		
	Male	Female	Total	Male	Female	Total
Pedestrians (V01-V04, V06-V09)	10177	2286	12463	10.6	2.4	6/6
Cyclists (V10-V19)	318	51	369	0.3	0.05	•/۲
Motorcycle (V20-V29)	5911	1079	6990	6.1	1.1	۳/۷
Automobiles (V40-V59)	15677	3359	19036	16.3	3.6	10
Trucks (V60-V69)	3636	811	4447	3.8	0.8	2.3
Bus & minibus (V70-V79)	555	140	695	0.6	0.1	•,۴
Other (V80-V86)	2071	542	2613	2.1	0.6	۱/۴
Total	38345	8268	46613	40	7.8	24.5

**Table 4.** Distance of YLLs (year) due to traffic accidents based on age and gender in Kermanshah province (2010)

Age groups	YLDs (year)								
	Short-term			Long Term			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4	0.28	0.57	0.85	104.76	55.48	160.24	105.04	56.05	161.09
5-14	1.98	1.17	3.15	240.2	155.53	395.73	242.18	156.7	398.88
15-29	12.26	4.42	16.68	1043.93	412.49	1456.42	1056.19	416.91	1473.1
30-44	7.7	3.71	11.41	640.91	204.58	845.48	648.61	208.29	856.9
45-59	4.94	3.64	8.58	231.87	145.09	376.96	236.81	148.73	385.54
60-69	0.91	0.91	1.82	42.61	36.78	79.49	43.52	37.69	81.21
70-79	0.73	0.45	1.18	23.48	9.61	33.99	24.2	10.06	34.26
+80	0.43	0.04	0.48	8.95	4.54	13.49	9.39	4.58	13.97
Total	29.24	14.92	44.16	2336.72	1024.09	3360.81	2365.96	1039.01	3404.97

**Table 5.** YLL (per 1000 population) due to traffic accidents based on age and gender in Kermanshah province (2010)

Age groups	YLD (per 1000 population)								
	Short-term			Long Term			Total		
	Male	Female	Total	Male	Female	Total	Male	Female	Total
0-4	0	0.01	0.01	1.27	0.79	1.04	1.27	0.8	1.04
5-14	0.01	0.01	0.01	1.85	1.31	1.58	1.86	1.31	1.59
15-29	0.04	0.01	0.03	3.76	1.33	2.56	3.79	1.34	2.58
30-44	0.04	0.02	0.03	3.14	1.06	2.09	3.17	1.07	2.12
45-59	0.04	0.03	0.03	1.92	1.2	1.56	1.95	1.22	1.58
60-69	0.03	0.02	0.02	1.2	0.89	1.03	1.22	0.91	1.05
70-79	0.03	0.02	0.02	0.91	0.43	0.69	0.94	0.45	0.71
+80	0.04	0.01	0.03	0.88	0.57	0.74	0.92	0.57	0.77
Total	0.03	0.02	0.02	2.44	1.09	1.77	2.46	1.1	1.79

**Table 6.** DALY (year) and DALY rate (per 1000 population) due to traffic accidents based on age and gender in Kermanshah province (2010)

Age groups	DALYs (year)			DALY (per 1000)		
	Male	Female	Total	Male	Female	Total
0-4	1780.04	901.05	2680.09	21.57	11.6	16.74
5-14	3381.18	1371.9	4753.09	25.06	10.71	18.19
15-29	17037.09	3137.11	20174.2	51.19	9.64	30.68
30-44	11924.61	1720.29	13644.9	56.87	8.07	32.42
45-59	4734.81	1356.67	6091.48	36.95	10.32	23.58
60-69	1088.3	518.67	1606.7	30.92	12.61	21.05
70-79	734.2	267.06	1002.26	28.54	12.05	20.91
+80	276.39	98.58	375.97	27.12	12.37	20.67
Total	40710.96	9307.01	50017.97	42.46	9.8	26.29

The DALYs in both genders were found to be 50017.97 (26.29 per 1000). The maximum DALYs in both genders were reported for the age groups 30-44 (32.42 per 1000) and 15-29 (30.68 per 1000). In this study, 67.6% of DALYs were related to the age group 15-44 (Table 6). Moreover, over 93% of total DALYs were reported for YLL (24.5 per 1000), and YLD (1.79) was found to have a small share.

### Discussion

The deaths due to traffic accidents in Kermanshah province were found to be 51.3 per 100,000 population, which is higher than the average death rate in other areas (50 in Iran, 48 in Switzerland, 44.5 in Iraq, 40 in Thailand and 25 per 100,000 in Afghanistan) (18-20). Bhalla et al. reported the rate of death due to traffic accidents in Iran to be 44 per 100,000 population, which is lower than the death rate obtained in the present study (21). In a study conducted in Mazandaran, the death due to traffic accidents was found to be 13.2 per 100,000 population, and the study of Maraci showed the death rate of 21 per 100,000 in Isfahan (4, 11).

The incidence of traffic accidents in Kermanshah province was reported to be 283.6 per 100,000 population (2.836 per 1000), and maximum incidence rate of injury in both genders was related to the age group +80. This is not in agreement with the results of other studies, indicating a higher rate, as in Southern Khorasan the incidence rates of inpatient injuries in men and women were 3.46 and 0.7 per 1000 and in both genders 2.12 per 1000 population (10). Further, Maraci reported the incidence rate of injuries in both genders to be 3.28 in 1000 population and maximum incidence rate of injuries in men in the age group 20-44 and in women in the age group 60-64. However, the obtained value for the sum of both genders was higher than that of the current research (11). The higher death rate in this study can be due to the use of more than one source of data for more accurate calculation of death rate, difference in driving style and skill, road conditions, quality and quantity of cars, and difference in unpredicted behaviors of the pedestrians. The difference in the incidence rate of injuries can be due to the difference in the sources used for calculation of these rates and/or study populations, as in other studies, the source for calculation of the incidence of injuries was the hospital data of the severely injured patients not the people with small injuries and outpatients (to include all cases of injury, the hospital data were considered along with the data of emergency medicine). However, in this study the

data of forensics medicine, which included more cases of inpatient and outpatient injuries, were used.

It can be argued that the strengths of the current study were the use of ICD-10 classification to determine the causes of death and application of classification of various injuries in victims of traffic accidents based on GBD 2010 study, which has not been used in other similar studies so far. Another strength of the present study was using more than one source of data, i.e. Death Registration and Forensics Medicine, using the cases related to garbage code to more accurately estimate the death rate and YLL due to traffic accidents in Kermanshah province, and using the data of forensics medicine to calculate the injury rate and YLD due to injuries, which has been less attracted by the researchers and contains more accurate information. On the other hand, the limitations of this study were lack of access to or presence of the data of the people who did not refer to hospital or forensics medicine and used traditional treatment methods, annual calculation of DALY of accidents which cannot be indicative of the trend and changes of traffic accidents in Kermanshah province, and analysis of single-cause DALY which cannot represent the share of each cause in total DALY.

In the current study, the years lost due to premature death in both genders were 24.5 per 100,000 population and YLD rate was 1.79 per 1000 population. Also, DALY in both genders was found to be 50017.9 years (26.2 per 1000). According to the reports of GBD 2010 on IHME site, traffic accidents in Iran are the third leading cause of DALY after cardiovascular diseases and low back pain and second cause of YLL in 2010 (1236 per 1000), with 60% change compared with 1990 (811 per 1000). Based on the YLL reported in GBD 2010 for Iran (1236 per 1000), Kermanshah province (24.5 per 1000) was found to have a share of 2%, but owing to using different sources of data in these two studies and considering correction for low-number cases, this value should be taken into account cautiously. The highest number and rate of YLL based on cause in this study were reported for the automobiles, which is indicative of the severity of consequences in car accidents and drivers leading to death. Since most of the accidents and deaths due to traffic accidents occur in young ages due to emotional and risky behaviors, the DALY due to traffic accidents is higher than that of other age groups, and in most cases road traffic accidents have a high YLL. In a study carried out in Southern Khorasan, the YLL due to traffic accidents was 7456 and YLL due to premature death along with

DALY was found to be 13.28 per 1000 population. The maximum YLL due premature death and DALYs per 1000 population were reported for the age groups 30-44 (20.86 per 1000) and 15.29 (16.96 per 1000), respectively (10).

Furthermore, more than 93% of DALYs belonged to YLL, which is in line with the studies carried out in Thailand (88%), Australia and Southern Khorasan, Iran, indicating a higher YLL (10, 11, 18, 22). This difference can be due to the high mean age of the dead in Isfahan study, which caused a reduction in YLL and increase of YLD (11). Of course, the value obtained in this study is higher than those of other studies, which can be indicative of the fact that death has been the consequence of most cases of accidents in Kermanshah province. Also, this difference may be because of using more than two sources of data simultaneously for calculation of mortality.

In the study conducted by Bhalla et al, the maximum rate of DALY was reported for the age groups 15-24 and 25-34, and while the middle-aged and elderly people were more involved in higher death rate, the young age groups were found to have the highest rate of nonfatal injuries (21). Part of the higher burden of road traffic accidents (DALY) obtained in this study can be due to lack of using discount rate and age value, which were not used in the present study, or it can be due to using new life expectancy used in GBD 2010 studies, considering a higher and equal life expectancy for both males and females than before and what is presented on WHO site. In fact, the methodology used in this study was different than that of other studies. In addition, a

part of the difference may be because of different data sources and populations used for analysis.

### Conclusion

Given the DALY more than 50000 years due to traffic accidents, a share of >93% YLL in DALY rate and occurrence of traffic accidents mostly in men and age group 15-44, this issue should be considered a serious public health problem. Kermanshah province, because of having a common border with Iraq, is the path for millions of pilgrims and vehicles annually, making the possibility and rate of injuries due to road traffic accidents higher than most of other provinces. Therefore, it seems necessary to create a surveillance system for accidents and injuries at national and provincial levels, implement the program of safe society practically and accurately, take preventive measures and perform proper planning to reduce accidents, increase the safety of roads, monitor mandatory fastening of the seat belts and provide required trainings about traffic regulations, speed limit and pre-hospital care, and supply appropriate and adequate equipment for better healthcare.

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