Original Article

Years of Life Lost due to early death from road traffic injuries in Mazandaran province

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Abstract

Background and Purpose: Disasters and traffic accidents as the leading causes of disability and death throughout the world are the most significant health problems which have usually been predictable and, therefore, possible to prevent. The present study, as the first attempt, was conducted to calculate the burden of life years lost due to early death caused by traffic accidents in Mazandaran Province.

Materials and Methods: The current study was cross-sectional, and the data was collected from the center of Mazandaran Legal Medicine. The number of years of life lost due to premature death was calculated by using the instructions GBD2010 age and gender composition of the province was taken in the last census in 2012 from the Statistical Center. Then the SPSS Software was used to key in all the collected information in order to perform the analysis.

Results: Of the total population in 2015, 729 deaths were recorded due to car accidents with 77.9 percent of them being male. Mean age was 43.07±21.18 and 44.67±23.34 in women. The number of years of life lost due to premature death was 24972.7 years in men, 6965.3 years in women, and the total of two genders was 31938 years (10.6 years per thousand people) which were calculated, and it was the highest in the age group ranging from 20 to 24 years old.

Discussion: According to the high rate of deaths from traffic accidents and damages resulted from it, and in order to reduce these losses, it is necessary to take appropriate preventive measures.

Key words: YLL; Traffic accidents; mortality; Mazandaran

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1. *Introduction*

Disasters and traffic accidents, as the leading causes of disability and death throughout the world (1,2), are among the most important health problems which have been predictable and could be prevented. According to the fact that deaths from accidents occur in the early and middle age of an individual, the impact of such kind of mortality on life expectancy and economic burden caused by it is inevitable (3,4) . Annually, 1.2 million people lose their lives due to traffic accidents. This number includes 2.4 percent of all deaths in the world (5). The number of injuries, deaths and disabilities caused by traffic accidents in developing countries is also increasing (6). The prediction of deaths from traffic accidents is based on the Global Burden of Disease, which will increase to 66% in 2020, as compared to 1990 (7). In Iran, traffic accidents are the second leading cause of death and disability after cardiovascular diseases. Before the implementation of Fourth Iranian National Development Plan, 27 thousand people had annually forfeited their lives in traffic accidents, and despite a decrease of 15.5 percent in 2006, this number is still consisted a high rate of mortality (8,9). In the study of the national burden of accidents in Iran, which was conducted in 2002, it was found that 15 percent of traffic accidents lead to premature death. Also, many studies have already shown that traffic accidents among men is three to five times more than women, and since most hurt women are in the age range of 15 to 44 years, a huge economic burden is imposed on society (7,9,10). It should be noted that one of the including overall health indicators which was developed and introduced by the World Health Organization to study the burden of disease is DALY index (Disability Adjusted Life Years). DALY index consists of two years of life lost due to premature mortality (YLL) and years of life lost due to disability (YLD) (11). In the present study, only the first part of DALY was considered. YLL indicator is utilized to determine the social and economic burden of loss in a population due to premature death, which could lead to various other results (12,13). The main advantage of this indicator in relation to other indicators, such as crude and specific death rate, is that this index is not only considered in the number of deaths, but also in the age of death, so that the younger the death age of an individual, the more YLL will occur. The results also examined death from social and economic aspects and illustrated the loss burden of life lost due to illness and death (13,14). By using these indicators, the health status of different populations can be compared in all (different) years (15, 16). Therefore, the present study was conducted to calculate the burden of life years lost due to early death due to traffic accidents, broken down by demographic characteristics, for the first time in Mazandaran Province.

2. Materials and Methods

In order to carry out this study, the information was collected from the center of Mazandaran Legal Medicine census about the people who had been suffering from the hurts in accidents with animals, vehicles, fixed objects or motor vehicles since the beginning of April 2015 to the end of March 2015, and died after more than a month from the incidents. These data also included the information about age,

gender, city of residence, and type of vehicle. The information about age and gender of the cases was also collected from the Statistical Center of Iran based on the census in 2012 (17). To calculate the number of years of life lost, the GBD formula (Global Burden of Disease) was used as developed in 2010 by the World Health Organization (WHO), and revised in the following format:

$$YLL = N \times L$$

Where N is the number of a specific age and gender and L is Standard life expectancy of the same age and gender. According to this formula, weight, age, and discount rate for calculating the burden of life years lost are not considered.

Also in the current study, the standard life expectancy was considered, which was published in GBD 2010, based on the life expectancy of countries with a population of more than 5 million people, and the lowest death rates. This table is the same for men and women, and life expectancy at birth is 86.01 years (18). This indicator is expressed in both total years of life lost in the studied population or years lost per 1000 people. The collected data was keyed in SPSS Software, version 20, so as to calculate the descriptive parameters, such as age, sex, mean, and standard deviation, in addition to YLL rates, which were then calculated through the Software.

3. Results

Generally, 729 cases of death were reported due to accident, 568 (77.9) of which were male and 161 (22.1) were female. The mean ages for males and females were 43.07± 21.18 and 44.67±23.34, respectively. The mortality rate due to traffic accidents was also 37.24 percent for men, 10.40 percent for women, and 23.72 percent for the total in hundred of thousands. 54.7 percent of the cases inhibited in urban areas, while 44.9 percent lived in villages (0.4 percent of people were unknown location). The highest mortality rate was observed in the first half of the year, and specifically in May with a death rate of 13.6 percent, and the lowest death rate was documented in December with a death rate of 5.8 percent from traffic accidents.

Figure 1 shows the percentage of accidents by city, where the city of Savadkooh had the death rate of 73 people per hundred thousand, and AbbasAbad and Galoogah had the death rate of 40 and 39 people per hundred thousand, respectively, as the first to third places. In terms of the type of transport, 34.8 percent of the deceased in both genders were carried by vehicles, while 31.6 percent of them were carried on the shoulders of pedestrians.

In the category based on the deceased status at the time of the accident, from a total of 568 men, 222 people (39.1 percent) were drivers, 174 (30.6 percent) pedestrians, and 172 (30.6 percent) were getting off or the passengers of vehicle. Also, from a total of 161 woman, 56 people (34.8%) were drivers, and 59 (36.6%) of them were pedestrians, while 46 of the cases (28.6%) were passengers or getting off the vehicle. The mortality rate in men and women was 0.37 and 0.1 per thousand, respectively. In general, the number of years of life lost due to premature death was calculated to be 24972.7 years (16.4 year per thousand persons) in men and 6965.3 years (4.5 years per thousand person) in women. Regarding the total of two

genders, the number of years of life lost due to premature death was 31,938 years (10.6 years per thousand people). It should be noted that the most years of life lost due to premature death were calculated in gender segregation in men in the age groups of 20-24 years (29.1 years per thousand), 25-29 years (21.1 per thousand), and 15-19 years (21.1 years per thousand), respectively. In women, it was also calculated in the age groups of 0-4 years (12.1 years per thousand), 60-64 years (6.7 per thousand), and 30-34 years (5.9 years per thousand), and the highest number of the years lost in total of both genders were calculated in the age groups of 20-24 years (16.1 years per thousand), 25-29 years (13.3 years per thousand), and 75-79 years (12.5 years each thousand), respectively (table 2). In a survey of lost years of season segregation, the influence of the seasons on Yll showed Spring has the highest number of years of life lost due to early death (105452) and Winter has the lowest number(173618) respectively. In terms of age group, the highest rate belonged to the number of years lost in the spring and fall in the age group of 20 to 24 years, in summer and winter to the age group of 15 to 19 years and group of 75 to 79 years, respectively (table 3). Table 4 shows the number of Years of Life Lost (YLL) due to traffic accidents in Mazandaran Province in segregation of suburban and interurban.

Table 1. Distribution of vehicle type of dead person in kind of gender and YLL

Type of vehicle	Male		female		total		
	Number	percent	number	percent	number	percent	YLL
Passenger	169	29.8	61	37.9	230	31.6	10264
Bicycle	9	1.6	0	0	9	1.2	340
Motorcycle	154	27.1	6	3.7	160	22	2036
Cars	175	30.8	78	48.4	253	34.8	10747
Minibus and bus	4	0.7	4	2.5	8	1	476
Truck	8	1.4	2	1.2	10	1.4	515
Pick ups	39	6.9	10	6.2	49	6.7	7233
Others	10	1.8	0	0	10	1.4	327
Total	568	100	161	100	729	100	31938

Table 2. Numbers of Years of Life Lost (YLL) per thousand persons due to traffic accidents in Mazandaran Province based on age and gender

Age group	Male				Female				total			
	Population	Number of death	YLL	YLL per thousand	Population	Number of death	YLL	YLL per thousand	Population	Number of death	YLL	YLL per thousand
0-4	101516	10	851.1	8.4	98360	14	1191.5	12.1	199876	24	2042.6	10.2
5-9	100298	6	472.6	4.7	95955	7	551.3	5.7	196253	13	1023.9	5.2
10-14	105658	6	442.7	4.2	1022.8	1	73.8	0.7	207866	7	516.5	2.5
15-19	120676	37	2546.7	21.1	117759	1	68.8	0.6	238435	38	2615.5	11
20-24	166702	76	4854.9	29.1	163252	7	447.2	2.7	329954	83	5302	16.1
25-29	178840	64	3772.2	21.1	174404	16	943	5.4	353244	80	4715.2	13.3
30-34	138975	44	2376	17.1	137604	15	810	5.9	276579	59	3186	11.5
35-39	120873	35	1718.2	14.2	119181	5	245.5	2.1	240054	40	1963.6	8.2
40-44	114178	48	2123	18.6	114005	11	486.5	3.4	228183	59	2609.6	11.4
45-49	99641	31	1222.3	12.3	100485	14	552	5.5	200126	45	1774.4	8.9
50-54	66927	40	1388.8	20.8	104954	15	520.8	5	171881	55	1909.6	11.1
55-59	62139	31	933.1	15	66927	9	270.9	4	129066	40	1204	9.3
60-64	46173	19	458.6	10.5	49795	13	332.2	6.7	95968	32	817.6	8.5
65-69	31598	30	633.6	20.1	33414	7	147.8	4.4	65012	37	781.4	12
70-74	26273	30	503.4	19.2	56780	8	134.2	5	53053	38	637.6	12
75-79	23385	35	449.6	19.3	22873	10	128.5	5.6	46231	45	578.3	12.5
+80	21269	26	198.9	9.4	20155	8	61.2	3	41424	34	260.1	6.3
Total	1525094	568	24972.7	16.4	1548111	161	6965.3	4.5	3073205	729	31938	10.4

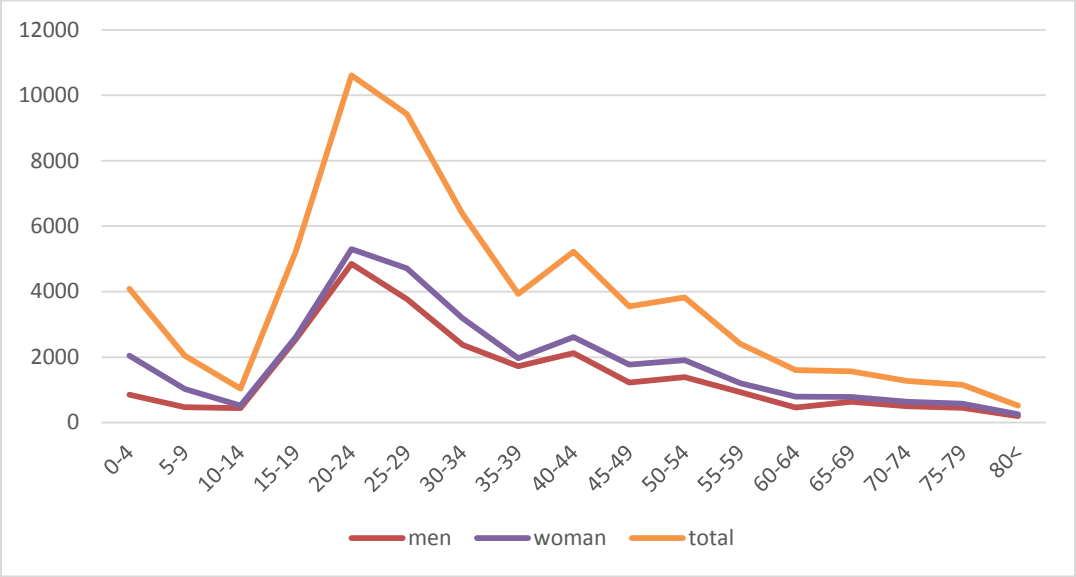

Figure 1. Trend of YLL value in different age groups

Table 3. Numbers of Years of Life Lost (YLL) and YLL per thousand persons due to traffic accidents in Mazandaran Province in segregation of seasons

	Spring			Summer			autumn			winter		
Age group	Numbers of death	YLL	YLL per thousand	Numbers of death	YLL	YLL per thousand	Numbers of death	YLL	YLL Per thousand	Numbers of death	YLL	YLL per thousand
0-4	10	851.1	4.3	4	340.4	1/7	3	255/3	1/3	7	595/8	3
5-9	3	236.3	1.2	4	315	1/6	3	236/3	1/2	3	236/3	1.2
10-14	2	147.6	0.7	3	221.4	1/1	1	73/8	0/4	1	73/8	0.4
15-19	11	757.1	3.2	17	1170.1	4/9	9	619/5	2/6	1	68/8	0.3
20-24	36	2299.7	7	13	830.4	2/5	23	1469/2	4/5	11	702/7	2.1
25-29	26	1532.4	4.3	17	1002	2/8	25	1473/5	4/2	12	707/3	2
30-34	17	918	3.3	16	864	3/1	12	648/0	2/3	14	756/0	2.7
35-39	9	441.8	1.8	15	736.4	3/1	8	392/7	1/6	8	392/7	1.6
40-44	12	530.8	2.3	23	1017.3	4/5	13	575/0	2/5	11	486/5	2.1
45-49	16	630.9	3.2	16	630.9	3/2	10	394/3	2/0	3	118/3	0.6
50-54	22	763.8	4.4	11	381.9	2/2	10	347/2	2/0	12	416/6	2.4
55-59	15	451.5	3.5	9	270.9	2/1	10	301/0	2/3	6	180/6	1.4
60-64	14	357.7	3.7	6	153.3	1/6	4	102/2	1/1	8	204/4	2.1
65-69	10	211.2	3.2	11	232.3	3/6	9	190/1	2/9	7	147/8	2.3
70-74	11	184.6	3.5	12	201.4	3/8	8	134/2	2/5	7	117/5	2.2
75-79	12	154.2	3.3	7	90	1/9	12	154/2	3/3	14	179/9	3.9
+80	10	76.5	1.8	10	76.5	1/8	4	30/6	0/7	10	76/5	1.8
Total	236	10545.2	3.4	194	8534.2	2/8	164	7397/1	2/4	135	5461/5	1.8

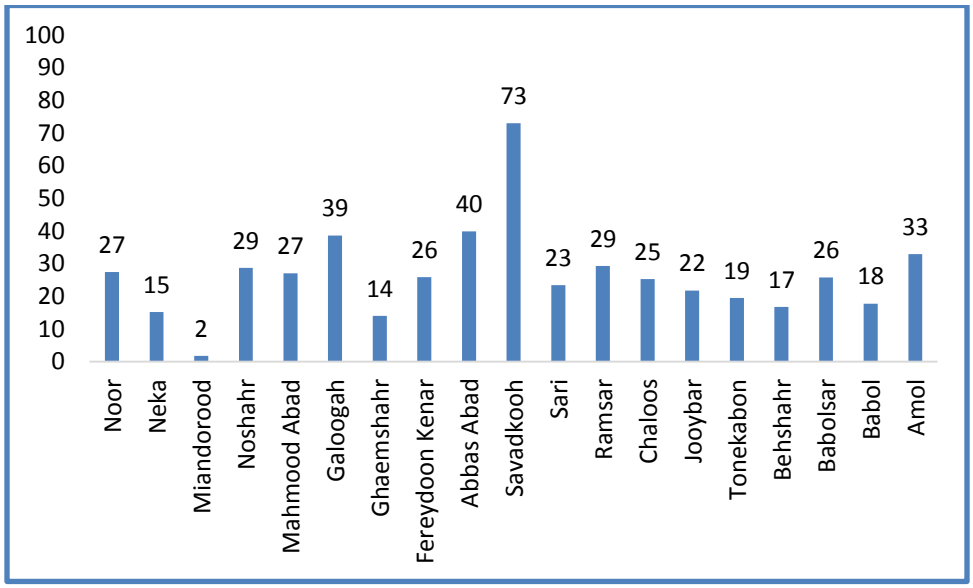

Figure 2. The value of fatalities due to traffic accidents per hundred thousand persons in segregation of the cities of Mazandaran Province

Table 4. Numbers of Years of Life Lost (YLL) due to traffic accidents in Mazandaran Province in segregation of suburban and interurban

Age group	Interurban		suburban		All	
	Number of death	YLL	Number of death	YLL	Number of death	YLL
0	2	170/2	22	1872/4	24	2042/6
5	2	157/5	11	866/4	13	1023/9
10	1	73/8	6	442/7	7	516/5
15	10	688/3	28	1927/2	38	2615/5
20	25	1597/0	58	3705/0	83	5302/0
25	18	1060/9	62	3654/3	80	4715/2
30	11	594/0	48	2592/0	59	3186/0
35	5	245/5	35	1718/2	40	1963/6
40	10	442/3	49	2167/3	59	2609/6
45	12	473/2	33	1301/2	45	1774/4
50	12	416/6	43	1493/0	55	1909/6
55	10	301/0	30	903/0	40	1204/0
60	7	178/9	25	638/8	32	817/6
65	15	316/8	2	464/6	37	781/4
70	12	201/4	26	436/3	38	637/6
75	20	257/0	25	321/3	45	578/3
80	17	130/1	17	130/1	34	260/1
680	189	7304/4	520	24633/6	729	31938/0

4. Discussion

Based on the results, the rate of deaths from traffic accidents in Mazandaran Province was 23.72 per hundred thousand people that is almost consistent with the result of the study conducted during the years 2006 to 2010 in Mazandaran Province (23.18 per hundred thousand people) (19). Although this value is much less than the losses from accidents in Iran (48 per hundred thousand of people) (7), compared with other countries, such as Australia (7.5 per thousand), the United States of America (10.7 in per hundred thousand of people), and France (8.5 per hundred thousand of people), it has a much higher rate (20). At the same time, in a study conducted in 2010 in Khuzestan Province, the incidence of fatalities caused by road traffic accidents was reported to be 28.3 per hundred thousand people (21).

Meracy and Tabar Isfahani reported that the death rate in Isfahan Province caused by accidents was about 21 per hundreds of thousands (22). In another study, the mortality rate of road accidents in Kermanshah Province was 51.3 per hundreds of thousands of people (23). The difference in the rate of deaths from accidents in different provinces could be due to the differences in road, the number of vehicles in each province, monitoring the traffic police, and the differences in risky behaviors of drivers or pedestrians. The results of the present study revealed that the death rate from traffic accidents in men is about 3.5 times higher than women. The average age has also increased exponentially, and the highest value for both genders was observed to be older than 75 years. Furthermore, the results of the current study were found to be consistent with the results of a research conducted by Izadi and colleagues in Kermanshah (2015) and Hashemi Nazari et al. (2012) (21,23). Yazdani Charati and colleagues reported the highest mortality rate in the age group over 65 years in Mazandaran Province (19). The findings of the present study were also found to be in agreement with the results of another study conducted in Australia and Argentina in terms of the death age groups, as it was revealed that the mortality rate increased with the age groups in Mazandaran Province (24). In an epidemiologic study of traffic accidents in 2014, the rate of injured men in comparison with injured women was more than 1.6%, and this rate was the highest at ages 20 to 24 years (25).

Other studies in many other countries also showed that the damage caused by traffic accidents was higher in men than in women (24,26,27), and the higher mortality rate in men can have several different causes. Outdoor activities among men are much more than women because of their job duties. There are also many men to earn money as their main or second jobs to drive on their own, so men are greatly exposed to traffic accidents which can lead to an increased mortality rate in men than in women. In addition, high-risk behaviors among men increases the mortality rate in men which can also have a significant effect on the high probability of accidents (28). The total years lost due to early death from road traffic injuries was equal to 31938 years (10.4 per thousand people), and the rate in men was almost 3.6 times more than in women (16.4 per thousand to 4.5 per thousand for men and women). The highest YLL for men were observed in younger ages than in women. The

men ranging from 15 to 29 years old had the highest number of years of life lost, while most of the years for the women were in the age group ranging from 0 to 4 years and 60 to 64 years. Most YLL per thousand for both genders was also calculated to be in the age range of 20 to 29 years old.

Izadi and colleagues reported that in Kermanshah, the value of YLL among both genders in total was 24.5 per thousand, and the values were 40 and 8.7 per thousand in men and women, respectively. They found that the largest numbers of men were in the age group of 30 to 34 years, while the largest numbers of women were in the older age group more than 80 years (23). Meracy and Tabar Isfahani have calculated the rate of years lost due to premature death in Isfahan. This value was 4 per thousand totally, and 5.7 and 2.2 in men and women, respectively (20). As shown in another study in South Khorasan, the rate of YLL was found to be 19.2 per thousand in men, and 6 per thousand in women, while this rate was 12.74 per thousand in both genders. The value was the highest for males in the age range of 20-24 years, but the same value was the highest for females in the age range of 35-39 years (10). In another study in Thailand, the rate of YLL was found to be 15.9 per thousand for men (490 185 year) and 3.4 per thousand for women (106 529 years), and in both genders, the highest rate belonged to the age group of 15-29 years (9).

In the calculation of the YLL in segregation of seasons, the highest number of years lost occurred in the spring of 10545.2 years (3.4 years in thousands people), and then in the summer of 8534 years (2.8 years per thousand person), respectively. The results of a study carried out in Isfahan and Kermanshah revealed that the highest death rate was in summer (22,23), which was obviously different from the result of the current study, and this difference was not unexpected and due to that fact that so many people of Mazandaran Province are engaged in agricultural jobs, and spring is the deadline of planting rice and the beginning of farming, which could increase the traffic of vehicles and could consequently be effective in increasing the possibility of traffic accidents. In addition, the large amounts of spring travels to Mazandaran Province in this season can also be a good reason for the increase in the accidents in the spring. In the present study, the lowest mortality rate was also observed in winter, and this result was in agreement with the findings of certain other studies (22,23). The mortality rate had several distribution types in different cities, the highest of which belonged to the Savadkooh city, and then by a wide discrepancy occurred in Abbas Abad and Galoogah.

In a study conducted by Yazdani Charati and colleagues, over the years 2004 to 2007, the city of Savadkooh was found to have the highest mortality rate due to road accidents (19), which could be as a result of the location of Savadkooh on the main route crossing the province named Firouzkoh. This problem can absolutely increase the number of passengers in the city, which could then lead to a high probability of accidents in the city.

In comparing the mortality rates based on the type of transportation means, the highest rate of casualties (253 deaths) belonged to cars and motorcycle, which was 1.6 times higher than the number of 160 persons, 36 times higher than the casualties caused by buses and mini-

buses (7 deaths), and equal to the cases of pedestrian deaths in traffic accidents. In many studies in Iran, such as the study of Izadi and colleagues (23) in Kermanshah, Yazdani Charati and colleagues (19) in Mazandaran, and Ghorbani and colleagues (29), passenger cars have had the highest rate of traffic fatalities (injuries). In their study, Yazdani Charati and colleagues (19) as well as Izadi and colleagues (23) found that pedestrians have had the second high rate and motorcycles had the third death scores. In a study conducted by Ghorbani and colleagues (29), after car occupants' injuries, most deaths were related to motorcycles. On the other hand, the research conducted in foreign countries, such as the study carried out by Bouaount and colleagues (27) in France, or Beck and colleagues (30) in the United States of America, it was reported that the death rate from traffic accidents among motorcycle riders was much more than other vehicles. Lin and colleagues, similarly, in a systematic review research have reported that motorcycles were most vulnerable road transportation means with the risk at about 34 times higher than other means of transportation (31). More astringency in the consideration of traffic regulations, differences in risk behaviors and differences in quality of vehicles, safety measures such as air bag, the strength of vehicle body, performing simulations to reduce the burden of accidents to passenger transporting are all included among the cases which can be outlined as reasons for these differences. Based on the current study, public transportation had the lowest mortality. Therefore, encouraging people to use public transportation through media, and establishing the culture, as well as enhancing the quality of the equipment and increasing their numbers could both provide greater security for people and reduce the movement of cars on the road, which could then result in the less probability of accidents. On the other hand, as the current study along with other previous studies showed, a large number of casualties are pedestrians, hence it is recommended that people, and especially students, to be justified to use public transportation means. It is also significant to install pedestrian bridges in hotspots, and encourage people to use them as a much safer route for pedestrians. As mentioned earlier, in the present study based on the guidelines of 2010GBD, the age value and the discount rate was not used, so YLL value in comparison with other studies was calculated to be in a bit higher level. Using the new life expectancy is also effective in the increasing rate of death in comparison to other studies. As indicated in the current research, traffic accidents and high rates of mortality, especially among young people, are the events of great human and financial losses which are imposed on society. Therefore, this issue should be considered as one of the most important public health problems, and necessary measures should be taken in order to prevent and control it. Improving the quality and safety of vehicles, greater oversight of safety issues, such as safety belts, observing speed limits, utilizing helmet in motorcycle users and improving the quality of relief roads, can all be effective in reducing these losses.

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Conflict of interest:

The Author has no conflict of interest

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