Trend of Mortality Rate Due To Traffic Accidents In Iran From 2006 to 2018

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Abstract

Background: Traffic accidents are one of the most common causes of mortality and physical disabilities, endangering the lives of many people all over the world annually and are among the top public health problems worldwide. In the present study, we aimed to investigate the trend of mortality rate due to traffic accidents in the provinces of Iran.

Methods: In this cross-sectional study, all the deaths caused by traffic accidents in Iran during 2006-2018 were investigated. Using the population of the country by age, sex, and provinces of the country, the mortality rate was calculated and the trend of 13-year changes was studied. The negative binomial regression was used to analyze the linear or nonlinear trend of reduction in mortality rate during the study years. Microsoft Excel 2016 and Stata version 14 software were used to analyze the data.

Results: During the study period, 259995 traffic accidents deaths occurred in Iran, of which 78.6% were men and 21.4% were women. The mean age of the deceased was 37.6 ± 20.7 years (37.4 ± 20 years in men and 38.6 ± 23 years in women). The number of the deaths in these years has decreased from 27,567 in 2006 to 17,183 in 2018 and the mortality rate has dropped from 39 per 100,000 in 2006 to 21 per 100,000 in 2018.

Conclusion: Despite the decreasing trend in the mortality rate of traffic accidents in Iran during the study years, this trend was different across the provinces. Therefore, it seems necessary to design epidemiological studies to be conducted in different area and provinces of a country, to better and more accurately determine the factors affecting the occurrence of these deaths.

Background

According to the definition of the World Health Organization, a traffic accident is any type of fatal or non-fatal accident in which there is at least one moving vehicle (1). Deaths due to traffic accidents are those that occur during a traffic accident or up to 30 days after due to injury caused by the accident (2). Traffic accidents are complex consequences which result from human, and technical and environmental risk factors. Road design, warning signs and regulations, as well as legislation on the structure of traffic transport, are all factors affecting the number and severity of accidents that occur in the suburbs and within cities (3). Traffic accidents are one of the most common causes of mortality and all kinds of physical disabilities that endanger the lives of many people in the world each year (4). Traffic accidents are the eighth leading cause of mortality, the first leading cause of death in the age group of 15–29 years, and also a major public health problem in the world (5). Annually, more than 1.35 million people are killed due to traffic accidents, more than 10 million people are permanently disabled, and 20–50 million are injured (6–8). Traffic accidents, in addition to high rates of death and disability, impose a heavy economic burden on the health system, so the World Health Organization (WHO) estimates the economic costs of traffic accidents worldwide more than US\$500 billion annually (9). More than 90 percent of deaths from traffic accidents occur in low- and middle-income countries, which account for about 60

percent of the world's vehicles. Moreover, in high-income countries, people with low economic status are more likely to be involved in road accidents (8). In Iran Traffic accidents and the death and disability rates caused by traffic accidents are higher than the global average (10). Therefore, Iran has been introduced as one of the countries with the highest number of accidents and road accidents death (4). Traffic accidents in Iran are the second leading cause of death and the first leading cause of lost life after cardiovascular disease. Accidental deaths in Iran are increasing in line with the industrialization of society and in various studies are considered high (30 to 39 cases per 100,000 population) (11). In recent years, measures such as establishing trauma emergencies centers in hospitals, road emergencies for first aid and rapid transfer of injured, more traffic police surveillance and other measures have been taken to reduce traffic accidents death. On the other hand, increasing population and the number of vehicles are among the factors which can be associated with an increase in traffic accidents. According to the mentioned reasons, the present study was conducted to determine the trend of the mortality rate of traffic accidents in Iran during the years 2006 to 2018.

Methods

This cross-sectional study was performed on all deaths caused by traffic accidents during 2006–2018. To collect the information, the most complete data source dealing with traffic accidents deaths in the country, namely the Iranian Legal Medicine Organization, was used. Moreover, to collect data meeting the objectives of the study, a pre-designed checklist containing variables such as age, gender and location of death was used. After collecting and confirming the accuracy of the data by statistical and epidemiological experts, all traffic accidents deaths occurred all over the country from 2006 to 2018 were included in the study. Prior to analysis, the data were checked and duplicates were removed.

In calculating the mortality rate – since the population of some years was not available – so existing data we used as follow: the results of the 2006 census to estimate the population of 2007 to 2010; the results of the 2011 census to estimate the population of 2012 to 2015; the census results from 2016 census to estimate the population of 2017 and 2018; and also the average annual growth rate of the country and the provinces were used.

Microsoft Excel version 2018 and Stata version 14 software were used to analyze the data. Mean and standard deviation were used to describe quantitative variables and frequency, frequency ratio, tables and graphs were used to describe qualitative variables. Then, using the population of the country and age, the mortality rate was calculated and the trend of 13-year changes was examined. The negative binomial regression was used to analyze the linear or nonlinear trend of reduction in mortality rate during the studied years. The level of statistical significance in this study was considered 0.05.

Results

In total, during the 13-year study period, 259995 traffic accidents deaths occurred in Iran, of which 78.6% were men and 21.4% were women. The mean age of the deceased was 37.6 ± 20.7 years (37.4 ± 20 years

in men and 38.6 ± 23 years in women). The mean age of the deceased increased from 36.1 ± 20.2 in 2006 to 38.9 ± 20.8 in 2018 (Table 1).

Table 1. The age trend of traffic accidents deaths in Iran from 2006 to 2018

Year	Mean $\pm$ SD*	Year	Mean $\pm$ SD*
2006	36.1 $\pm$ 20.2	2013	38.3 $\pm$ 20.9
2007	36.5 $\pm$ 20.3	2014	38.7 $\pm$ 21.1
2008	36.9 $\pm$ 20.6	2015	38.7 $\pm$ 21.1
2009	37.5 $\pm$ 20.7	2016	38.7 $\pm$ 20.9
2010	37.6 $\pm$ 20.6	2017	38.5 $\pm$ 20.9
2011	37.3 $\pm$ 20.7	2018	38.9 $\pm$ 20.8
2012	37.5 $\pm$ 20.8	Total	37.6 $\pm$ 20.7
*Standard Deviation			

The number of deaths from 2006 to 2018 has decreased from 27,567 to 17,183 and the mortality rate has decreased from 39 per 100,000 to 21 per 100,000. The highest mortality rate was related to Semnan province, however, a decreasing trend in mortality rate was also observed in this province, and the mortality rate has decreased from 79 per 100,000 in 2006 to 42 per 100,000 in 2018 (Fig. 1).

The highest mortality rate was observed in the age group over 65 years. The mortality rate in this age group decreased from 85 per 100,000 in 2006 to 40.5 per 100,000 in 2018 (Fig. 2).

The share of traffic accidents deaths in urban areas has decreased from 28.6% in 2006 to 25.3% in 2018 and the share in Suburban areas has increased from 64.2–67% (Table 2).

Table 2. Frequency distribution of traffic accidents deaths by accident site in Iran from 2006 to 2018

Year	Urban		Suburban		Rural and dirt roads		Total
	N	%	N	%	N	%	
2006	7794	28.6	17470	64.2	1967	7.2	27231
2007	7018	30.8	13763	60.5	1976	8.7	22757
2008	7213	31.1	13984	60.3	2002	8.6	23199
2009	7058	31	13556	59.5	2179	9.6	22793
2010	6666	28.9	14176	61.5	2206	9.6	23048
2011	5888	29.6	12232	61.4	1803	9	19923
2012	5404	28.5	11811	62.2	1764	9.3	18979
2013	5063	28.3	11568	64.5	1296	7.2	17927
2014	4595	27.3	10962	65.3	1241	7.4	16798
2015	4464	27.1	10880	65.8	1180	7.1	16524
2016	4356	27.4	10428	65.7	1101	6.9	15882
2017	4380	27.1	10751	66.5	1042	6.4	16173
2018	4353	25.3	11496	67	1319	7.7	17168

According to the negative binomial regression, the 13year trend of mortality rate dealing traffic accidents was decreasing. The incidence rate ratio in 2018 compared to 2006 was 0.508 with a 95% confidence interval of 0.48–0.54 ($p < 0.001$) (Table 3).

Table 3
The 13-year trend of mortality rate dealing traffic accidents (2006–2018)

Variables	Incidence Rate Ratio	P-Value	95% confidence interval
Year			
2006	1	Reference	
2007	0.819	< 0.001	0.77–0.87
2008	0.82	< 0.001	0.77–0.87
2009	0.798	< 0.001	0.75–0.85
2010	0.79	< 0.001	0.74–0.84
2011	0.665	< 0.001	0.62–0.71
2012	0.628	< 0.001	0.59–0.67
2013	0.579	< 0.001	0.54–0.62
2014	0.538	< 0.001	0.50–0.57
2015	0.522	< 0.001	0.49–0.56
2016	0.49	< 0.001	0.46–0.52
2017	0.49	< 0.001	0.46–0.52
2018	0.508	< 0.001	0.48–0.54

Discussion

According to the Global status report on road safety 2018, 1.35 million people worldwide die each year due to traffic accidents, and traffic accidents are the eighth leading cause of death for all ages. Also, the mortality rate dealing with traffic accidents in low-income countries (27.5 percent of people) is 3 times higher than in high-income countries (8.3 percent of people), which shows the high importance of traffic accidents, especially in low-income countries (12). The results of the present study showed that the mortality rate dealing with traffic accidents in Iran during the years 2006 to 2018 had a decreasing trend. However, based on these results, the average age of the deceased has increased during the study years. According to the WHO, the number of traffic accidents deaths decreased slightly from 18.8 percent to 18.2 percent, from 2000 to 2016 (12). In this regard, the results of the study by Sadeghi-Bazargani et al., conducted in East Azerbaijan province among bus and minibus users during 12 years (13), and Mahdian's study conducted in Kashan (14), showed the decreasing trend of fatal accidents in Iran. Also, the results of a study performed in Colombia showed that the incidence of traffic accidents deaths from 1998 to 2012, in people under 60 and over 60, has a decreasing trend (15). The results of a study by Fernandes et al showed that the incidence of traffic accidents across pedestrian in Brazil decreased from 1996 to 2015 (16). In our study, the results for vulnerable road users (pedestrians, cyclists and

motorcyclists) were not available for further investigation, however, the study of Hamzeh et al., conducted in Kermanshah showed that there was a declining trend in the number of traffic accidents deaths in pedestrians from 2004 to 2013, while the number of the deaths among other vulnerable road users fluctuated during these years (17). In general, the declining trend can be partly due to the separation of type 2 traffic accidents and non-traffic accidents (since 2013) from traffic accidents which can have a significant impact on reducing the trend of the mortality, and likely more to some reasons such as reforming traffic laws and imposing heavy fines on offending drivers, especially in cities, installing more surveillance cameras on roads and in cities, and emphasizing the use of helmets (15, 17). It seems that the existing differences between the provinces of the country in terms of traffic accidents deaths and its trend over the years are affected by the economic situation of the provinces, although this issue needs further investigation. However, in this regard, studies have shown that the amount and trend of the reduction in traffic accidents deaths in different countries are different and has a strong relationship with the economic level of the countries so that the risk of traffic accidents death in low-income countries is 3 times higher than high-income countries (12). The results of a study conducted in Brazil showed that the reduction in the incidence of pedestrian deaths in the northern regions of Brazil has been slower than in other regions. Results of the study showed that one of the reasons for this difference is the worse economic situation in the northern regions of Brazil than in other areas (16). This difference can be due to having more facilities and financial support for designing safe and preventive interventions at different levels and different tools in areas with better economic status. According to the results of this study, the highest mortality rate was observed in the age group of 65 years and above, although this rate has been decreasing during the study years. These results are similar to the results of studies reported in Iran (14, 18, 19) and Colombia (15). A significant proportion of older people suffer from hearing loss, visual impairment, cognitive decline, musculoskeletal problems, imbalance and gait, and a variety of chronic diseases, which puts them at greater risk for road accidents, injuries and subsequent deaths (15, 19). Since a significant proportion of traffic accidents deaths are likely to occur in people over 60 years of age due to urban accidents and pedestrians, street crossings should be installed or adapted for this age group. Installing escalators or elevators in the area of pedestrian bridges can be such measures.

Conclusions

The results of the present study showed that, the mortality rate dealing with traffic accidents in Iran from 2006 to 2018 has a decreasing trend, although the difference in this trend in different provinces of the country can be due to reasons such as socioeconomic status and age pyramid of their population. Therefore, it seems necessary to design epidemiological studies to be conducted in different area and provinces of a country, to better and more accurately determine the factors affecting the occurrence of traffic accident deaths.

Declarations

Ethics approval and consent to participate

Ethical approval was received for this study from the Ethics Committee of The Shahid Beheshti University of Medical Sciences.

Consent for publication

Not applicable

Availability of data and materials

Data is available by the corresponding author on reasonable request.

Competing Interests

The authors declare no conflict of interest

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Authors' contributions

research idea and study design: S.H., S.E, J.H, R.HM, D.M, statistical analysis and write the first draft of the manuscript: S.H., S.E, J.H, R.HM, D.M, helped as a consultant on the study design: S.H., S.E, J.H,, critically and substantially revised the final article: S.H., S.E, J.H, R.HM, D.M. All authors read and approved the final manuscript

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Figures

Figure 1

Comparison of 13-year mortality rate dealing with traffic accidents (per 100,000 populations) in provinces of Iran (2006-2018)

Figure 2

Comparison of 13-year mortality rate dealing with traffic accidents (per 100,000 populations) by age groups in Iran (2006-2018)