



# Fatality Rate of Trauma Victims in Southern Iran: A Five-Year Survey

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## Abstract

**Background:** In recent years traumatic injuries and their related mortality have become a major public health issue in Iran. This study aimed to assess injuries and mortality rate in southern Iran.

**Methods:** In this cross-sectional study, all trauma cases aged above 14 years, who were referred to Rajaei hospital, Shiraz, Iran from January 2010 to December 2014, were enrolled. Age, gender, cause of injury, and in-patient hospital mortality were extracted from the hospital information system and analyzed.

**Results:** The study participants included 41,182 patients, among whom 32,219 (78.2%) were male and 8,963 (21.8%) were female. The frequency of all injuries was higher in males. In the current study, fatality rate was 2.65%, male and female fatality rates were 2.70% and 2.45%, respectively. Even though admission had an ascending trend from 2010 to 2014, a noticeable reduction in the trend of fatality rate was seen 4.5% and 3% in pedestrian-related injuries and gunshot-related injuries.

**Conclusions:** In the light of medical advances in trauma management, allocating budget is necessary for prevention and implementation of vehicles' safety protocols and developing educational programs to reduce mortality.

**Keywords:** Injury, Trauma, Fatality, South of Iran

## 1. Background

Trauma is one of the major leading causes of death and disability in Iran and worldwide (1). One out of 10 deaths around the world is trauma-related. It accounts for 11% of disability adjusted life years (DALY) (2). Among mechanisms of injury, road traffic injuries (RTIs) were reported to involve the highest number of cases (3-5). This public health subject is anticipated to grow significantly, as the global death ranking of RTIs has surged from 10 in 1990 to 8 in 2010 (6). Although RTIs affect all regions of the world, yet, their worldwide distribution is alarming, which mostly comprises low to middle-income countries. It is the fourth leading cause of years of life lost in the Middle Eastern countries (6).

Due to rapid growth in the number of vehicles in Iran, RTIs are becoming a serious public health problem (7). Disease and health characteristics show a transition from communicable diseases to non-communicable diseases and RTIs (8). Like other developing countries, RTIs in Iran were high (39 per 100,000 population) and male to female ratio of these fatalities was 4.2:1 (9). In comparison with European countries, RTIs fatality in Iran has doubled in the recent years (9). In addition, RTIs are argued to be the first cause of DALY in Iranian males (8). Although there are

differences in patterns of injuries in different categories of RTIs in each country (10), motor vehicle accidents have been reported as the major cause (11).

In addition, many developing countries, such as Iran, do not have a supportive health statistics system, hence the effects of trauma on the population are not exact (12). Therefore, an accurate calculation of fatality rate as well as learning about the characteristics of traumatic injuries can be useful to evaluate the quality of care in severe traumatic injuries compared with other countries.

This study was conducted to find, in-hospital fatality trend and causes of injuries among various gender and age groups at Shahid Rajaiee hospital, which is the largest level I referral trauma center in the south of Iran. Therefore, the results of this study can be used in short- and long-term planning to promote medical management and prevention programs.

## 2. Methods

The present study had a cross-sectional design, and was conducted in Shiraz, capital of Fars province, located in the south of Iran with a population of 1.4 million, according to the latest census. The protocol was approved by

the ethics committee of Shiraz University of Medical Sciences. The study included all trauma patients aged more than 14 years, who were admitted to the emergency and other wards of this hospital, over a 5-year period from January 2010 to December 2014. All Patients, who were admitted for other surgical procedures, such as emergency intervention, complications of previous trauma, and injury through burns, were excluded. The study was conducted at a 200-bed governmental hospital, which is an adult trauma center in Shiraz and is fully equipped to deal with any type of injury and has sufficient government funding to sustain a high level of care for intensive and none intensive trauma patients. After a patient was screened and admitted to the hospital, demographics information, including age, gender, admission date and time, as well as the cause of injury were automatically recorded by the admission team 24/7. Finally, after the patient was discharged, computerized records were transferred to hospital medical archives, where trained staff retrieved information regarding the cause of injury and the hospitalization outcome. These data were coded with ICD-10 injury diagnostic code system and entered to the hospital information system. All data were collected by merging these 2 hospital information systems together.

Cause of injury was classified to 9 predetermined groups, including car, motorbike, and pedestrian accident, assault trauma, falling down, being struck by objects, gunshot, suicide, and other types of injuries.

Investigative analysis was carried out to determine the distribution variables. Continuous variables are presented as mean  $\pm$  standard deviation (SD) and categorical variables as frequencies and percentages. The association between each continuous variable and fatality rate was evaluated using independent sample t test. Additionally, the relationship between each categorical variable and fatality rate was also evaluated using the chi-square test. P values of  $< 0.05$  were considered statistically significant. All the statistical analyses were performed using IBM-SPSS (version 19) and the figures were drawn by the Sigma plot software (version 11).

### 3. Results

#### 3.1. Descriptive Findings

A total of 41 182 trauma patients were included during the study period, among whom 32,219 (78.2%) were male and 8,963 (21.8%) were female. The male/female ratio was 4 to 1. Moreover, the mean age of the total population was  $35.83 \pm 17.30$  and that of males and females was  $33.77 \pm 16.14$  SD and  $43.24 \pm 19.18$  SD years, respectively. There was a significant difference between male and female patients, regarding their mean age ( $P < 0.001$ ). The main

cause of referral to Shahid Rajaei hospital was car accidents (38.1%). Cause of injury based on gender and age group is presented in [Table 1](#). Accordingly, causes of injuries were higher in males than females. Additionally, the 15- to 30-year-old age group had the highest admission rate for all the injury mechanisms, except for falling down and pedestrian injuries, for which the over 45-year-old age group was dominant.

#### 3.2. Fatality Rate

The total, male and female fatality rates were 2.65%, 2.70%, and 2.48%, respectively. The fatality rate of injury causes based on gender and age groups is presented in [Table 2](#). Based on the findings, 79.6% of the victims were male and 20.4% were female. Additionally, the fatality rate was higher among males than females. Fatality rate due to car accident was also higher in males than females ( $P = 0.005$ ). Considering age group, the highest fatality rate was related to  $> 45$ -year-old age group for all injury causes, except for suicide and other injuries. The fatality rate of pedestrian injury was also high, yet, most of the pedestrian fatalities were related to older age groups.

#### 3.3. The Trend of Admission and Fatality Rate

Patients' admission had an ascending trend from 2010 to 2014 ([Figure 1](#)). However, fatality rate had a descending trend from 2011 to 2014 ([Figure 2](#)). Fatality rate from January 2010 to December 2014, based on age and gender, are shown in [Figures 3](#) and [4](#). Accordingly, a significant decrease was observed in the trend of fatality rate in both genders from 2010 ( $P < 0.001$ ). Nevertheless, fatality rate was higher in males than females most of the time. Also, a significant reduction was seen in the trend of fatality rate from 2010 to 2014 in all age groups, especially in the 15- to 30-year-old age group. Overall, the fatality rate of most injury causes was reduced in the recent years compared to the past. The fatality rate based on injury mechanisms for each study year is shown in [Figure 5](#).

### 4. Discussion

Although patients' admission had an ascending trend from 2010 to 2014, yet, an obvious reduction was seen in rate of fatality due to medical advances in trauma management. It should be noted that patient admission was increased due to several factors, such as the commencement of the new hospital admission area and rise in the population of urban areas as well as increase in the number of personal errors, which has led to an increase in the number of injuries (9).

**Table 1.** Distribution of the Causes of Injury Based on Gender and Age Group

Mechanism of Injury	Gender		Age Groups, y			Total
	Male	Female	15 - 30	31 - 45	> 45	
Car	11385 (72.5)	4315 (27.5)	8193 (52.2)	3761 (24.0)	3746 (23.8)	15700 (38.1)
Motor	8591 (93.3)	617 (6.7)	6183 (67.1)	1670 (18.2)	1355 (14.7)	9208 (22.4)
Fall	4219 (67.6)	2019 (32.4)	1982 (31.8)	1309 (21.0)	2947 (47.2)	6347 (15.2)
Assault	3648 (90.0)	407 (10.0)	2779 (68.5)	862 (21.3)	414 (10.2)	4055 (9.9)
Pedestrian	2263 (63.7)	1292 (36.3)	1289 (36.3)	676 (19.0)	1590 (44.7)	3555 (8.6)
Struck by object	1455 (85.9)	239 (14.1)	973 (57.4)	411 (24.3)	310 (18.3)	1694 (4.1)
Gun shot	436 (93.6)	30 (6.4)	304 (65.2)	116 (24.9)	46 (9.9)	466 (1.1)
Suicide	84 (88.4)	11 (11.6)	62 (65.3)	21 (22.1)	12 (12.6)	95 (0.2)
Others	138 (80.7)	33 (19.3)	96 (56.1)	39 (22.8)	36 (21.1)	171 (0.4)
<b>Total</b>	<b>32219 (78.2)</b>	<b>8963 (21.8)</b>	<b>21861 (53.1)</b>	<b>8865 (21.5)</b>	<b>10456 (25.4)</b>	<b>41182 (100)</b>

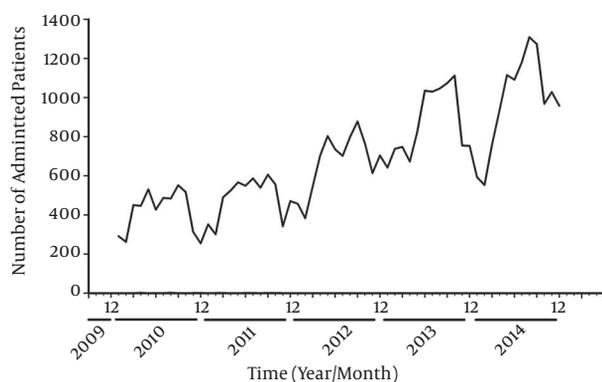
**Table 2.** Number of Deaths and Fatality Rate (%) Based on Gender and Age Groups for Each Cause of Injury

Mechanism of Injury	Gender			Age Groups, y				Total
	Male	Female	P Value	15 - 30	31 - 45	> 45	P Value	
Car	386 (3.4)	110 (2.5)	0.007	176 (2.1)	90 (2.4)	230 (6.1)	< 0.001	496 (3.2)
Motor	198 (2.3)	10 (1.6)	0.269	109 (1.8)	40 (2.4)	59 (4.4)	< 0.001	208 (2.3)
Fall	121 (2.9)	44 (2.2)	0.113	33 (1.7)	19 (1.5)	113 (3.8)	< 0.001	165 (2.6)
Assault	21 (0.6)	3 (0.7)	0.687	14 (0.5)	4 (0.5)	6 (1.4)	0.107	24 (0.6)
Pedestrian	109 (4.8)	52 (4.0)	0.275	25 (1.9)	13 (1.9)	123 (7.7)	< 0.001	161 (4.5)
Struck by object	19 (1.3)	3 (1.3)	0.949	8 (0.8)	6 (1.5)	8 (2.6)	0.107	22 (1.3)
Gun shot	14 (3.2)	0 (0.0)	0.319	8 (2.6)	3 (2.6)	3 (6.5)	0.491	14 (3.0)
Suicide	0 (0.0)	1 (9.1)	0.005	1 (1.6)	0 (0.0)	0 (0.0)	0.886	1 (1.1)
Others	4 (2.9)	0 (0.0)	0.322	3 (3.1)	1 (2.6)	0 (0.0)	0.716	4 (2.3)
<b>Total</b>	<b>872 (2.7)</b>	<b>223 (2.5)</b>	<b>0.225</b>	<b>377 (1.7)</b>	<b>176 (2.0)</b>	<b>542 (5.2)</b>	<b>&lt; 0.001</b>	<b>1095 (2.6)</b>

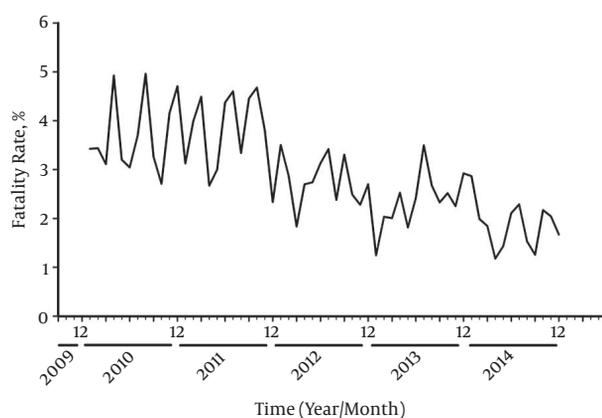
Our results demonstrated that the most common reason for the patients' referral to and admission at the studied hospital was car accidents, which is in line with other studies (13). This result may be attributed to several factors, such as mechanical lifestyle, economic growth, production of low-quality cars, driving carelessly, limited road infrastructure development, and absence of alternatives to street for adolescents to play. Therefore, public education about traffic rules and vehicle safety check seems to be crucial.

In the current study, the majority of the admitted cases were youths; the most active group of the society. This was concordant with the results of all other studies on trauma in the Iranian population (12, 13). Additionally, the male/female ratio was 4 to 1 (3, 14, 15). For instance, a study conducted by Wong et al. in Singapore demonstrated that

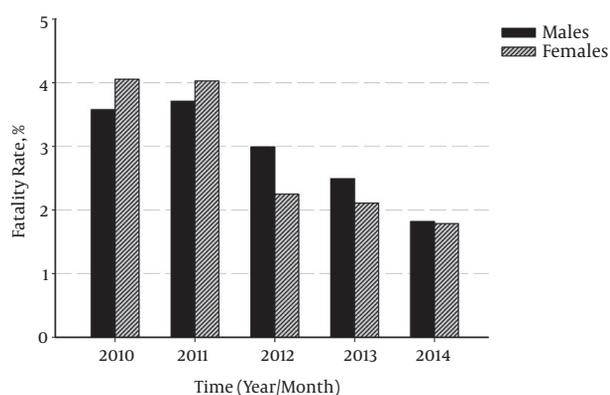
the highest casualties were among males and young people, and the 15- to 30-year-old age group had the highest admission rate for most injury causes, and majority of the victims were male with median age of 31 years (15). A similar report of male dominance was also published in Australia (3). However, an obvious reduction was observed in the trend of fatality rate in all age groups, yet, mortality rate of the patients aged more than 45 years was significantly dominant, which could be due to improvement in trauma care quality and issuing new traffic regulations. This was consistent with the current results; a previous study in an urban area in India also revealed that early hospital mortality in trauma patients decreased over a 13-year period between 1998 and 2011 (16). In addition, a report from the US also indicated a significant improvement in mortality of severely injured patients over time, however, there were



**Figure 1.** The Trend of Patients' Admission at Shahid Rajaee Hospital from January 2010 to December 2014



**Figure 2.** The Trend of Fatality Rate at Shahid Rajaee Hospital from January 2010 to December 2014



**Figure 3.** Fatality Rate Based on Gender at Shahid Rajaee Hospital from January 2010 to December 2014

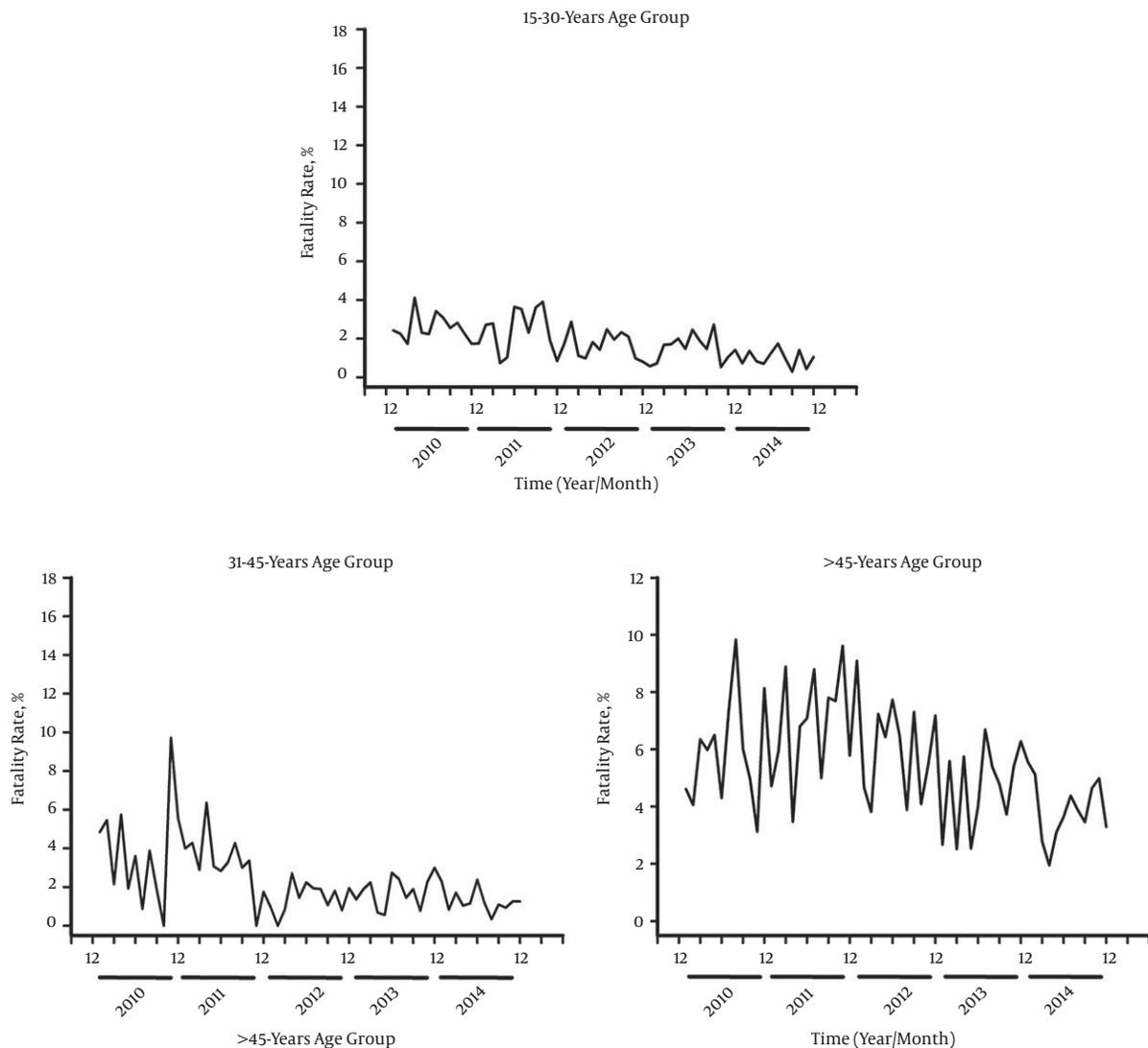
considerable differences in mortality among various centers (17). Nevertheless, a study on road traffic fatalities and injuries in Iran and other countries disclosed an increase in RTIs fatality rates during 1997 to 2005 (9). The difference between the results of that study and the present report might be related to the periods of investigation. It might have been due to results from the measures taken by the government during the interval between the 2 studies.

Considering the mechanisms of injury in the present study, the highest fatality rate was related to pedestrian injury. Similarly, vulnerable road users particularly pedestrians comprise about 50% of total road-related fatalities around the world (18). Moreover, Iranian surveys demonstrate that pedestrian deaths consist of the major portion of all deaths due to traffic accidents (19). This can be due to the fact that these types of injuries occur more in older people, most probably leading to their death, and evidences have determined old age has an increased fatality risk among pedestrians. Moreover, studies have shown that force and energy transfer are major factors affecting patient outcomes, and pedestrian injuries are considered as high-energy trauma (20). Therefore, this may be the probable cause for high mortality rate in pedestrians. Also, due to high fatality rate of pedestrian injuries, it is necessary to reinforce the existing regulations as well as designing new up to date regulations.

In all the previous reports, RTIs were the most prevalent causes of fatality (13), yet, there were differences with regards to the other causes. Although in some studies, fall injuries ranking went from first to third (13), yet, they were the fourth cause of fatality in the current study. One possible explanation is that other mechanisms of injury had a greater proportion of death in this study. On the other hand, gunshot injuries had the highest fatality rate among non-road traffic injuries. This was concordant with the results of other studies (20).

Trauma quality programs conducted and directed by trauma centers around the world are also of great importance. For example, a research was performed on 21 years of experience about trauma quality improvement program in Australia and demonstrated that crude and risk-adjusted mortality reduced in severely injured patients in a major trauma center after implementation of a comprehensive quality improvement program (21).

Since the major cause of trauma in Iran is RTIs, hence to reduce its related mortality and morbidity, the government has to tackle this issue by allocating resources to promote general public training programs to reduce human errors and improve road and vehicle safety.



**Figure 4.** The Trend of Fatality Rate Based on Age Groups at Shahid Rajaei Hospital from January 2010 to December 2014

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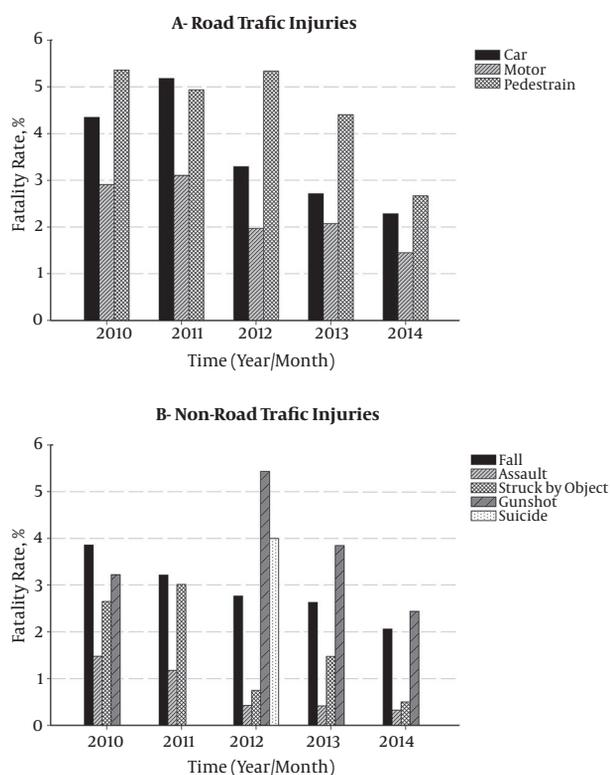
### Footnotes

**Conflict of Interests:** The authors declare that they had no competing interests.

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**Figure 5.** Fatality Rate Based on Injury Mechanisms at Shahid Rajaei Hospital from January 2010 to December 2014

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