

## Fatal Road Traffic Injuries in Hamadan Province, Iran

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### ABSTRACT

**Introduction:** Road traffic injuries (RTIs) are important health problems in the world and particularly in the low and middle-income countries. The prevention of RTIs needs vast coordinated and comprehensive efforts. Iran has one of the highest number of deaths due to the RTIs in the world. The objective of this study was to determine the epidemiological characteristics of fatal RTIs in Hamadan Province, Iran.

**Methods:** This cross-sectional study was conducted in Hamadan province of Iran, during a 24-month period, from 21 March 2009 to 20 March 2011. The data of fatal injuries were obtained from the Forensic Medicine Department of Hamadan province. The data were analyzed by using statistical package for social sciences (version16).

**Results:** This study showed that a number of 1434 road traffic related mortality was reported during two years, including 730 in 21 March 2009 to 20 March 2010 and 704 in 21 March 2010 to 20 March 2011. The highest number of deaths occurred among men (78.66%) and in the age group of 21-40 years (38%). The highest number of deaths occurred among the illiterate and low-literate individuals (52.1%); whereas, the lowest number of deaths occurred among people with university education (9.13%). Furthermore, the most fatal crashes occurred in the summer (35.56%). The head injuries were the most common cause of fatal RTIs (50.20%). The most of the vehicles which were involved with crash related deaths were car and the most of the deaths occurred in the scenes of crashes (48.39%). This study showed that the highest number of deaths occurred among drivers (40.65%) and were on the roads outside the cities (65.13%).

**Conclusion:** The results of this study showed that RTIs should be regarded as important health problems. Their characteristics, which were determined in this study, can help to develop more appropriate intervention programs.

**Keywords:** Injury Prevention, Road Traffic Injury, Injury Related Death, Safety Promotion

### Introduction

Road traffic injuries are major public health problems, and its continuous and effective prevention requires coordinated and

comprehensive efforts. Iran has one of the highest rates of road fatalities in the world; therefore, more than 20 thousand people die annually that is the leading cause of burden of

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disease and also second cause of death after cardiovascular disease (2). More than 50 million people are injured every year in road traffic crashes and 1.2 million people are killed, of these 90% are from low and middle-income countries (LMICs) (2). It is predicted that if there is no intervention, and mortality rates increase with this trend, deaths resulting from traffic injuries from 2000 to 2020 will increase 65 percent around the world and 80 percent in LMICs; therefore, RTIs will be ranked from the ninth place in the causes of death in 1990 to the sixth place in 2020, worldwide (2).

The death rate is 1 to 2.5 per 10 thousand vehicles in developed countries (1), while this rate for developing countries is 10 to 12 per 10 thousand vehicles (3).

Comparison of the road traffic death rate in Iran and other countries shows that road traffic death rate in Iran are higher than global and regional average. For example, in 2000-2001 in Iran, road traffic death rate was 44 per 100000 population, which is the highest death rate in the world. This study also shows that RTIs were the third cause of death in Iran during this year (4). Another study showed that road traffic death rate was 30 per 100,000 inhabitants in Iran in 2006 (3), while this figure in other countries is much lower (1, 3).

Considering the fact that in recent years significant studies have not been carried out in the Hamadan province and also in order to identify the characteristics of injuries, and to plan more appropriate for the purpose of preventive intervention in the future, this study was conducted with the aim of investigating the epidemiology of Road traffic deaths in Hamadan province from April 1, 2009 to the end of March 2010.

### Materials and Methods

In this cross-sectional study, data on deaths from road traffic injuries was collected during a 24-month period, from 21 March 2009 to 20 March 2011. The data of fatal injuries, occurred during the study period, were obtained from recorded data in the

files of Forensic Medicine Department of Hamadan province. This information contained data on age, gender, educational level, type of activity, place of death, status of the deceased at the time of death, location of trauma, immediate cause of death, types of vehicles involved in road traffic injuries, traffic crash location and year, season, month, day and hour of the injury event. The collected data in this study were analyzed using SPSS 16 software.

This study has been approved by the Research and Technology Deputy of Hamadan University of Medical Sciences.

### Results

This study showed that 1434 road traffic related mortality was reported during two years, including 730 in 21 March 2009 to 20 March 2010 (each year start from 1<sup>st</sup> of March and 20<sup>th</sup> next March in Iranian calendar) and 704 in 21 March 2010 to 20 March 2011). The number of road traffic deaths in Hamadan decreased 3.56 percent, from 730 people in 2009 to 704 people in 2010.

As **Table 1** shows the demographic characteristics of the victims of road traffic injuries in the province of Hamadan during the two years of study, most victims were 21 to 30 years old (21%), and the second and third age groups were 31 to 40 and 41 up to 50. The results of this study indicate that more than 50% of the victims were between the ages of 21 and 50.

The distribution of the gender of the dead people indicates that 78.66% of victims were men and 21.33% were women.

The results shows that the majority of deceased were among the illiterate and primary school level (52.01%), and the victims with secondary school (19.31%), high school (10.11%) and university levels (9.13%) were in the next ranks, respectively.

Most of the victims of the injuries in this study were self-employed (21.89%) and housewives (16.24%), farmers (14.36%) and workers (10.87%), respectively.

**Table 1:** Frequency distribution of demographic characteristics of the victims of road traffic injuries in Hamadan province in two years of 2009 and 2010 (number = 1434)

	Characteristic	Number	Percentage
<b>Age group</b>	Under 10 years old	92	6.50
	10 to 20 years	182	12.50
	21 to 30 years old	295	21.00
	31 to 40 years old	244	17.00
	41 to 50 years	190	13.20
	51 to 60 years old	156	10.90
	61 to 70 years	108	7.50
	Over 70 years old	139	9.70
	Unknown	28	1.95
<b>Sex</b>	Man	1128	78.66
	Female	306	21.33
<b>Education level</b>	Illiterate	340	23.70
	Primary	409	28.31
	Secondary school	277	19.31
	High school	145	10.11
	Academic	131	9.13
	Unknown	125	8.71
	Unreported	7	0.50
<b>Occupation</b>	Self-employment	314	21.89
	Housewife	233	16.24
	Farmer	206	14.36
	Worker	156	10.87
	Student	116	8.08
	Driver	105	7.32
	Retired	50	3.48
	Employee	50	3.48
	Student	49	3.41
	Unreported	48	3.34
	Others	46	3.20
	Unemployed	35	2.44
	Soldier	15	1
	Unknown	11	0.80

**Table 2** shows the characteristics of the road traffic injuries in Hamadan province during the two years of study. The most of road traffic

deaths in Hamadan province were in drivers, during these two years (40.65%).

**Table 2:** Frequency distribution of road traffic injury characteristics in Hamadan province in two years of 2009 and 2010 (number = 1434)

	Features	Number	Percentage
<b>Role of injured people</b>	Driver	583	40.56
	Other occupants	528	36.82
	Pedestrian	298	20.78
	Unreported	25	1.74
<b>The ultimate cause of death</b>	Head trauma	1056	73.63
	Multiple trauma	336	23.43
	Other cases	143	9.97
	Unreported	132	9.20
	Bleeding	86	6
	Burn	15	1.05
	Under testing	2	0.13
<b>The type of vehicles involved</b>	Car	436	30.40
	Truck and Trailer	257	17.92
	Pickup truck	122	8.50
	Motorcycle	82	5.70
	Bus	34	2.37
	Minibus	21	1.46
	Tractor	11	0.76
	Ambulance	9	0.62
	Bike	0	0
	Other cases	55	3.83
	None of them	337	23.50
	Unknown	54	3.76
<b>Place of crash</b>	Roads inside the cities	934	65.13
	Roads outside the cities	359	25.03
	Other	135	9.41
	Unknown	6	0.04
<b>Season of crash</b>	Summer	510	35.56
	Autumn	378	26.35
	Spring	316	22.03
	Winter	230	16.03
<b>Place of death</b>	Crash scene	694	48.39
	Hospital	590	41.14
	During transfer	116	8.08
	Home	26	1.81
	Unknown	8	0.55

The most important leading cause of death due to RTIs was head trauma (73.63%) followed by multiple fractures (23.43%) and bleeding (6%).

The most important vehicle involved in deaths was car (30.4%), followed by trucks and pickup trucks.

The most road traffic crashes resulted in death was reported on roads inside the cities (65.13%)

followed by roads outside the cities (25.03%), other roads (9.41%) and unknown (4%).

The highest and lowest road traffic deaths were in summer (35.56%) and winter (16.03%) respectively. The number of victims in the summer was 28.88% higher than the winter.

The distribution of victims frequency based on the month of the injury event shows that this factor has had a relatively similar distribution in

most months of the year except June, July and August. Furthermore, the distribution of dispersion of the victims shows that the highest and lowest victims of road traffic injuries were in the month of August (12.69%) and January (4.67%), respectively.

Most of the road traffic deaths took place at daytime and between 12:00 and 18:00 o'clock (33.43%). Nearly half of the victims died at the crash scene (48.39%), also 41.14% died in the hospital and 8.08% during the transfer, and only 1.81% died at home.

### Discussion

A total of 1434 deaths due to road traffic injuries in the current study indicate that there was no significant difference in the frequency of victims due to road traffic injuries in 2009 and 2010 (730 versus 704 cases). However, in other studies, there were some differences. For example, the number of deceased caused by road traffic injuries in Kermanshah province, Iran, was 309 in 2003 and more than twice in 2004 (686) (6). In Hamadan province (from October 1998 to October 1999) the number of deceased was equal to 251 cases (5), in Ardebil province of Iran in 2001 it was equal to 272 (7) and in Lorestan province of Iran in the years 1999, 2000 and 2001 it was 449, 470 and 538 cases (10). However, for comparison, it is better to consider the population of provinces as well as the number of their roads.

The lower number of people killed with a higher education level could be linked to a lower proportion of this group in comparison to other groups in the community. With regard to the relatively high level of illiteracy and primitive affiliation with other educational groups, it is necessary to consider educational issues with a simpler method for this group in different ways. This issue has also been emphasized in other studies (5-7). Barzegar et al in Kermanshah province, Rostami et al in Ardebil province, and Mohammadfam and Sadri in Hamadan province have also referred to a statistical reverse relationship between

education and road traffic injuries. Therefore, by using all the possibilities of educating all stakeholders, such as highway police, traffic organization service, municipality, transportation public affairs and etc. Also, the students should be trained in this regard.

In the present study, the largest number of victims based on the type of activity and occupation was related to Self-employment. This can be related to the low educational level and the high frequency of this group of people in the community, as compared to other occupational groups. Other studies also showed that the largest occupational group among the deceased was from self-employed people (6, 10).

In the present study, head injury was reported as the main cause of death (50.20%). Also, in the province of Lorestan, Kermanshah, Tehran and Hamadan (1999) in the majority of road traffic injuries, head trauma has been reported as the main cause of death (5, 6, 10); however, a similar study in Ardabil Province reported the most common cause of death as multiple injuries and then a stroke (7). Related studies in other countries also indicate that head trauma is one of the major causes of death in road traffic injuries (13). Usually most of the deaths occurred on the crash scene.

Analysis of the deceased based on the anatomical location of the injury indicates that more than half of the cases were multiple trauma or injury to various parts (54.6%) followed by head and face trauma as the second rank (38.20%).

The vast majority of deaths in this study were in males (78.66%). In other internal (5, 6, 7, 10) and foreign (15) studies, male people also had the highest number of deaths. Furthermore, more than half of the road traffic deaths in the Hamadan province (50.83%) were among the population in active ages (21-50 years old). Considering this, it is necessary that the excessive travel of this age group in terms of their occupation and activities increases their risk in comparison to other age groups. The

relative high proportion of victims over 60 years old are noteworthy (17.22%), due to their physical and psychological characteristics, namely the low speed of perceiving risk and the escape of risk, which indicates the need for serious attention to the above category in the safety of traveling. In this study, the highest rate of victims in the Hamadan province were from 21 to 30 years old, and then from 31 to 40 years old, and 41 to 50 years old people, respectively, which indicates the high mortality rate of young and active people in the province. A study in Mozambique also shows that the largest number of people affected by road traffic injuries were between 25 and 38 year of age (39.35%) and then 16-24 years (20.79%) (11).

In the present study, the largest involved vehicles in the injury event were cars (30.4%). Other studies also reported cars as the most vehicles involved in road traffic crashes (6, 7, 10). High speed cars as well as large numbers of them can contribute to the high mortality rates associated with cars. According to the place of road traffic crashes and injuries, the events which were on the roads inside the cities were 65.13%. It can be due to their high speed, fatigue of the drivers and less supervision on the roads inside the cities. In other studies (6, 7, 10), road traffic crashes and injuries which occurred on roads inside the cities have also been reported more.

Nearly half of the deceased (48.39%) died at the crash scene. Barzegar and Khalili also reported the most cases of deaths in the crash place in their studies [6, 7]. While in a study by Mohammadfam in the province of Hamadan in the year 1999, this amount was 27.20% [5]. Perhaps the reason for high death incidence at the crash scene and the most common cause of death is head injury. A remarkable point in this study is the significant reduction of deceased during transport (8.08%). This reduction could be related to the quantitative and qualitative development of road bases as well as the upgrading of pre-hospital care.

The investigation of deceased status during the road traffic injuries showed that drivers and occupants had the most number of victims, 40.65% and 36.82%, and pedestrians formed a small percentage. In the study which was carried out in Kermanshah province, most of cases were related to the pedestrians [6]. The decrease in the percentage of pedestrian victims could be attributed to preventive measures in this regard in the cities of the Hamadan province. The high proportion of victims in the driver and passenger status in the province (77.47%) can be largely prevented by safety devices such as airbags and seatbelts for vehicles and helmets for motorcyclists. These statistics indicate the low level of using safety devices at the community level.

The investigation of distribution of victims by season shows that the highest number of road traffic injuries was in the summer (35.56%), which could be due to the closure of the schools and the increase in extra-urban travel. Furthermore, investigating the distribution of the dispersion of the dead shows that the largest number of deaths occurred in the month of August, which could be due to an increase in extra-urban travel in this month. A study in Romania also reported that the most road traffic injuries occurred in the summer months. (16).

It is noteworthy that in April, despite the increase in extra-urban travel, the percentage of victims was low in comparison to other months (76.6%), which can be attributed to the massive media advertisements and significant police presence in these days. However, another study shows that most road traffic injuries occurred in April (10).

The distribution of victims based on the day of the injuries also shows that there was no apparent difference between the days of the week; while according to the volume of travel on the weekend, the number of victims was expected to be more on the weekend compared to other days. Most of the deaths occurred in the daytime (than the night) and between 12:00 and

18:00 o'clock. In a study in Romania, the most frequent events were in the afternoon (16).

### Conclusion

The findings of this study showed that a relatively large proportion of people in the community lost their lives during the year due to road traffic injuries. The characteristics of RTIs, which were determined in this study, can help to develop more appropriate interventional program. Taking basic measures such as traffic safety education especially for drivers in the society as well as education for the adolescents in the school can be helpful to reduce RTIs. Given the fact that the most of the deaths were due to head injury, there is no doubt that accurate monitoring of the implementation of the mandatory use of seat-belts for drivers and helmets for motorcyclists and at the same time providing related training will reduce mortality rates of road traffic injuries. Moreover, in order to reduce the number of road traffic injuries, especially during high season, serious action by the relevant authorities seems to be necessary.

Since most deaths occur at the crash scene and before reaching the hospital, it seems that most of them are preventable. Therefore, in order to overcome this problem, there is a need

for comprehensive policies and strategies for controlling RTIs, as well as improving the quality of pre-hospital care and the prehospital transport time. These factors that contribute to reducing mortality of road traffic injuries can play an important role.

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### Conflict of interest

The authors declared no competing interests.

### Authors' contribution

MS and FRS developed the study designing, MS collected and analyzed the data, MS and FRS interpreted the data. MS and FRS drafted and finalized the manuscript.

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