

# Characteristics of road traffic injuries in the second largest city of Iran

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## Abstract

**Objective:** Road traffic injuries (RTIs) are the second leading causes of death in Iran. One of the most important steps in the prevention of traffic-related trauma and its consequences is gaining insight into the epidemiology of injuries. We conducted this study to describe the characteristics of RTIs and to find strategies for its prevention.

**Methods:** This was a prospective cross-sectional study on consecutive road traffic trauma patients admitted to the emergency department (ED) of the second largest trauma center in the northeast of Iran, during July to September 2013. Demographic characteristics, type of vehicle, and injured area of the body were documented for each patient.

**Results:** Of 666 included patients, 562 (84.4%) were male and 104 (15.6%) were female, with a mean age of  $28.89 \pm 16.62$  years. Most of the patients were uneducated. The highest frequency of RTIs was related to motorcyclists with an attributed risk of RTIs for motorcycles at 75.8%. The most common traumatized area was head, face, and lower extremities.

**Conclusion:** The largest number of traumatized patients was among motorcyclists and uneducated population underscores the importance of public training about motorcycle usage and security and increase social awareness about reasons behind traffic law.

**Keywords:** Trauma, Injury pattern, Road traffic injury, Iran

## Introduction

Trauma is one of the greatest health threats particularly in the first four decades of life. In Iran, injuries are the leading cause of death in people under the age of 50 (1) and trauma has the first burden of diseases (2). According to the World Health Organization (WHO) Eastern Mediterranean office reports, accidents and trauma are one of the most important suffering issues in this area and are responsible for 1 of the 3 causes of death in this part of the world (3). The incidence rate of fatal road traffic injuries (RTIs) in the Eastern Mediterranean region is 26.4 per 100 000 versus 19 per 100 000 worldwide (3). Iran with RTIs fatality rates of 31.8 per 100 000 in the year 2007 had the highest rate in the region (4).

Although tertiary prevention (efforts following the incident to optimize the outcome of the injury) continues to be the most effective method of injury control, primary prevention (eliminate the injury incident from occurring)

is equally important to optimize injury control (5). In order to plan prevention strategy for traffic-related injuries and their consequences, it is necessary to gain insight into the epidemiology of the trauma. The victim of an accident could be a pedestrian, car occupant, motorcycle or bicycle rider, and the injury pattern may differ significantly in each group. The severity of injury is an important factor in the mortality and morbidity. WHO declared the necessity of more epidemiological research on the pattern of RTIs in low- and middle-income countries to address the scope of this problem and vulnerable population (6). As there is no national trauma registry system, the epidemiologic data of RTIs is not accurate. So, the effect of this important health issue is not completely understood (7).

We planned this study to determine the pattern of injuries in the traffic victims admitted to the emergency department (ED) of Shahid Hasheminejad hospital, one of the main trauma centers in Mashhad, north-east Iran, to pro-



vide an insight into the epidemiology of RTIs in this large and touristy city. We hope this study helps to determine the pattern of trauma injuries in traffic accident victims, the vulnerable population, and propose possible preventative strategies.

## Methods

After ethical approval of Mashhad University of Medical Sciences, this cross-sectional study was prospectively conducted on all road traffic trauma patients admitted to the ED of Shahid Hasheminejad hospital, Mashhad, Iran, from July to September 2013. This hospital is affiliated to Mashhad University of Medical Sciences. It is the second main trauma center in north-east of Iran. The annual attendance at the ED is approximately 47 000. Located in the north-east of Iran, with a population of 2 772 287 according to 2011 census, Mashhad is the second most populous city of the country.

Six hundred sixty-six consecutive road traffic trauma patients who were admitted to the ED were enrolled to the study. Road traffic trauma patients who had not consented to be admitted to the ED were excluded from the study. We also excluded the patients who were managed as outpatients, without admission to the ED.

By explaining the aim of the study to the emergency medicine residents, they collected data using a checklist. The main variables of the study were age, sex, educational level, type of vehicle, injured area of the body, and in-hospital outcome of the patient. Data were coded and entered in SPSS version 11.5 software (SPSS Inc., Chicago, Illinois, USA), and were presented as mean  $\pm$  SD. Chi-square and one way analysis of variance (ANOVA) tests were used as appropriate. A P-value of  $\leq 0.05$  was considered significant.

## Results

There were 666 victims, 562 (84.4%) male and 104 (15.6%) female, from 2 to 90 years old (mean =  $28.89 \pm 16.62$ ). In all types of accidents, the percentage of male patients was higher except for the car accident; and there was a statistically significant relation between sex and type of accident ( $P < 0.000$ ). Considering the educational level (for 588 patients older than 15 years old), most victims were uneducated: 160 (27.21%) without any classic education and 191 (32.48%) had only elementary education.

Among all patients, motorcyclists were the most vulnerable group (60.4%) and pedestrians were in the second position (24.6%). It seems important to mention that motorcycles were involved in 62.8% of traffic injuries in pedestrians ( $n = 103$ ). We can estimate the attributed risk of RTIs for motorcycles as:  $60.4\%$  "motorcyclists' RTIs" +  $(62.8\% \times 24.6\%$  "pedestrians' RTIs") = 75.8%.

Table 1 depicts the type of vehicle used by victims according to sex and age.

Abrasions and lacerations were the most prevalent injuries in all anatomic sites. The injury was severe enough for 18 patients (2.5%) to lead to emergent laparotomy, all of

whom were male and motorcyclists. 45 cases (6.7%) had a Glasgow Coma Scale (GCS) of 8 and less (severe head injury) requiring tracheal intubation in the ED, among whom the number of motorcyclists, car drivers or passenger, and pedestrians were 20, 11, and 14 respectively.

Two hundred sixty-one cases of motorcyclists (64.9%) had worn helmets but the second or third passenger on a motorcycle did not have a helmet.

Among 88 victims of car occupants, 50 were drivers and 38 were passengers. Forty-seven drivers (94%) had fastened their seat belts versus 2 passengers (5.2%).

Lower limb was the most injured site in pedestrians and motorcyclists, 55.5% and 76.9% respectively. Tibia fracture was the most common fracture in lower limb in both groups, 30% and 35% of the total lower limb injuries in pedestrian and motorcyclists respectively.

Motorcyclists involved in 61.6% of the total 333 head trauma and 44.4% of the total 45 severe head trauma. Head and face injuries had the highest rate in car passengers (55.6%), all of whom were among nonusers of seatbelts. For bicycle riders, the most common injury was upper limb trauma and most of them (50%) had radius fractures. Two hundred ninety-one patients (43.7% of) had 1 traumatized area and 375 (56.3% of) had more than 1 injured part. Table 2 shows the injury patterns according to the type of vehicle.

In hospital, the mortality of patients was 4.6% (31 cases); and 32.2% of these deaths (10 cases) occurred in ED. Brain injury was the most common cause of death. The average length of stay in ED was 115 minutes ranging from 20 minutes to 14 hours.

## Discussion

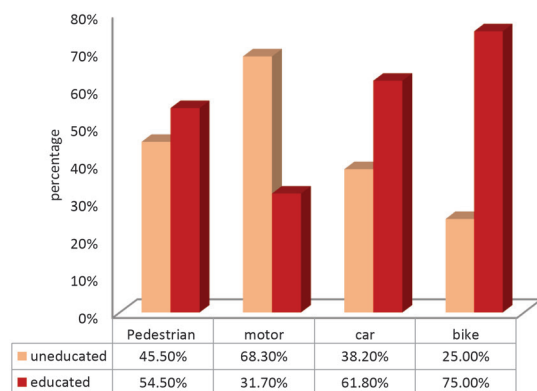
RTIs have a sharp increasing trend in developing countries because of the rapid rate of motorization (8). In Iran, RTIs are an important health problem and are responsible for a death rate of 44 per 100 000 which are the highest of any country in the world (9). This may be a warning for policymakers to prioritize RTIs among health care issues (7). In this study we enrolled all patients who were admitted to the ED due to RTIs. Like other similar studies, the majority of injured patients were young men who were mostly involved in out-door works and constituted the active part of the society (10,11). Male to female ratio was 5.4:1

**Table 1.** Type of vehicle used by victims according to sex and age

	Male No. (%)	Female No. (%)	Total No. (%)	Age (Mean $\pm$ SD)
Type of vehicle				
Pedestrian	125 (22.2)	39 (37.5)	164 (24.6)	31.38 $\pm$ 23.91
Motorcycle	383 (68.1)	19 (18.3)	402 (60.4)	28.0 $\pm$ 13.10
Car	42 (7.5)	46 (44.2)	88 (13.2)	30.31 $\pm$ 14.14
Bicycle	12 (2.1)	0 (0)	12 (1.8)	13.33 $\pm$ 1.30
Total	562 (100)	104 (100)	666 (100)	28.89 $\pm$ 16.62

**Table 2.** Injury patterns according to the type of vehicle

	No. of Head & Face (%)	No. of Neck (%)	No. of Trunk (%)	No. of Lower Limb (%)	No. of Upper Limb (%)	Total
Pedestrian	75 (45)	4 (2.4)	42 (25.6)	91 (55.5)	86 (52.4)	164
Motorcyclist	205 (45.7)	22 (5.5)	54 (13.4)	309 (76.9)	192 (47.8)	402
car occupant	49 (55.6)	4 (4.5)	28 (31.5)	38 (43.2)	25 (28.4)	88
Bicycle rider	4 (33.3)	0 (0.0)	4 (33.3)	4 (33.3)	8 (66.7)	12
Total	333	30	128	442	311	

**Figure 1.** Level of education according to the type of vehicle.

(562/104), but studies concerning all mechanisms of injury revealed a male to female ratio of approximately 4:1 which was far less than our study (11-13).

In our study similar to other studies in Iran and other developing countries, motorcyclists were responsible for the largest percentage of trauma patients and pedestrians constituted the second most vulnerable population (10,12,14,15). 62.8% of all pedestrian injuries were caused by motorcyclists so it seems necessary to put more strict regulations for motorcyclists in order to prevent harm to themselves and others. It is not rare that a motorcyclist offends the traffic regulations and passes through the red light or enters the sidewalks and the law does not enforce them as strongly as the drivers (7).

Most of the patients in our study were uneducated or had only primary education (59.7% of the 588 patients who were older than 15 years old). Figure 1 which demonstrates the level of education based on the vehicle used could clearly show that the percentage of uneducated patients among motorcyclists was higher than other groups. This difference was statistically significant ( $P < 0.000$ ). It highlights the importance of public education, especially mass media. In addition, including teaching materials in the educational system from an early stage of schooling can be another important matter in this regard.

We classified injuries according to the type of vehicles, age, sex, and the involved part of body in order to have a better planning and strategies to prevent traffic injuries in different types of vehicles. Lower limb (leg) was the most injured site for both pedestrians and motorcyclists. Head injuries were the most significant injuries in car oc-

cupants especially back seat passengers. Severe abdominal trauma was seen only in motorcyclists. In a study in France, motor-vehicle crashes were associated with more injuries to the lower extremities and a high percentage of head traumas. These probably match to a first blow on the legs of the cyclists (by the motor-vehicle); followed by a fall where the head is most often injured and internal organs are in the second place (16).

Maybe some strategies should be taken into account to support the lower limb in motorcyclists such as mandatory wearing of a limb safety guard. Also, it may be helpful to make fastening the seatbelt obligatory for all the car occupants not only for the drivers. Although in 2005, the use of seatbelts became mandatory for the drivers in Iran, other car passengers rarely use seatbelts and this may be the reason for the high prevalence of head and face injuries in car passengers.

One of the important problems contributing to accidents and injuries is the matter of drugged driving which there is limited information in this regard in Iran (17). This problem was not investigated in our study but based on the limited current literature such as a study by Assari et al (17), 60% of Iranian drivers involving in fatal car accidents were under the influence of drugs. In a survey done by Narenjiha et al (18) among professional drivers in Iran, 434 cases (46.8%) used opioids and 256 cases (27.6%) were addicted to kerack (18). These findings highlight the need for more strict regulations such as random drug screening tests to empower police force in detecting drugged drivers. Trauma-related mortality in our study was 4.6% which is lower than a similar study by Modaghegh et al in Mashhad (6.1%) but it is higher compared to studies in other countries (2%) (10). In our study, the most common cause of death was brain injury. Based on the literature, the first most significant cause of traumatic brain injury is traffic accidents (19). This shows the importance of paying special attention to the timely detection and appropriate management of traumatic brain injury (TBI) in these groups of patients. In our study, 32.2% of deaths occurred in ED compared to the studies of Zargar and Modaghegh (12) in Tehran and Modaghegh et al (10) in Mashhad which were 60% and 40.2% respectively. Lower mortality of patients in the ED may be attributable to the 24-hour presence of emergency medicine physicians in our ED which was not true about the 2 mentioned studies. As the injury severity score (ISS) of the victims was not determined, compari-

son could not be done. We suggest a comparative study between 2 trauma centers with and without the presence of emergency physicians to evaluate the effect of 24-hour presence of emergency physicians on the reduction of mortality in the ED.

Having insight about injury patterns according to the type of vehicle in addition to planning prevention strategies could be useful to predict the more probable site of injury in each group and pay more attention to that site.

The diagnostic and therapeutic costs of road traffic victims are fully paid by the health ministry and this is a great financial burden for the government in a country which faces many shortages of resources. So, it seems reasonable to plan for prevention strategies such as more severe traffic laws and increasing social awareness about reasons behind this. As mentioned by Ebrahimi (20), the establishment of trauma centers in our country is a necessity. It is vital to implement a trauma system and a trauma registry all over the country in order to provide a precise reliable estimation of Trauma related injuries (TRIs) and a comprehensive understanding of its consequences on the health system.

#### Ethical issues

The study was approved by the local ethic committee.

#### Authors' contributions

Substantial contribution to conception and design: Davood Soroush, Morteza Talebi Deloei, Reza Farahmand Rad; Acquisition of data: Azadeh Mahmoodi Gharae, Azadeh Tafakori, Davood Soroush, Morteza Talebi Deloei, Elham Pishbin, Hamidreza Reihani; Analysis and interpretation of data: Hamidreza Reihani, Vida Vakili, Elham Pishbin; Drafting the article: Elham Pishbin, Hamidreza Reihani; Revising the article critically for important intellectual content: All of the authors; Final approval of the version to be published: All of the authors.

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