

# Epidemiological Study of Fatal and Nonfatal Road Traffic Accidents and Their Outcomes on Children and Adolescents in Shahroud, Iran

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## ABSTRACT

**Background:** Traffic accidents are among the important health issues that threaten human life. Children are among the main victims of these accidents. This research aimed to study the epidemiology of fatal and nonfatal road traffic accidents and their outcomes in children and adolescents in Shahroud, Iran.

**Materials and Methods:** This descriptive and analytical study was conducted from July to December 2011. Data were collected through a researcher-made questionnaire. After verifying its content validity and reliability, the questionnaire was completed by emergency medical technicians. The data were analyzed using descriptive and inferential statistics (the Chi-square test).

**Results:** Of 363 studied cases, the majority of accidents happened in July with 108 (29.8%) cases and on Thursdays (18.7%). About 89.3% of drivers were male and aged 39 to 40 years (44.6%). Most accidents happened during 8 to 12 AM (23.7%). Moreover, 21.28% (1161 persons) of all injured people and 18.75% (48 persons) of all deceased victims were children under 14 years old. None of the victims under 14 years of age used protective tools. Head and spine trauma, respectively, were reported as the most common injury in this age group. There was no significant differences between victims aged less and more than 14 years old in terms of spinal cord injury ( $P=0.03$ ).

**Conclusion:** Based on the results of this study, it is recommended to take some basic actions such as improving roads, identification of black spots, installation of warning signs at those points, and extending controls and supervisions by police. It is also very important to use standard protective tools for children and adolescents, force rules for using appropriate safety equipment for this age group, and provide public trainings for the people to raise their level of awareness.

## Keywords:

Accident, Traffic, Child, Adolescent

## 1. Introduction

Road traffic injuries are a global public health problem [1]. According to the World Health Organization, mortality rate due to traffic ac-

cidents in 2000 will increase 80% by 2020 [2, 3]. In many developing countries, long-term health care costs, death, or disability of the breadwinner, funeral expenses, lack of income due to loss of work ability, and so forth can easily drive a family to poverty [4].

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According to reports from around the world, more than 5 million people annually get injured and 1.2 million people killed in traffic accidents; of all the mentioned cases, 90% occur in countries with low or moderate income [2, 3]. In addition, 20 to 50 million people suffer from injury or disability caused by traffic accidents every year [4].

Road accidents can lead to different damages such as physical defects, chronic physical pain, and disruption in the normal course of life, and such negative outcomes can be significant even a year after the accident [5]. The results of several studies indicate the negative psychological and social effects resulting from the damages caused by traffic accidents [6-8].

Traffic accidents are also one of the main health problems in Iran which leads to a large number of deaths and injuries [9]. Traffic accidents in Iran are reported as the most common cause of injury [10] and the second leading cause of death [11]. According to annual reports, more than 400000 traffic accidents occur in Iran and nearly 26000 people die as a result of these accidents every year [12]. In recent years, the number of deaths caused by road accidents increased about 10% to 15% every year [13].

Like other diseases such as heart disease, cancer, and so on, the consequences of accidents and their effects on public health must be considered and necessary actions be taken to prevent and avoid such accidents [5]. Victims of traffic accidents account for 13% to 31% of patients referred to the hospital and about 48% of patients admitted to surgical wards and intensive care units [6]. There is a large variation in the patterns of road traffic injuries and mortality rates in different countries. Therefore, specific approaches and strategies are necessary to deal with traffic accidents and their consequences in every community [8].

In this regard, motor vehicle accidents are the leading cause of mortality among children aged 2 to 4 years; the reported statistical data indicate the high mortality of children under 14 years of age due to such accidents [14, 15]. In addition, traffic accidents have been reported as the most common cause of mortality and disability in children [16]. The aforementioned items call for more attention to this problem.

Shahroud district is located on the way of Tehran-Mashhad highway in Iran and hence it has a special location. Because of traffic accidents in Shahroud, many people are suffering from injuries and deaths and the statistical data suggest high rates of mortality and disability caused by traffic accidents [17]. Thus, this study was designed and conducted to investigate the epidemiology of road traffic

accidents resulting in injury or death and their consequences among children and adolescents in Shahroud district.

## 2. Materials and Methods

This study was a descriptive analytical study and assessed the factors influencing traffic accidents in 3 domains of human factors, road, and environmental from June 22 until December 21, 2011. We used a researcher-made questionnaire to collect the required data. We choose this period because usually there is an increase in road traffic accidents usually increase in the summer due to rise of travels. In addition, we had a chance to review environmental factors in different months in the mentioned period.

To determine the face and content validity of the questionnaire, it was presented to faculty members and experts, as well as 3 police officers working in Qazvin police headquarter. After receiving their comments and suggestions, we reviewed and revised the questionnaire and made the necessary changes and improved it. The reliability of the questionnaire in this study was measured by Cronbach  $\alpha$  (0.84).

Data were collected from 115 emergency technicians and police personnel from June 22 until December 21, 2011. We collected data about all traffic accidents happened out of the city (in roads and rural areas) in Shahroud district which had led to injury or death of people during the mentioned period. Accordingly, the 115 emergency technicians completed the pre-designed questionnaires after attending the scene of traffic accident. If needed, we used the records of the police and traffic department for completing the required information. If some of the items in the questionnaire were not completed for any reason, these cases would be excluded from our analysis.

The mentioned questionnaire was completed via face-to-face interviews (the questionnaire was self-reported, and patients were assured that their responses would not have any effect on their medical and judiciary issues). To observe ethical issues, the participants were explained the objectives of the study and assured about the confidentiality of information. Furthermore, the questionnaire was completed anonymously and those who rejected to participate in the study were excluded. The collected data was analyzed using SPSS version 16; we used descriptive and inferential statistical tests to analyze the data.

## 3. Results

In this study, a total of 363 traffic accidents were evaluated happened over 6 months (July to December 2011).

Based on the results, most of the traffic accidents happened in July. In addition, the highest numbers of accidents were reported on Thursdays and between the hours 13 to 18 (Table 1).

Moreover, 89.3% of the drivers were male and 10.7% were female. In terms of demographic characteristics, most of the drivers were in the age group of 30-40 years, their education level was less than high school diploma, and were government employee (Table 2).

Of all drivers, 91% had driving license, 2.5% did not have any driving license, and the status of 5.8% was unknown. Among individuals who had a certified driving license, the interval from obtaining the driving license until the accident was less than a year in 2.4% of the drivers, between 1 and 5 years in 21.6% of the drivers, and more than 5 years in 76% of the drivers.

Of all drivers, 83.5% used seat belts and 7.7% did not; the use of seat belts was unknown in 8.5% of the cases. Among motorcyclists, only 17.4% had used helmet, while 79.7% did not use helmet, and the situation was unknown in 9.2% of the cases. Of 363 traffic accidents reported, 87.1% occurred on the roads and 12.9% occurred in the rural routes.

In general, during this period, traffic accidents had led to injuries in 1161 people, and about 247 of the injured people (21.28%) were children under 14 years old. Because of the traffic accidents which occurred during this period, 48 people died, i.e. 13.2% of all the accidents led to death. Of all people who died in the accidents, 48 (18.75%) people were in the age group under 14 years (Table 3).

None of the victims under 14 years of age used protective tools. In this age group, the highest rate of trauma was observed in the head (62.4%) and spinal cord

**Table 1.** Absolute and relative frequency distribution of traffic accidents by month, day, and time.

Frequency of occurrence of road traffic accidents by month, day, and time					
Month of accident	Frequency (%)	Day of accident	Frequency (%)	Time of accident	Frequency (%)
July	108 (29.8%)	Saturday	56 (15.4%)	1-6	83 (22.9%)
August	38 (10.5%)	Sunday	33 (9.1%)	7-12	113 (31.1%)
September	63 (17.4%)	Monday	48 (13.2%)	13-18	119 (32.8%)
October	59 (15.3%)	Tuesday	54 (14.9%)	19-24	48 (13.2%)
November	50 (13.8%)	Wednesday	49 (13.9%)		
December	45 (12.4%)	Thursday	68 (18.7%)		
		Friday	55 (15.2%)		
Total	363 (100%)	Total	363 (100%)	Total	363 (100%)

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**Table 2.** Absolute and relative frequency distribution of demographic characteristics of drivers involved in traffic accidents.

Demographic characteristics of drivers involved in traffic accidents					
Age group (year)	Frequency (%)	Education level	Frequency (%)	Job	Frequency (%)
Less than 30 years	94 (25.9%)	Illiterate	30 (8.3%)	Unemployed	12 (3.3%)
30 - 40 years	162 (44.6%)	Less than high school diploma	141 (38.8%)	Employee	120 (33.1%)
40 - 50 years	79 (21.8%)	High school diploma	95 (26.2%)	Worker	51 (14%)
		Associate diploma	38 (10.5%)	Student	8 (2.2%)
More than 50 years	28 (7.7%)	Bachelor	49 (13.5%)	Self-employed	72 (19.8%)
		Master or higher	10 (2.8%)	Driver	61 (16.8%)
				Unknown	39 (10.7%)
Total	363 (100%)	Total	363 (100%)	Total	363 (100%)

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**Table 3:** Absolute and relative frequency distribution of people who injured and died in traffic accidents by age group.

Age group	Injured people		Deceased people	
	Frequency	%	Frequency	%
More than 14 years	914	78.72	39	81.25
Under 14 years	247	21.28	9	18.75
Total	1161	100	48	100

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**Table 4:** Prevalence of trauma to different parts of body in victims aged less than and more than 14 years.

Place of trauma	Age group (year)*		The Chi-square (P)
	Less than 14 years	More than 14 years	
Head	176	581	0.11
Upper limbs	87	325	0.47
Chest and abdomen	58	225	0.38
Vertebral column	132	572	0.03
Hips and thighs	24	94	0.54
Knee and lower limbs	81	310	0.19

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\* The frequency is calculated for each row independently and relative to the total study population

(58.7%), while the lowest rate of trauma occurred in the pelvic area and thighs (6.6%). In addition, the prevalence of trauma to the spine was significantly different between people aged less than and more than 14 years. There was no statistically significant difference between 2 groups in terms of trauma to the other parts of body (Table 4).

#### 4. Discussion

According to the findings of this study, the majority of traffic accidents occurred in July and then in September. In Sadeghian et al. study (2008) which was conducted in Shahroud, the largest number of traffic accidents out of towns was reported in August and September which included about 62% of all accidents in the first 6 months of the year [17]. The majority of traffic accidents in Turkey occurs in May and June [18], while in Delhi it occurs in July, August, and September [19], and in the US a third of accidents happen in December and October [20]. It seems that the significant reduction in the incidence of traffic accidents in August may be due to the coincidence of August with Ramadan, which had led to a significant decrease in out of city journeys. Changes in the traffic pattern and people's behavior to observe the regulations and the rights of others are among the factors which increase or decrease accidents during Ramadan compared

to the other months [21]. Studies in the United Arab Emirates and Saudi Arabia reported the increase in road accidents in Ramadan [22, 23] that are not consistent with the results of this study. Such a difference might be due to cultural differences in the populations studied, for instance increased activity at night in these countries is one of the differences. A study conducted on the accidents in Tehran showed no difference between Ramadan and the other months in terms of the incidence of accidents [21].

In this study, most traffic accidents occurred on Thursdays. Such a finding had been observed in other studies as well [17, 24]. In a study by Sozuer et al. in Turkey, the number of traffic accidents was higher in the weekends [18] and in America most traffic accidents occur on Saturdays [26]. Increased incidence of traffic accidents over the weekend could be due to increased rate of journeys out of cities; hence, police must take necessary measures and actions to deal with this issue.

In this study, the majority of dead or injured drivers were male that can be due to higher number of male drivers, especially in out of city journeys, and also the higher prevalence of risk behaviors in men. The results of a study in America showed that overlooking the speed limit, passing through unauthorized areas, taking risk for entertainment,

and passing through several vehicles were significantly more common among men than women [25].

In terms of time, the majority of accidents occurred between 13 and 18 in the afternoon. A 10-year study in Khor and Biabanak, Iran showed that most incidents happened between 12 and 18 [26]. In other studies, there has been also a higher frequency of accidents between the mentioned time [13, 24] and their results were consistent with our findings. This can be attributed to the fatigue and sleepiness of drivers during this time interval.

Most drivers were 30 to 39 years old. Since we assessed road accidents, it was predictable to observe this phenomenon in this age group. This is a very important finding which needs especial attention because injuries in this age group can cause a lot of economic and social damages.

Most drivers were educated below high school diploma. Employees had the highest share among occupational groups. Previous research has shown that the probability of accidents is higher among people with lower income or education level [27, 28]. The results of a study in New Zealand showed that drivers with low level jobs and education were more prone to injuries caused by traffic accidents [29].

The majority of drivers had a driving license and most of them had obtained their driving license 5 years or more before the accident. In addition, most drivers also used safety belts, while most of the motorcyclists did not wear helmets. Several studies conducted across the world have shown that ignoring seat belts is the leading cause of death among motorcyclists. On the other hand, the compulsory use of safety belts has been significantly effective in reducing deaths, injuries, and disabilities [30].

According to the results of a study by Ghorbani conducted in Gonbad City, Iran, 81.2% of drivers used seat belts and only 12% of motorcyclists used helmets [13]. The results of the mentioned study were consistent with the results of our study. In a study by Charehsaz in Uremia, 94% of motorcyclists did not use helmet [31] and according to the results of Sadeghian study, 90.1% of motorcycles did not use helmets that was in line with the results of this study.

However, according to the results of that study, 44.1% of drivers did not use seat belts, which was higher than the rate observed in the present study [26]. This difference may be due to the fact that drivers use seat belts more in the roads because roads are more controlled by the police; in addition, over the past few years, public awareness has increased significantly.

The rate of using safety seat belts has been reported differently in several countries, so that only 1% of drivers in Kenya [32] and 26% of drivers in Argentina [33] use seat belts. According to the results of a study in America, the use of seat belt increased from 58% in 1994 to 75% in 2002 [34]. The increasing rate of using seat belts might be the result of new legislations, changes in control level, and culture of various communities. For example, in Korea, following the implementation of a police emergency plan in 2001 for the control and monitoring of safety seat belts, which was accompanied by increased fines, 98% of drivers used seat belts [35]. Similarly, the results of a study by Vaghari et al. in Gorgan, Iran showed that the use of safety seat belts increased by 15.4% within a period of 4 years [36].

In this study, none of the injured people under 14 years of age used protective tools. Nevertheless, it should be noted that using protective tools is the only way and the most cost-effective measure to prevent trauma which is a risk threatening the children in the industrialized world [16]. Studies have shown that 451 children under 5 years of age were rescued from death due to the proper use of protective tools; it has been also found that if all children under 5 years of age use safety seats, the number of survived children could reach 566 children [37].

Traffic accidents occurred in this period led to injuries in 1161 people, 254 of whom were children under 14 years of age. Moreover, a total of 48 people died due to accidents during the mentioned period, 9 of them were under 14 years of age. Iran has the highest number deaths from traffic accidents in the world [11, 38]. The mortality rate due to traffic accidents in the country in 2006 was 393 deaths per 100000 people [39]. The annual mortality rate due to traffic accidents in Iran is 258 deaths per 100000 people while in America it is 1.8 deaths per 100000 people [40] a very significant difference. Factors such as personal behaviors, environmental factors, and types of vehicles are responsible for the high mortality rate in Iran compared to other countries [39].

The results of a study in America showed that the mortality rate in children aged 8-15 years changed from 1300 in 1998 to below 700, also the mortality rate in the age group 4-7 years changed from approximately 700 to 300 [41]. According to a report by the US National Center for Disaster Control in 2003, about 14110 deaths from trauma occurred in children under 18 years, 63% of them were due to injuries caused by car crashes [42].

Based on the results of this study, trauma to the head and spine, were the most common reported injuries in this age group. Zargar also reported head injuries as the

most common injury to children in car crashes [16]. In a study reported by Memarzade et al., head was also the most common site of trauma in children [43]. The results of studies by Kay et al. [44] and Lett et al. [45] showed that head and neck trauma is the most common anatomic sites of trauma in children. It might be due to the larger size of head in children compared to adults, as well as their thinner skull bones [46]. This is an important point because intracranial injuries are the most common cause of death due to trauma in children. The traumatic coma can affect the performance of the airway, breathing, and cerebral blood flow. Thus, paying special attention to the protection of the head while making protective safety tools seems necessary. In addition, designing appropriate programs for public education and emergency pre-hospital and hospital personnel is essential, because they are responsible for transferring the children and must have adequate training about the differences between the transfer of children and adults [47].

## 5. Conclusion

In conclusion, taking some basic actions such as improving roads, identification of black spots, installation of warning signs at those points, and extending controls and supervisions by police are recommended. It is also very important to use standard protective safety tools for children and adolescents, make obligatory rules for using appropriate safety tools for this age group, and also provide public trainings for the people to raise their level of awareness.

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