



# Epidemiological Survey on Traffic Accident Mortality Referred to the Forensic Medical Center of Chaharmahal and Bakhtiari Province During 2005-2016

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## Abstract

**Background and aims:** The World Health Organization has listed Iran as the country with the highest number of driving accidents worldwide. Chaharmahal and Bakhtiari is among the top ten provinces in Iran. The aim of this study was to carry out an epidemiological survey on driving accidents resulting in deaths that were referred to the Forensic Medical Center.

**Methods:** In this cross-sectional study, the data were obtained from the Forensic Medical Center in Shahrekord, the provincial capital, during 2005-2016. Data were analyzed using descriptive statistics and the chi-square test by SPSS.

**Results:** The number of registered accidents causing death was 3001. The highest number of accidents (13.5%) occurred from August 23rd to September 22nd, which equates to the last months of the summer according to the solar calendar. Location wise, the highest number of accidents happened in Shahrekord (58.2%). In addition, men and married people were more involved in accidents compared to women and singles. The age group of 21-25 had the most number of accidents. Further, the main road had the highest percentage of accidents (86.7%) compared to freeways, by-ways, and rural roads. Finally, head trauma 1634 (60.7%) was the most important cause of death in people who were in car accidents.

**Conclusion:** Based on these results, policymakers and planners have to carry out necessary positive interferences and plans in order to reduce the number of factors which increase car accidents. Eventually, accidents are usually caused by multiple elements and this makes it necessary to review and optimize the operational output of responsible organizations and offices and the cooperation between them.

**Keywords:** Traffic accident, Mortality, Injury, Death records, Forensic medicine

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## Introduction

The changing of the human lifestyle from traditional to machine-based system has significantly altered the epidemiological model of a disease. Therefore, the use of any new phenomenon requires familiarity with the culture of using that phenomenon. The use of cars in the transport of goods and passengers has led to a dramatic development in various aspects of social life but has also exposed the inhabitants of the earth to numerous environmental hazards.<sup>1</sup> One of these dangers is motor vehicle accidents. The increasing population, the migration of villagers to urban areas, and the widespread use of human vehicles have put people at risk of accidents. Conversely, urban growth as a result of rapid population growth, the lack of public awareness of the laws and regulations of urban life, social defects, and non-standard transport vehicles

and non-standard streets, along with roads and crossings, could cause road accidents.<sup>1,2</sup>

In the United States, 500 000 people lose their lives in traffic accidents annually, and driving is the third leading cause of death in the country. Losses incurred by accidents account for the loss of 1.3% of gross domestic product per annum. Based on news reports given by public and official media and according to the World Health Organization, Iran has the highest number of driving accidents in the world.<sup>3</sup> In a cross-sectional study on traumatic patients referred to Golestan hospital of Ahwaz in the Southwest of Iran, Salimi and Zarei showed that the most common type of injuries occurs among pedestrians (36%) and most accidents were on the roads (47.6%) among vehicles and motorcyclists by 37.8% and 36%, respectively.<sup>4</sup> In a study carried out by Ghorbani et al, it was reported that 50%

of accidents occurred in urban areas and the other half were outside these areas. Moreover, the highest number of injured people were the drivers, passengers, and pedestrians, respectively<sup>5</sup>. Similarly, Holakoi Naeini and Moradi assessed the knowledge, attitude, and practice of pedestrians toward traffic rules. Based on the findings, 67%, 61%, and 55% of subjects had knowledge, attitude, and practice in the field of driving.<sup>6</sup>

Various studies have focused on the burden of deaths in the world and Iran. These studies have proven that communities and governments pay huge amounts in the forms of years of life lost or living with disabilities, as well as the damage caused by the treatment of injured people in accidents each year.<sup>7-18</sup> The other research studies investigated the impact of accidents and driving accidents leading to death on life expectancy, as well as its economic burden<sup>19</sup> and implications on economic development.<sup>20</sup> As the province of Chaharmahal and Bakhtiari is among the top ten provinces of the country in terms of traffic accidents,<sup>21</sup> it is, therefore, necessary to carry out epidemiological research in this regard in order to prevent and reduce the number of casualties caused by these incidents. Accordingly, the main objective of the present study was to investigate the epidemiology of accidents and driving accidents leading to deaths that were referred to the Forensic Science Center of Chaharmahal and Bakhtiari province during 2005-2016.

## Methods

This cross-sectional epidemiologic study was conducted in a 12-year period from 2005 to 2016. The research plan was approved by the Research Council of the Center for Investigating Social Factors Affecting Health, the University Ethics Committee (Code of Ethics 93-10-15), and finally, the Research Council of the University. Using the information gathering form designed by the researchers, the required data were collected through an official correspondence with the Forensic Science Center. Then, different variables were extracted, including age, gender, education, place of injury to the deceased, the unit reporting the accident, the ultimate cause of death, death location, the status of the deceased before the accident, the way of accident occurrence, the type of the car used by the deceased, the type of the car involved in an accident with a deceased pedestrian, the accident location, and occupation. The collected data were recorded and analyzed using SPSS (version 23) software based on descriptive statistics frequency and percentage and the chi-square test.

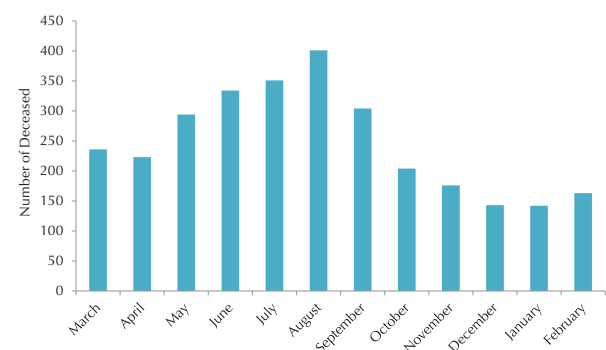
## Results

A total of 3001 deaths caused by accidents was documented by the Forensic Science Organization during the years under study. Most of the accidents resulting in deaths occurred in 2008 and 2012, and the fewest were in the years 2009 and 2015 (Figure 1). During the last 12-year period, the

rate of accidents has decreased significantly (Spearman's rho = -0.65,  $P=0.022$ ). In terms of the distribution of the months of the year, the highest percentage of accidents belonged to the end of August and the beginning of September while the lowest percentage was related to the end of February and the beginning of March (Figure 2). In addition, the frequency of accidents leading to death indicated a significant change based on the month and the year ( $P<0.001$ ). Further, the frequency of deaths caused by accidents represented a significant difference when compared based on gender and marital status ( $P<0.001$ ). Based on the results, the highest frequency of deaths caused by accidents belonged to married men. Furthermore, the frequency of accidents leading to deaths based on age demonstrated a significant difference ( $P<0.001$ ), in which the highest frequency belonged to the age range of 21-25 while the lowest frequency was related to the age range of 11-15 and 80 and over. The frequency of deaths caused by accidents also had a significant difference when compared based on the level of education ( $P<0.001$ ). According to the data, the highest frequency was related to illiterate groups whereas the lowest frequency belonged to people with master's degrees and higher (Table 1). As regards the county, most accidents leading to deaths belonged to Shahrekord (58.2%) while the lowest number of accidents



**Figure 1.** Frequency of the Deceased Population Because of Accidents and Driving Accidents Leading to Death in Chaharmahal and Bakhtiari Province During 2005 to 2016.



**Figure 2.** Monthly Frequency of Death Caused by Accidents and Car Accidents in Chaharmahal and Bakhtiari Province During 2005 to 2016.

**Table 1.** Distribution of Accidents and Deaths in Chaharmahal and Bakhtiari Province From 2005 to 2016 in Terms of Age, Gender, Marital Status, Education, and County of the Deceased

Variable	Level	Frequency		P Value
		Number	Valid Percent	
Age	0-10	284	9.4	<0.001
	11-20	410	13.7	
	21-30	699	23.4	
	31-40	489	16.4	
	41-50	359	12.1	
	51-60	381	9.3	
	61-70	199	6.6	
	71-80	201	6.7	
	Above 80	69	2.3	
	Missing	11	-	
Gender	Sum	3001	100	<0.001
	Men	2260	75.4	
	Women	739	24.6	
Marital Status	Missing	2	-	<0.001
	Sum	3001	100	
	Married	1067	38	
Education	Single	653	62	<0.001
	Missing	1281	-	
	Sum	3001	100	
	Illiterate	747	25	
	Primary	694	23.2	
	Middle school	592	19.8	
	High school	398	13.3	
	Diploma	379	12.7	
	University student	39	1.3	
	College	43	1.4	
County	BSc	85	2.8	<0.001
	MSc and higher	16	0.5	
	missing	8	-	
	Sum	3001	100	
	Shahrekord	1747	58.2	
	Borujen	448	14.9	
	Lordegan	420	14	
Ardal	127	4.2		
County	Farsan	94	3.1	<0.001
	Koohrang	58	1.9	
	Kiar	29	1	
	Out of province or unknown	78	2.6	
	Sum	3001	100	

Note. BSc: Bachelor of Science; MSc: Master of Science.

was related to Kiar (1%). Thus, the frequency of accidents leading to deaths indicated a significant difference based on the county ( $P < 0.001$ ). A total of 1.2% was from outside the province, most of which were in the neighboring counties (Table 1).

Similarly, the results (Table 2) revealed that the frequency of deaths caused by accidents based on lighting had a significant difference ( $P < 0.001$ ). Most accidents leading to deaths happened during the day (64.8%) and the lowest number occurred during the dawn and dusk (6.9%) (Table 2). Most accidents leading to death happened on main roads (86.7%) and the least belonged to freeways (0.4%). The frequency of accidents leading to deaths had a significant difference when considering the conditions of the road ( $P < 0.001$ ). Moreover, the frequency of deaths caused by accidents represented a significant difference when compared according to the center announcing the death ( $P < 0.001$ ), the most and the least of which were announced by the police and the hospital/Forensic Medical Center, respectively. Additionally, the frequency of accidents leading to deaths had a significant difference when compared based on the method of transportation to the hospital ( $P < 0.001$ ), so that most deaths happened when the injured were transported by the ambulance while the least number of deaths occurred when they were transported by the police. In addition, the frequency of deaths due to accidents demonstrated a significant difference when considering the final cause of death ( $P < 0.001$ ). The head trauma and burning were considered as the most and the least causes of deaths, respectively (Table 2). The frequency of accidents leading to deaths showed a significant difference when compared based on the place of death ( $P < 0.001$ ). Most deaths happened at the place of accidents while the least number of deaths occurred at home (Table 2). Furthermore, the frequency of accidents leading to deaths had a significant difference when considering the vehicle of the deceased ( $P < 0.001$ ), in which the highest rate belonged to car and bike passengers whereas the lowest rate was related to pedestrians. Similarly, the frequency of deaths caused by accidents represented a significant difference when compared according to the color of the clothing of the deceased ( $P < 0.001$ ). People wearing dark color clothing had the highest percentage of accidents which resulted in deaths (59.4%) and those with light color clothing were in second place. The results further revealed that the frequency of accidents leading to deaths had a significant difference when compared in terms of their way of occurrence ( $P < 0.001$ ). Accidents which involved cars colliding with each other had the highest percentage of deaths while the lowest rate belonged to free falls. Moreover, the frequency of accidents leading to deaths indicated a significant difference when compared in terms of the type of involved vehicles ( $P < 0.001$ ). The distribution of accidents in terms of the involved vehicles which resulted in deaths in Chaharmahal and Bakhtiari

**Table 2.** Distribution of Accidents and Deaths in Chaharmahal and Bakhtiari Province From 2005 to 2016 in Terms of Lighting, the Type of Road, the Ultimate Cause of Death, and the Place of Death

Variable	Level	Frequency		P value
		Number	Valid Percent	
Lighting	Day	1112	64.8	<0.001
	Night	441	25.7	
	Dawn or dusk	164	9.6	
	Missing	1284	-	
	Sum	3001	100	
	Sum	3001	100	
Type of road	Freeway	3	0.4	<0.001
	Highway	14	2	
	Main road	618	86.7	
	By-way	29	4.1	
	Rural	48	6.7	
	Missing	2289	-	
	Sum	3001	100	
Ultimate cause of death	Head trauma	1634	60.7	<0.001
	Bleeding	291	10.8	
	Numerous fractures	520	19.3	
	Burning	5	0.2	
	Asphyxiation	141	5.2	
	Combination of the above	102	3.8	
	Missing	308	-	
	Sum	3001	100	
Place of death	Place of accident	1532	51	<0.001
	Transport to hospital	371	12.4	
	Hospital	1068	35.6	
	Home	26	0.9	
	Missing	4	-	
	Sum	3001	100	

showed that family cars had the highest role whereas the lowest role belonged to agricultural, civil engineering, army, and police vehicles. Additionally, the frequency of accidents leading to deaths represented a significant difference when compared based on the place of its occurrence. It should be noted that 70.2% of accidents, which resulted in deaths, happened in the roads outside the cities while 20.7% of them happened on the roads in the cities. In addition, the frequency of accidents leading to deaths had a significant difference when compared based on occupation. The highest percentage belonged to private-sector workers and housewives (56.5%) whereas the lowest rate was related to soldiers. In terms of the distance from the highways, the frequency of accidents leading to deaths demonstrated a significant difference. In Chaharmahal and Bakhtiari Province, the highest percentage of accidents resulting in deaths (56.5%) happened in the distance less than 10 km from the highways but the lowest percentage (4.1%) occurred with the distance of more than 200 km from the highways.

## Discussion

The present study focused on the epidemiological state of the accidents and car accidents resulted in deaths referred to the Forensic Medical Center in Chaharmahal and Bakhtiari Province from 2005 to 2016. The total number of registered accidents and car accidents in this period was 3001. The trend of accidents and car accidents in these 12 years has shown a decrease despite the increasing number of cars. The results indicated that most accidents leading to deaths happened in Shahrekord County (58.2%) whereas the lowest number of accidents was related to Kiar county (0.9%). Further, men were more involved in accidents compared to women in this province, which is similar to the results of Ahanchi et al,<sup>7</sup> Davoodi et al,<sup>8</sup> Mohammadfam and Sadri,<sup>9</sup> and Erfanpoor et al.<sup>10</sup> The main reason might be the fact that men drive more than women and cultural factors may have an effect on this choice. Furthermore, the highest percentage of accidents belonged to the end of August and the beginning of September (13.5%). It is possible to attribute this to the increased number of summer vacation trips as school children are free from additional summer school classes and are getting ready to start the new school year. Research in other provinces such as Isfahan,<sup>7</sup> Lorestan,<sup>8</sup> Hamadan,<sup>9</sup> and Khorasan Razavi<sup>10</sup> also confirm this hypothesis. Moreover, the age group of 21-25 had the highest frequency of accidents whereas the lowest frequency belonged to the age group of 11-15 and people above 80 years of age. It is obvious that young people drive more and are more adventures while driving compared to other age groups, which is in line with the findings of Bordbar and Nedjatiyan.<sup>11</sup> The percentage of accidents in urban areas (58.1) was higher compared to rural areas (41.8), and the higher volume of traffic in urban areas was one of the main reasons in this regard. Additionally, the highest and lowest percentage of accidents were observed among illiterate people and those with master's degrees and higher, respectively. This could be attributed to their education and knowledge of driving laws or their low social presence. This finding is corroborated with those of other studies carried out by Mohammadfam and Sadri,<sup>9</sup> Erfanpoor et al,<sup>10</sup> and Davoodi et al.<sup>8</sup> Regarding the time, most accidents happened during the day (64.8%) as much of the driving is done in these busy hours. Location wise, most accidents occurred in highways (86.7%) in comparison to freeways, along with urban and rural roads. Similarly, most accidents were reported by police stations (48.2%), and 39.8% of injured people were transferred by ambulances. Head trauma was the main cause of the death in motorbike accidents mostly because of not using safety helmets although Iran has a better record for motorbike safety in comparison to developed neighboring countries.<sup>12</sup> Based on the findings, 51.1% of deaths happened at the scene of the accidents from which based on this research 42% were the driver or pillion and 50.3% passed away because of collusion with

the other vehicle. Likewise, family cars had the highest percentage of accidents resulting in deaths. In addition, most accidents happened outside the cities (70.2%) and involved private-sector workers and housewives. Further, 56.5% of accidents happened in the distance of less than 10 km from the highways.

Based on these results, policymakers and planners should conduct necessary positive interferences and plans in order to reduce the number of factors which increase car accidents. Actions such as passing preventive laws, focusing on educating the public on driving laws and enforcing law adherence culturally, monitoring and controlling the speed limit, and encouraging people to use safety helmets while on bikes are among such interferences. Furthermore, repairing roads, especially places which are more dangerous and accident-prone, putting in place warning and inhibitory signs, educating specialized emergency care staff, and reforming the emergency care services in order to be at the scene of the accidents as close to the golden time period as possible include the other positive actions in this regard. Accidents are usually caused by multiple elements and this makes it necessary to review and optimize the operational output of organizations and offices like the traffic and highway police, the Ministry of Road and Transport, the Ministry of Industry and Mines, car manufacturers, insurance companies, education ministry, mass media, national TV and radio, as well as research centers and universities and the cooperation between them.

Numerous studies have addressed the burden of accidents and car accidents resulting in deaths in Iran and worldwide.<sup>14-18</sup> It has been proven that societies and governments pay a huge annual price for accidents resulting in deaths, in the form of the years of life lost, living with disabilities, and the cost of treatment for injured people. Other studies have focused on the effect of accidents resulting in deaths on life expectancy, its economic consequences,<sup>19</sup> and its implications on economic development.<sup>20</sup> Such a study has not been carried out in this province and it is suggested accordingly.

One of the limitations of this study was a small change in the checklist of registering accidents in the years under the study, which caused the loss of some prior data.

### Conclusion

In general, 3001 cases were reported regarding the issue of car accident mortalities registered in the Forensic Medical Center of Chaharmahal and Bakhtiari Province during a 12-year period from 2005 to 2016. The number of accidents during this period has shown a slight decline. The results necessitate that policymakers and planners be determined in carrying out necessary positive interferences and plans to reduce the number of factors increasing car accidents. Due to the fact that accidents usually occur as a result of various elements and factors, it is necessary that the operational output of organizations and offices be reviewed

and optimized, including the Traffic and Highway Police, the Ministry of Road and Transport, Education Ministry, and the Ministry of Industry and Mines, as well as car manufacturers, insurance companies, mass media, national TV and radio, and research centers and universities.

### Ethical Approval

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### Conflicts of Interest

The authors declare no conflicts of interest.

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