Original Article

Road Traffic Accident Fatality Predictors: A Case–Control Study in Isfahan

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Abstract

Background and Objectives: Traffic accidents are the most important cause of trauma and mortality in communities. Due to the limited information in this field about Isfahan, a metropolitan in the center of Iran, this study investigates and identifies the epidemiological characteristics of fatal traffic accidents in this city. **Methods:** This is a case–control study conducted on hospitalized patients due to traffic accidents in 2016–2017. Lethal accidents (n = 189) were considered cases, and a group of survivors (n=189) was the control. The demographic and clinical characteristics of the population were gathered, and compared between the cases and controls. Logistic regression assessment was applied to determine the factors associated with death. **Results:** Logistic regression assessments revealed that facial and head trauma, chest trauma, abdominal trauma, pelvic trauma, lower extremity trauma, surgical procedure requirement within 12 hours after the accident and intubation were the prognostic factors associated with fatality. **Conclusions:** According to the findings of this study, mortality due to accidents was independently associated with facial and head, chest, abdominal, pelvic and lower extremity traumas, intubation requirement, and surgery within the first 12 h after the accident. Besides, aging was inversely associated with the chance of survival following a road accident.

Keywords: Epidemiology, mortality, traffic accidents

Introduction

Traffic accidents are considered the underlying etiology of numerous injuries and deaths, and cause remarkable damage to the national economy.[1,2] The World Health Organization (WHO) has reported 1.25 million annual deaths and 20–50 million injured persons due to road accidents.[3,4] Accordingly, traffic accidents account for 2.1% of all-cause mortality and 23% of the direct deaths.[5,6] In general, 3% of gross domestic product is applied to compensate for accident damages.[7] Although 54% of the world's vehicles are in developing countries, above 90% of fatal accidents occur in these communities.[8,9]

Currently, the rate of road accidents is up to 20 folds greater in Iran than the average worldwide.[10] This rate has risen along with the increasing trend of industrialization in communities. Despite a lower proportion of cars per 1000 person in Iran than in the developed countries, the numbers of deaths due to traffic accidents is considerably higher.[11,12] Unfortunately, national reports have declared that traffic accidents have been the second leading cause of mortality in Iran. Moreover, such accidents have been regarded as the primary cause of death in the under 40-year-old population.[13]

Traffic accident-related death is defined as the one occurring at the time of the accident or within 30 days afterward. Therefore, immediate mortality at the scene of the event, during

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hospitalization, after discharge, and at home can be included in this categorization.[7]

The current study aims to investigate and analyze some of the characteristics of the fatal traffic accidents, including demographic characteristics of the victims, clinical factors, and previous interventions by comparing them with a group of survivors.

Methods

This is a case–control study conducted on traffic road multiple trauma patients referred to Alzahra and Kashani Hospitals, trauma referral centers affiliated at Isfahan University of Medical Sciences, from September 22, 2016, to September 23, 2017.

The study met the tents of Helsinki declaration and was proposed to the Ethics Committee of Isfahan University of Medical Sciences. This study was approved by the code number of IR.MUI.MED.REC.1398.020. The patients (or their legal guardians) were informed about the study design and signed written consent.

We included the patients referred to Alzahra or Kashani Hospitals due to multiple trauma following road accidents in Isfahan, had accessible medical records, and were visited by surgery services once (at least). It was also possible to contacting with the patients or their companions. Reluctance of the patients or their legal guardians for participation in the study, over 20% defect in the medical records and failure to contact with the patients or their legal guardians to complete the required information were determined as the exclusion criteria.

The case group, defined as the patients who died following a traffic road accident was selected through convenience sampling. Accordingly, equal numbers of gender-matched controls who met the inclusion criteria were randomly selected. The controls were selected from among the patients admitted at the hospitals due to traffic accidents and being discharged from a surgery service.

A checklist was designed and the data were extracted from the hospitals' records. The checklist included age (<15 years, 15–24 years, 25–34 years, 35–64 years, more and equal to 65 years), gender (male vs. female), chronic medical conditions (cardiovascular disease, hypertension, renal injury and others), site of the trauma (head, chest, abdomen, pelvis, upper limbs, lower limbs, spine and neck), the interval between the accident and death (first 6 h, 6–24 h, 1–7 days, up to 30 days), accident location (in the city, or intercity), month of the accident occurrence, final cause of death (head injury, bleeding, spinal column injury, septic shock, fat embolism, lung embolism, acute respiratory distress syndrome, multiple fractures), vital signs status on arrival (stable vs. unstable), respiratory condition on arrival (intubated vs. nonintubated), any surgical procedure requirement within the first 12 h after the accident (performed vs. not performed), and chest tube implementation requirement (inserted vs. not inserted).

Unstable hemodynamic was defined as at least one of the following conditions, including systolic blood pressure <90 mmHg, or pulse rate ≥100 per minute.

The obtained data were analyzed by the Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, USA) version 23. Descriptive statistics included mean, standard deviation, percentages, and absolute numbers. For analytic data, Chi-square test was utilized. Logistic regression analysis was applied to find the association between death and each variable. $P < 0.05$ was considered significant.

Results

The current study has been conducted on 189 patients in the case and control groups. The studied population was predominantly 15–34-year-old and consisted of 269 males (71.16%).

Table 1 represents the demographic characteristics of the studied groups. The two groups were similar in terms of gender distribution ($P = 0.73$) and chronic medical conditions ($P = 0.24$), while the survivors were remarkably younger than the case group ($P = 0.01$).

The site of the injury due to traffic accident ($P = 0.001$), hemodynamic stability ($P < 0.001$), on arrival respiration condition ($P < 0.001$), chest tube implantation ($P < 0.0.001$) and surgical procedure requirement within the first 12 h after the accident ($P < 0.001$) were remarkably different between those who died and survived after an accident. Detailed information is demonstrated in Table 2.

Head trauma was the most common cause of death with 41.3%, followed by hemorrhage and spinal cord trauma in the second place with 15.3%. Notably, we found that 78 people died because of head trauma; 30 (38.46%), 17 (21.79%), 14 (17.94%), 9 (11.53%) and 8 (10.25%) deaths were due to brain hemorrhage, crush the skull and exiting the brain tissue,

Table 1: The demographic characteristics of the studied population

	Case group (*n*=189), *n* (%)	Control group (*n*=189), *n* (%)	*P*
Gender			
Male	136 (72)	133 (70.4)	0.73
Female	53 (28)	56 (29.6)	
Age group (years)			
<15	17 (9)	18 (9.5)	0.01
15-24	47 (24.9)	64 (33.9)	
25-34	30 (15.9)	41 (21.7)	
35-64	57 (30.1)	49 (25.9)	
>65	38 (20.1)	17 (9)	
Chronic medical condition			
None	146 (77.3)	155 (82)	0.24
Cardiovascular disease	7 (3.7)	9 (4.8)	
Hypertension	25 (13.2)	15 (7.9)	
Renal injury	0 (0)	2 (1.1)	
Others	11 (5.8)	8 (4.2)	

Table 2: The comparison of medical records between the cases and controls

	Case group (*n*=189), *n* (%)	Control group (*n*=189), *n* (%)	*P*
Site of trauma			
Head and facial trauma	116 (61.4)	50 (26.4)	0.001
Chest trauma	27 (14.3)	20 (10.6)	
Abdominal trauma	11 (5.8)	10 (5.3)	
Pelvic trauma	9 (4.8)	14 (7.4)	
Upper extremity	3 (1.6)	23 (12.2)	
Lower extremity	11 (5.8)	49 (25.9)	
Neck and spinal trauma	13 (6.3)	23 (12.2)	
Place of accident			
In the city	114 (60.3)	121 (64)	0.45
Intercity	75 (39.7)	68 (36)	
On admission hemodynamic stability			
Stable	129 (68.3)	178 (94.2)	<0.001
Unstable	60 (31.7)	11 (5.8)	
Respiration condition on arrival			
Intubated	105 (55.6)	7 (3.7)	<0.001
Nonintubated	84 (44.4)	182 (96.3)	
Surgery requirement within the first 12 h after accident			
Performed	98 (51.9)	19 (10.1)	<0.001
Not performed	91 (48.1)	170 (89.9)	
Chest tube implantation			
Inserted	40 (21.2)	8 (4.2)	<0.001
Not inserted	149 (78.8)	181 (95.8)	

brain contusion, cerebral death, and base of skull fractures, respectively [Figure 1].

Out of 29 patients who died of hemorrhage, 10 cases (34.48%) had hemothorax, and 9 (31.03%) had a major vascular hemorrhage. Moreover, abdominal and pelvic hemorrhage occurred in 6 (20.68%) and 4 (13.79%) patients, respectively. Most people died within an hour after the accident (44.4%), most of the leading to death accidents occurred in September (13.1%) and most of the survivors experienced road accidents in June (14.6%).

Table 3 represents logistic regression assessments in which facial and head, chest, abdominal, pelvic and lower extremity traumas, requirement of intubation, and surgery within the first 12 h after the accident were the factors associated with mortality.

The Kaplan–Meyer diagram assessing the impact of age on survival shows that increasing age was accompanied by the lower survival probability [Figure 2].

Table 3: Logistic regression assessment of the factors associated with mortality in road accidents

	OR	95% CI	*P*
Age (years)			
<15	1.861	0.63-5.42	0.256
15-24	1.589	0.72-3.49	0.249
35-64	1.105	0.46-2.64	0.823
25-34	1.116	0.49-2.50	0.790
≥65	1	1	-
Site of trauma			
Facial and head trauma	0.044	0.016-0.118	<0.001
Chest trauma	0.059	0.02-0.171	<0.001
Abdominal trauma	0.115	0.032-0.417	0.001
Pelvic trauma	0.092	0.025-0.339	<0.001
Upper extremity	0.389	0.078-1.95	0.251
Lower extremity	0.205	0.062-0.682	0.010
Neck and spinal trauma	1	1	
Hemodynamic instability	1.916	0.934-3.93	076
Surgery requirement	3.197	1.583-6.45	0.001
Respiratory condition (intubated)	7.016	3.498-14.07	<0.001
Chest tube implantation (inserted)	0.561	0.226-1.39	0.213

OR: Odds ratio, CI: Confidence interval

Discussion

The present study assessed the epidemiological characteristics of fatal traffic accidents in Isfahan. The findings revealed that the highest frequency for deaths above 35 years old; however, survivors were mainly in the age range of 15–24-year-old. The pattern of age distribution in lethal road accidents was a matter of debate as most of the victims who used cars were in the adult group with age range of 18–65-year-old. Accordingly it was estimated that death would mostly occur in this group. In agreement with our study, a large population-based investigation by Sadeghi-Bazargani *et al*. in East Azerbaijan presented the highest mortality in over 35-year-old cases.[14] In contrast, some of the studies have presented the highest rate of death among elderly despite their lower rate of involvement in nonfatal crashes.[15] On the other hand, accidents in which motorcycles were one side of the events were significantly associated with increased rate of death. Furthermore, most of the users of this vehicle were youths with age range of <35-year-old. Accordingly, further investigations of this group and preparing a schedule to minimize the lethal accidents by motorcycles are a critical matter of research.[16-18]

Most of the accidents and subsequently deaths occurred in males, a finding that is consistent with the studies in the literature regardless of the community in which the study has been performed.[13,19]

In general, most of the accidents occurred between June to August, a period in Summer when most of the families prefer travelling because of their children holidays.[13] Although this was in line with the other studies in Iran, we wonder why there was a notifying surge in the mortality of traffic accidents occurrence in September. Further investigations in this regard are recommended.

Head and facial trauma are the most frequent source of traumas in this studied population regardless the outcomes.

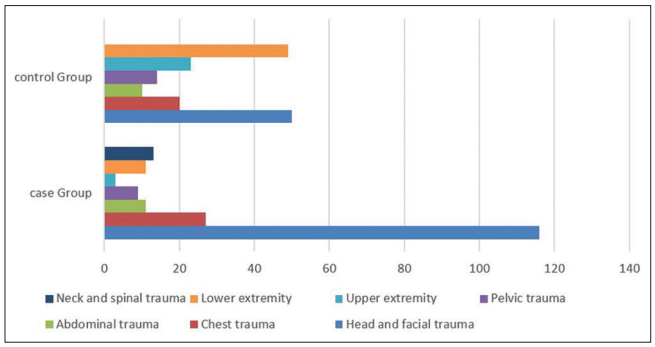

Figure 1: The comparison of trauma sites between the cases and controls

Nevertheless, the frequency of head trauma among those who died following an accident was significantly more compared to the survivors. Intracranial hemorrhage, skull crush with exiting brain contents and brain contusion were the most prominent types of injuries lead to death. Similar outcomes have been proposed by other researchers.[20-22]

Based on the results of our study and consistent with the previous investigations, the majority of deaths have occurred in the early hours after the events; a fact that shows the significance of emergency care as soon as an accident occurrence. Therefore, improvement in the provision of emergency services should be considered in the schedules of health ministry.[23] Promotion of road and vehicle safety are the other strategies that should be considered to minimize the incidence of traffic events and moreover, its adverse outcomes.[24]

Logistic regression evaluations revealed that higher age, facial, head and chest trauma, hemodynamic instability, surgical procedure, on admission intubation and chest tube implantation requirement were the independent predictors for mortality caused by traffic road accidents.

Zangooei Dovom *et al*. investigated the data of fatal traffic accidents in Mashhad, another metropolitan in the East of Iran, in 2012. Similarly, the highest rate of accidents occurred in elderly. However, the type of vehicle by which road accident took place was primarily motorcycles in under 30-year-old deceased individuals that replaced by cars in elderly. In agreement with the present study, hemodynamic instability, chest tube implantation, orotracheal intubation and head injury were the associated factors with death in the hospitalized patients admitted due to road accidents.[25] Hamzeh *et al*. tried to identify the conditions associated with increased risk of mortality due to traffic accidents in a period of 9 years in Western Iran and consistent with us stated head and face injuries along with unstable vital signs as the contributors of death.[26] Sánchez-Mangas *et al*. investigated a large population in Spain in 2010 and represented that head and face injuries along with unstable vital signs on arrival, older age, and the need for mechanical ventilation were the most critical causes of death in traffic accidents.[27]

Statistics from the WHO show that human factors play a major role in traffic accidents, in this regard, the WHO has

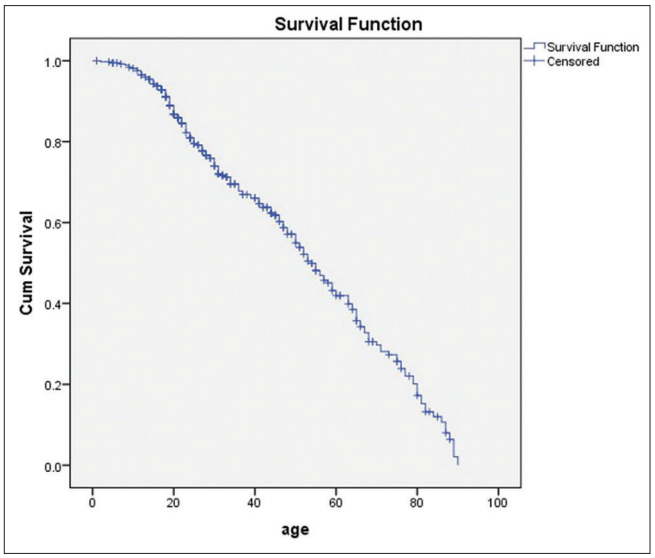

Figure 2: Kaplan–Mayer diagram of age

suggested that the word "accident" should be replaced by the word "injury" to eliminate the conception of human passive role in these events. This shows the significance of preventive strategies administration, especially to reduce high-risk behaviors.[28]

Conclusion

In summary, this study figured out that facial and head, chest, abdominal, pelvic and lower extremity traumas, intubation requirement, and surgery within the first 12 h after the accident were the independent predictors of death due to road accidents. Besides, aging was inversely associated with the survival chances following a road accident. Further investigations are strongly recommended.

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Conflicts of interest

There are no conflicts of interest.

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