

**FATAL TRAFFIC ACCIDENTS- A REVIEW ON THE CAUSES OF MORTALITY IN IRAN**Seyed Mohammad Reza Esmailnejad Ganji<sup>1</sup>, Seyed Mokhtar Esmailnejad Ganji<sup>2</sup><sup>1</sup>MD, Boston University School of Medicine, Boston, U. S. A.<sup>2</sup>Associate Professor, Department of Orthopaedics, Clinical Research Development Center, Shahid Beheshti Hospital, Babol University of Medical Sciences, Babol, Iran.**ABSTRACT****BACKGROUND**

Traffic accidents have remarkably had negative impacts on the patient's life and health systems in Iran and has remained among the most important causes of mortality. In this article, we aimed to review the causes of traffic accidents-related deaths in Iran.

**MATERIALS AND METHODS**

The databases PubMed, Scopus, Web of Sciences were searched using MeSH keywords of "accidents" and "mortality" and "Iran". We also searched the Iranian databases, such as Scientific Information Database and Magiran, using the Persian equivalent of the keywords. The articles which reported causes of traffic accident mortality and published from inception to 2018 were included in this review.

**RESULTS**

Finally, 17 articles were included and reviewed. Six main causes of death were identified through reviewing the papers. There were variations in the rate of mortality causes between different regions. Head trauma was the most common cause of death reported in the studies, with a rate between 38% and 72.4%. Other mortality causes included bleeding (1.25-32.8%), burns (1-2%), central nervous system injury (1.9- 61.8%), multiple fractures (6.3- 47.5%) and multiple trauma (12.6-35%). Undetermined causes were responsible for 0.8-9.8 % of traffic accident mortality.

**CONCLUSION**

According to the results, head trauma was the most common cause of traffic-related mortality in Iran. Altogether, to reduce the rate of road traffic accidents and road traffic accidents related deaths, it is necessary to increase public knowledge regarding risks of unsafe driving, encourage people to use seatbelt and helmet, implement the traffic laws more seriously, raise the road safety standards and improve the emergency services.

**KEYWORDS**

Accidents, Mortality, Cause of Death.

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**BACKGROUND**

Trauma is still among the main causes of mortality and morbidity in the world and Iran is one of the countries in which trauma has negatively had enormous effect on the patient's life and health systems.<sup>(1-3)</sup> Injuries account for approximately 28% of the disability adjusted life years lost (21, 572) in Iran.<sup>(4)</sup> Road traffic accident, as one of the most important injuries, leads to death of 1.25 million people in the world every year, according to the World Health Organization (WHO) report. This rate is nearly 18, 000 people in Iran.<sup>(5)</sup> It is stated that about 1.5 million vehicles are annually added in this country, as the ratio of vehicle to people is 4:1 which is highest among the Eastern Mediterranean countries.<sup>(6,7)</sup> Traffic accidents have considerably more serious outcomes in developing countries versus developed counties and the WHO and World Bank estimate that rate of fatal traffic accident will increase even by 147% within the next two decades in low and middle income countries.<sup>(8-10)</sup>

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Thus, it is necessary to consider traffic crashes as priorities in such communities, such as Iran. In the present study, we aimed to review the causes of death due to traffic accidents in Iran. The obtained data will be useful for the relevant authorities to plan and improve health promotion interventions based on the identified causes of traffic accidents-related mortality.

**MATERIALS AND METHODS**

We searched the literatures from electronic databases PubMed, Scopus, Web of Sciences using MeSH keywords of "accidents" and "mortality" and "Iran". We also searched the Iranian databases, such as Scientific Information Database and Magiran, using the Persian equivalent of the mentioned keywords. The literature published from inception to 2018 was considered for retrieval and discussion. By the way, the studies stated the causes of traffic accident mortality were included. Full-text of the relevant articles were completely reviewed and the necessary data were extracted.

**RESULTS**

Six main causes of death were identified through reviewing the seventeen articles, including bleeding, burns, central nervous system injury, head trauma, multiple fractures, and multiple trauma. Other causes were reported, as well as undetermined causes. There were variations in the frequency of mortality causes between different regions (Table 1).

Study Place	Author	Publication Date	Study Date	Death Nos.	Cause Rate (%)
<b>Bleeding</b>					
Amol	Nazari <sup>(11)</sup>	2010	2007	125	32
East Azerbaijan	Sadeghi-Bazargani <sup>(12)</sup>	2018	2006-2014	7818	8.6
East Azerbaijan	Sadeghi-Bazargani <sup>(13)</sup>	2018	2006-2016	1357	32.8
Fars	Heydari <sup>(14)</sup>	2013	2009-2011	3642	13.2
Fars	Hasanzadeh <sup>(15)</sup>	2014	2004-2010	5840	5
Fars	Rakhshani <sup>(16)</sup>	2016	2011-2012	1668	12
Kerman	Ghadipasha <sup>(17)</sup>	2015	-	1185	7.8
Nationwide	Montazeri <sup>(18)</sup>	2003	1999-2000	15045	10
Qom	Parvaresh Masoud <sup>(19)</sup>	2017	2014	80	1.25
Semnan	Hasani <sup>(20)</sup>	2016	2011	331	8.5
Tabriz	Gholipour <sup>(21)</sup>	2016	2013-2014	160	28.1
Tehran	Sanaei-Zadeh <sup>(22)</sup>	2002	2000-2001	2128	11.1
Yazd	Moharamzad <sup>(23)</sup>	2008	2006	251	16
Yazd	Fallahzadeh <sup>(24)</sup>	2011	2003-2008	2565	11.4
<b>Burns</b>					
East Azerbaijan	Sadeghi-Bazargani <sup>(13)</sup>	2018	2006-2016	1357	2
Kermanshah	Hamzeh <sup>(25)</sup>	2016	2004-2013	5110	1
<b>Central Nervous System Injury</b>					
Tabriz	Gholipour <sup>(21)</sup>	2016	2013-2014	160	60.6
Tehran	Sanaei-Zadeh <sup>(22)</sup>	2002	2000-2001	2128	1.9
Yazd	Moharamzad <sup>(23)</sup>	2008	2006	251	61.8
<b>Head Trauma</b>					
Amol	Nazari <sup>(11)</sup>	2010	207	125	57.6
East Azerbaijan	Sadeghi-Bazargani <sup>(12)</sup>	2018	2006-2014	7818	62.5
East Azerbaijan	Sadeghi-Bazargani <sup>(13)</sup>	2018	2006-2016	1357	81
Fars	Heydari <sup>(26)</sup>	2012	2009-2010	2345	70.8
Fars	Heydari <sup>(14)</sup>	2013	2009-2011	3642	72.4
Fars	Hasanzadeh <sup>(15)</sup>	2014	2004-2010	5840	38
Fars	Rakhshani <sup>(16)</sup>	2016	2011-2012	1668	72
Kerman	Ghadipasha <sup>(17)</sup>	2015	-	1185	63.4
Kermanshah	Hamzeh <sup>(25)</sup>	2016	2004-2013	5110	69.9
Mazandaran	Janmohammadi <sup>(27)</sup>	2009	2002-2004	348	50.6
Nationwide	Montazeri <sup>(18)</sup>	2003	1999-2000	15045	66
Qom	Parvaresh Masoud <sup>(19)</sup>	2017	2014	80	45
Semnan	Hasani <sup>(20)</sup>	2016	2011	331	44.1
Tehran	Sanaei-Zadeh <sup>(22)</sup>	2002	2000-2001	2128	49.8
Yazd	Fallahzadeh <sup>(24)</sup>	2011	2003-2008	2565	70.2
<b>Multiple Fractures</b>					
Amol	Nazari <sup>(11)</sup>	2010	2007	125	9.6
East Azerbaijan	Sadeghi-Bazargani <sup>(12)</sup>	2018	2006-2014	7818	14
East Azerbaijan	Sadeghi-Bazargani <sup>(13)</sup>	2018	2006-2016	1357	6.3
Fars	Heydari <sup>(14)</sup>	2013	2009-2011	3642	11.6
Fars	Hasanzadeh <sup>(15)</sup>	2014	2004-2010	5840	27
Fars	Rakhshani <sup>(16)</sup>	2016	2011-2012	1668	12
Kerman	Ghadipasha <sup>(17)</sup>	2015	-	1185	21
Nationwide	Montazeri <sup>(18)</sup>	2003	1999-2000	15045	8
Qom	Parvaresh Masoud <sup>(19)</sup>	2017	2014	80	47.5
Semnan	Hasani <sup>(20)</sup>	2016	2011	331	41
Yazd	Fallahzadeh <sup>(24)</sup>	2011	2003-2008	2565	8.6
<b>Multiple Trauma</b>					
Kermanshah	Hamzeh <sup>(25)</sup>	2016	2004-2013	5110	12.6
Tehran	Sanaei-Zadeh <sup>(22)</sup>	2002	2000-2001	2128	35
<b>Not Defined</b>					
Amol	Nazari <sup>(11)</sup>	2010	2007	125	0.8
East Azerbaijan	Sadeghi-Bazargani <sup>(13)</sup>	2018	2006-2016	1357	9.8
Nationwide	Montazeri <sup>(18)</sup>	2003	1999-2000	15045	3
Qom	Parvaresh Masoud <sup>(19)</sup>	2017	2014	80	1.25
<b>Other Causes</b>					
East Azerbaijan	Sadeghi-Bazargani <sup>(12)</sup>	2018	2006-2014	7818	11.3
East Azerbaijan	Sadeghi-Bazargani <sup>(13)</sup>	2018	2006-2016	1357	8.4
East Azerbaijan	Sadeghi-Bazargani <sup>(13)</sup>	2018	2006-2016	1357	7
Fars	Heydari <sup>(26)</sup>	2012	2009-2010	2345	29.2
Fars	Heydari <sup>(14)</sup>	2013	2009-2011	3642	6.6
Fars	Hasanzadeh <sup>(15)</sup>	2014	2004-2010	5840	30

Kermanshah	Hamzeh <sup>(25)</sup>	2016	2004-2013	5110	9
Kermanshah	Hamzeh <sup>(25)</sup>	2016	2004-2013	5110	7.5
Nationwide	Montazeri <sup>(18)</sup>	2003	1999-2000	15045	13
Tehran	Sanaei-Zadeh <sup>(22)</sup>	2002	2000-2001	2128	0.6
Yazd	Fallahzadeh <sup>(24)</sup>	2011	2003-2008	2565	6.1
<b>Table 1. Studies evaluating Causes of Traffic Accident Mortality in Iran</b>					

### Bleeding

Thirteen articles from 9 different regions and 1 national study reported the rate of accident mortality for bleeding between 1.25% (Qom)<sup>(19)</sup> and 32.8% (East Azerbaijan).<sup>(13)</sup> Bleeding or haemorrhage is not unexpected in the traffic accidents, but based on severity and degree, it has its own priority for management. Bleeding can represent as internal and external types following trauma. Internal bleeding can occur in different organs and parts of the body, such as head (Subarachnoid or subdural haemorrhage), kidney, liver, and retroperitoneal space. In the study by Ghadipasha et al.<sup>(17)</sup> In Kerman, internal bleeding was responsible for 7.8% of deaths in 1185 victims. This rate was reported 11.1% in the study by Sanaei-Zadeh et al.<sup>(22)</sup> in Tehran, and 8% in Moharamzad et al.'s study<sup>(23)</sup> in Yazd. Also, Moharamzad et al.<sup>(23)</sup> Stated that 8% of 251 people died due to lower limb haemorrhage.

Early hypotension and haemorrhagic shock can lead to remarkable complications, such as eventual organ failure and the development of infections, including sepsis.<sup>(28,29)</sup> Prehospital emergency care has a vital role in this regard. Early diagnosis and assessment of bleeding severity, rapid primary intervention in the first hours of traffic accident and then transportation of patients from the scene of accident to definitive trauma center care can efficiently decrease risk of mortality and morbidity. Overall, interventions to improve haemostasis in traumatic cases are classified as four phases: A) Prehospital interventions (Control overt haemorrhage, direct pressure, pressure dressing or tourniquet, diagnose and treat occult haemorrhage, stabilization of pelvis and long bone fractures, keep patient warm); (B) Resuscitative phase (Warmed intravenous fluids, hypotensive resuscitation prior to surgical control of haemorrhage, appropriate transfusion of blood and blood products); (C) Operative phase (Surgical control of life-threatening haemorrhage, damage control operations for critically ill patients, appropriate transfusion of blood and blood products); (D) Critical care phase (Effective resuscitation, end-points of tissue perfusion, physiologic support to prevent coagulopathy).<sup>(30)</sup>

### Burns

Limited data were found regarding burns and their frequency in list of morality causes. One study in East Azerbaijan<sup>(13)</sup> and one study in Kermanshah<sup>(25)</sup> reported rates of 2% and 1% among 1357 and 5110 deaths for burns, respectively. Previously, Purdue et al.<sup>(31)</sup> reported a mortality rate of 24.7% in the United States This rate was 11% in Bunn et al.'s study.<sup>(32)</sup>

Despite technical improvements by the automobile industry, burned patients due to traffic crashes have been remained dramatic in clinical routine.<sup>(33)</sup> Traffic accident burn injuries are typically categorized as three groups: Heat burns, electrical burns, chemical burns. Among them, heat burns are the most frequent type related to traffic accident victims. The first step for management of burns in determination of burn type and its extent.

Thereafter, measures should be taken to decrease victims' pain and potential infection. Simultaneously, fluid therapy containing resuscitation and maintenance needs to be done.

### Central Nervous System Injury

After reviewing the available data, three articles reported variable rates of traffic accident mortality for central nervous system (CNS) injury, from 1.9% in Tehran<sup>(22)</sup> to 61.8% in Yazd.<sup>(23)</sup> These two were of course related to cervical spinal cord injury.

CNS injury outcomes following traffic crashes depend on place of injury and its severity. Patients may experience different symptoms after CNS traffic injury from the first hours to next times, including headaches, migraines, tingling and numbness. At the scene of accident, we need to think about the spine protection (Especially cervical spine) as a priority. Neck protection can be facilitated with appropriate cervical immobilization devices (e.g., hard collar and tape), if not available, sandbags or rolled-up pieces of clothing can be used.<sup>(34,35)</sup>

### Head Trauma

Head trauma was reported as the most common cause of death in almost all of the included articles. Its rate was between 38% and 72.4%. A national study by Montazeri et al.<sup>(18)</sup> Reported a rate of 66%. Head injury was the most frequent cause of death in other countries as well, for instance, 78.7% in Vietnam,<sup>(36)</sup> 66.4% in Karachi, Pakistan,<sup>(37)</sup> and 48.3% in Nigeria.<sup>(38)</sup> Study by Hamzeh et al.<sup>(25)</sup> Stated a rate of 69.9%, which was higher in drivers (73.1%) than in occupants (71.9%) and in pedestrians (64.3%). This difference can be explained by various road user types.

Head trauma and intracranial haemorrhage are closely linked to each other, as the trauma is one of the principle causes of intracranial bleeding.<sup>(39)</sup> Previous surveys revealed that helmet and seat belt use could provide adequate protection and reduce the severity of head injury and resultant traffic accident mortality by at least 50%.<sup>(40)</sup> However, use of helmet in Iran is not usual, for example, and two studies from Tehran alluded to its use only by 6% and 8% of motorcyclists.<sup>(41,42)</sup> An investigation from Shiraz reported the total estimated costs of 513 billion Rials (20.7 million USD) by brain trauma deaths resulting from traffic accidents during 2009 to 2013.<sup>(43)</sup> Altogether, it is highly the necessary measures should be performed to increase public awareness toward importance of helmet and seatbelt use by the relevant authorities and policy-makers. Also, the mandatory seatbelt and helmet laws need to be enforced more seriously.

### Multiple Fractures

Eleven articles reported various rates of causality for multiple fractures between 6.3% in East Azerbaijan<sup>(13)</sup> and 47.5% in Qom.<sup>(8)</sup> In Moharamzad et al.'s study<sup>(23)</sup> in Yazd,

skull base fracture with rate of 10% and skull vault fracture with rate of 4% were identified as causes of fatal traffic accidents. An investigation from India reported that near 70% of the vehicular deaths was related to skull fractures.<sup>(44)</sup> Fractures were among the most common injuries following traffic accidents in the previous studies.<sup>(45,46)</sup>

To manage fractures, both of non-operative and operative techniques can be used. In non-operative approach, closed reduction and immobilization with casting or splinting are used for the patients whose fractures are displaced or angulated. Blood supply and soft-tissue health are the most important factors in fractures healing. Although indications for surgical intervention is determined by the surgeon, some of them include failed non-operative (Closed) management, unstable open fractures, and non-unions or malunions.<sup>(47,48)</sup>

### Multiple Trauma, and Other Causes

Two reports were available on multiple trauma. One study in Kermanshah revealed a rate of 12.6%<sup>(25)</sup> and another study in Tehran alluded to a rate of 35%.<sup>(22)</sup> A recent systematic review stated that brain trauma is an early cause of death after multiple trauma (up to 24 hours of the injury) and the second frequent cause of death results from thoracic or abdominal injuries.

A survey by Hamzeh et al.<sup>(25)</sup> Expressed that limb injury was responsible for morality of 7.5% of victims in Kermanshah. Mixed causes of death were reported by Sadeghi-Bazargani et al. in two articles in East Azerbaijan, with rates of 11.3%<sup>(12)</sup> and 8.4%.<sup>(13)</sup> A series of undetermined causes was mentioned in reports from Amol (0.8%),<sup>(11)</sup> East Azerbaijan (9.8%),<sup>(13)</sup> Qom (1.25%) and nation (3%).<sup>(19)</sup> Others causes of traffic accidents mortality were stated by the researchers in eight studies but without more explanations and details.<sup>(13,22,25,18,26,14,15,24)</sup>

### CONCLUSION

Our results show that head trauma was the most common cause of traffic-related mortality in Iran. Furthermore, bleeding, burns, and multiple fractures were other main causes. To reduce the rate of road traffic accidents and road traffic accidents related deaths, it is necessary to increase public knowledge about risks of unsafe driving, encourage people to use seatbelt and helmet, implement the traffic laws more seriously, raise the road safety standards and improve the emergency services.

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