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Epidemiology of injuries among patients admitted to Imam Khomeini Hospital, Urmia, affiliated with the national trauma registry of Iran

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Abstract: **Objective:** Trauma is one of the major causes of mortality and morbidity globally. The current study aimed to improve the understanding of characteristics, severity of injuries and outcomes of trauma patients admitted to Imam Khomeini Hospital, Urmia, Iran.

Methods: Data were obtained from the trauma registry of Imam Khomeini Hospital, a level 1 trauma referral center, for all patients admitted to the center from 17 september 2016 to 21 January 2023. Patients' demographics, injury mechanisms, and patients' outcomes were analyzed.

Results: The emergency department attended to 5555 trauma patients. The gender distribution was with 3998 (71.9%) males and 1557 (29.1%) females. Patients' age ranged from 1 to 101 years, with a mean±standard deviation (SD) of 33.1 (±20.7) years. Road traffic accidents followed by falls were the most common causes of traumas reported in 2138 (38.5%) and 1298 (23.4%) trauma patients, respectively. The in-hospital mortality rate was 0.9% (53 patients). The mean (±SD) age of death was 43.5 (±22.4) years. 569 (10.2%) patients were admitted to the intensive care unit (ICU). The univariable logistic regression models showed that there were significant associations between age (P<0.001), Glasgow coma scale (GCS) (P<0.001), injury severity score (ISS) (P<0.001), and mechanical ventilation (P<0.001) as independent variables and death outcome. The univariable and multiple logistic regression analyses showed statistically significant associations between age, cause of trauma, ISS, GCS and body site injury with ICU admission. The odds of ICU admission in patients after being adjusted for age, ISS, GCS, cause of trauma and type of transportation was 1.73 times higher in head, face, and neck injuries compared to limb injuries. (adjusted OR: 1.73, [95% CI: 1.23,2.42]; P<0.01).

Conclusion: Older age, low GCS, higher ISS and mechanical ventilation were associated with higher mortality. Older age, higher ISS, lower GCS, body site injury, type of transportation, and cause of trauma were all significant independent predictors of ICU admission.

Keywords: National Trauma Registry of Iran; Registry; Trauma

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1. Introduction

Trauma is one of the major causes of mortality and morbidity in both developed and developing countries. Trauma injuries lead to five million deaths annually (1). Nearly 50% of trauma-related deaths are under 44, affecting a large proportion of any nation's productive workforce (1). Road traffic crashes (RTCs), falls, penetrating injuries, burns, poisonings, self-inflicted injuries, suicides, and interpersonal violence are some of the most common forms of trauma (2). Furthermore, a huge percentage of patients sustain nonfatal injuries resulting in disability, which necessitates long-term rehabilitation (2). Trauma can have numerous negative consequences on nations, particularly concerning economic issues. The economic influence of trauma on developing countries is undeniable (1). In 2019, the world health organization (WHO) published an instruction indicating that low- and middle-income countries (LMICs) experience a significant number of fatalities due to RTCs each year (2).

Iran, classified as a middle-income country with a population of over 87 million people, faces great challenges in addressing the high rates of trauma-related mortality and morbidity (3). The WHO's global status report on road safety showed that in the past year, 1,354,840 fatalities related to RTCs occurred in Iran (4). RTCs accounted for 1.06% (95% CI: 0.94,1.20) and 5.63% (95% CI: 4.83,6.58) of years lived with disability (YLDs) and disability-adjusted life years (DALYs), respectively, in the Iranian population (5). The implementation of trauma systems in developed countries has resulted in lower mortality and morbidity (6). However, there are significant barriers to accessing high-quality trauma data in developing countries (7,8).

WHO released an instruction on trauma care quality improvement in 2009 to lower the number of trauma-related deaths in LMICs (8). This article stresses on the significance of "developing hospital trauma care systems and evaluating the quality of care through the implementation of good practices on trauma care systems and quality assurance" (9).

The trauma registry is a crucial data analysis tool that records the epidemiology, management according to guidelines, and trauma care results, enabling quality improvement in trauma systems (6,10). Furthermore, it is utilized to evaluate the performance of trauma systems in improving strategies for the prevention of trauma (11,12). Trauma registries' ultimate goal is to enhance the efficacy of care for injured patients resulting in lower morbidity and mortality rates worldwide (13,14). There are significantly fewer trauma registries in Asia, South America, and Africa than in developed countries (11). The national trauma registry of Iran (NTRI) was formed at Sina hospital, affiliated with Tehran University of Medical Sciences, for the first time in 2016 (15,16). The NTRI is a multicenter registry established in several Iran's leading trauma centers with the ministry of health and medical education (MOHME) (16).

Urmia is the largest city located in the center of the West Azarbaijan province in Iran (17). This study aimed to assess the epidemiology of injuries in trauma patients admitted to Imam Khomeini hospital in Urmia, Iran, as a referral level 1 trauma university hospital and one of the collaborators of NTRI.

2. Methods

2.1. Study design

This is a cross sectional, registry-based study performed from September 17, 2016, to January 21, 2023 using the NTRI database. The NTRI is a hospital-based registry among 25 major trauma centers nationwide (16,18) and Imam Khomeini hospital, located in Urmia, is one of the collaborating centers. The NTRI's registration method, minimum dataset, and data quality assessment have been discussed in detail previously (15,16). We included all trauma patients referred to Imam Khomeini hospital who were admitted for more than 24 hours, who died on their first day of admission, and also those who were transferred from other hospitals' intensive care units (ICUs) without considering time limits. We excluded patients discharged from the hospital within 24 hours (with the exception of those who died during their hospital stay) and trauma patients referred to the hospital for follow-up reasons such as pin removal, surgical site infections (SSI), etc.

2.2. Data collection

The data collection process is the same in all of the NTRI's collaboration centers. The registration process is divided into several phases. Patients eligible to enroll in the research are identified after admitting to the hospital in the first step. Patients' verbal informed consent is obtained regarding ethical considerations. In each collaborating center, trained interviewers complete checklists related to demographic features, mode of injury characteristics, prehospital data, and emergency department (ED) information by interviewing the patient or the patient's companion, patient examination, and reviewing their hospital records. Remaining data including diagnosis, complications, outcome, and injury severity, are completed after the patient is discharged. Data collected are then entered and saved into the NTRI's online portal. Professional supervisors thereby evaluate the accuracy of the data. Previous articles have discussed the data collection process in detail (15,19).

2.3. Variables

Gender, age, marital status, level of education, time of admission, type of transportation, cause of trauma, injury severity score (ISS), ICU admission, body site injury, Glasgow coma scale (GCS), need for mechanical ventilation, and mortality were examined in this study. We categorized patients' education into four groups: no formal education (illiterate), primary education, secondary education, and higher education (university education). We classified the type of transportation into three groups: ambulance, private cars, and other (police, public transportation, and by foot). The cause of trauma was divided into eight categories: RTCs, falls, stab wounds, blunt trauma, burns, poisoning, gunshot, and others (i.e., animal bite, traumatic asphyxia, electrical injury, and blast injury). The abbreviated injury scale (AIS) was applied to grading injury severity. The ISS in specific regions was summed up using AIS. In this study, we considered ISS scores of 1 to 8 as mild injury, 9 to 15 as moderate injury, and a score of 16 and above as severe (14,20). The GCS score is an important tool in assessing and managing patients with brain injuries, as it can help predict their prognosis and guide their mangement. The GCS score is calculated by adding up the scores for eye-opening, verbal, and motor responses. The total score ranges from 3 (deep coma) to 15 (fully awake and alert). A GCS score of 8 or less indicates a severe brain injury, while a score of 9-12 indicates a moderate brain injury and a score of 13-15 indicates a minor brain injury (21). In our study, multiple trauma was defined as having two or more trauma body sites with AIS≥3 (22). To assess the outcome of mortality, we defined it as any death related to the trauma that occurred after hospital arrival. We reviewed medical records and hospital databases to determine the number of patients who died during their hospital stay. Specifically, we assessed mortality by identifying patients who died as a result of their trauma-related injuries, and excluded deaths that were not related to the trauma (16).

2.4. Statistical analysis and ethical consideration

Nominal and categorical variables were described using frequency and percentage. The chi-squared test assessed the association between nominal and categorical variables with gender. Logistic regression models assessed the association between covariates and in-hospital mortality and ICU admission. P<0.05 was considered statistically significant. Statistical analyses were accomplished utilizing the STATA software version 15.0 (Stata Corp, College Station, TX, USA). This research was confirmed by the ethics committee of Sina hospital, Tehran University of Medical Sciences, with the ethics code: IR.TUMS.SINAHOSPITAL.REC.1399.090.

3. Results

A total of 5555 trauma patients admitted to Imam Khomeini hospital were included in this study. Patients' ages ranged from 1 to 101 years, with a mean±standard deviation (SD) of 33.1 (±20.7) years. Three thousand nine hundred ninety-eight (71.9 %) were males and 1557 (28.0 %) were females. 40.2% of females and 18.1% of males had no formal education. RTCs and falls accounted for the cause of trauma in 2138 (38.5%) and 1298 (23.4%) cases respectively. The incidence of other trauma injuries are as follows: stab wounds 1083 (19.5%), blunt traumas 524 (9.4%), burns 252 (4.5%). The type of transportation was by ambulance in 2077 (37.5%) patients and private transport in 3277 (59.2%) patients (Table1).

In this study, 569 (10.2%) patients were admitted to the ICU, and a total of 53 (0.9%) patients died during their stay at the hospital (Table 2). The age of patients who suffered death due to trauma had a mean (±SD) age of 43.5 (±22.4) years. Among these patients, 11 (2.2%) were above 65 years of age and 152 (30.6%) were admitted to the ICU. The results of univariate logistic regression models showed that increasing age was associated with increased mortality and ICU admission. The odds of mortality in geriatric (≥65 years) and adult (18-64 years) patients were 7.61 and 3.48 times more than the odds of mortality in pediatrics (<18 years), respectively. No statistically significant differences in mortality and ICU admission were found between men and women. Patients who were brought to the hospital by ambulance had greater mortality than those transported by private car (Crude OR: 6.12, [95% CI: 3.14,11.92]; P<0.001). Additionally, individuals who were taken to the hospital via ambulance had higher rates of ICU admission compared to those transported in private vehicles (Crude OR: 4.44, [95% CI: 3.67,5.37]; P<0.001). Of those with ISS scores higher than 16, 17 (18.1%) died, and 35 (37.2%) were admitted to the ICU. We observed 25 (29.8%) deaths and 76 (90.5%) ICU admissions among patients with GCS between 3 and 8. GCS, ISS, and mechanical ventilation were all associated with mortality and ICU admission in patients (Table 2).

Table 3 compares ICU admission and mortality in patients with different body site injuries. Both mortality and ICU admission rates were significantly higher in patients with head/face/neck, abdomen, spine, and multiple traumas injuries than in patients with upper and lower limbs injuries. Abdominal injuries increased the odds of ICU admission by 2.64 times compared to the extremities (Crude OR: 2.64, [95% CI: 1.67,4.16]; P-value<0.001). Meanwhile, the odds for death were 18.36 times more in patients with multiple traumas compared to the patients with either upper or lower limb injuries (Crude OR: 18.36, [95% CI: 7.87,42.81]; P-value<0.001). The odds of being admitted to the ICU were 6.93 times higher in patients who had multiple traumas compared to those who only had injuries to their upper or lower limbs (Crude OR: 6.93, [95% CI: 5.45,8.83]; P-value<0.001).

Table 4 revealed the findings of the multiple logistic regression model. Age, GCS, type of transportation, cause of trauma, ISS, and body site injury were introduced to the model. After adjusting other factors, the odds of ICU admission in patients aged 65 years and older was 8.15 times more than in patients aged 18 years and younger (Adjusted OR: 8.15, [95% CI: 5.42,12.25]; P-value<0.001). After adjusting for other covariates, the odds of ICU admission in patients transported to the hospital by ambulance was 1.69 times more than in patients transported by private car (Adjusted OR: 1.69, [95% CI: 1.31,2.19]; P-value<0.001). ICU admission was 54.56 times higher for those with severe GCS compared to those with mild GCS after controlling for other variables (Adjusted OR: 54.56, [95% CI: 22.88,130.12]; P<0.001). In addition, after controlling confounding factors, patients with severe ISS had considerably increased ICU admission odds (Adjusted OR: 4.37, [95% CI: 2.07,9.24]; P-value<0.001). Considering the site of injury, the highest ICU admission odds belonged to abdomen injuries after controlling other covariates (Adjusted OR: 6.95, [95% CI: 3.46,13.94]; P-value<0.001) (Table 4).

4. Discussion

This study revealed that majority of trauma cases were male, similar to the statistics reported by many articles from Iran and other countries (12,18-21). Socioeconomically in Iran, men are more likely to engage in outdoor activities than women, therefore they are more vulnerable to the effects caused by trauma.

Results showed that RTCs were the most common cause of trauma, followed by falls and stab/cut wounds. These findings are consistent with other studies. According to statistics from the NTRI's prior studies and the study on southern Iranian trauma patients, the most common cause of trauma

Table 1 Baseline characteristics of trauma patients by gender

		Female **N (%)** **(N=1557)**	**Male** **N (%)** **(N= 3998)**	**Total** **N (%)** **(N=5555)**	**P-value**
Age, year					<0.001
	<18	**412 (26.5)**[a]	**938 (23.5)**	1350 (24.3)	
	18-64	**904 (58.1)**	**2798 (70.1)**	3702 (66.7)	
	≥65	**240 (15.4)**	**257 (6.4)**	497 (9.0)	
	Missing	1	5	6	
Education					<0.001
	No formal education	**625 (40.2)**	**720 (18.1)**	1345 (24.3)	
	Primary education	380 (24.5)	979 (24.6)	1359 (24.5)	
	Secondary education	444 (28.6)	1963 (49.3)	2407 (43.5)	
	Higher education	**105 (6.8)**	**322 (8.1)**	427 (7.7)	
	Missing	3	14	17	
Marital status					<0.001
	Single	556 (36.2)	1896 (48.2)	2452 (44.9)	
	Married	796 (51.8)	1956 (49.8)	2752 (50.3)	
	Divorced/widow	**184 (12.0)**	**79 (2.0)**	263 (4.8)	
	Missing	21	67	88	
Cause of trauma					<0.001
	Road traffic crash	**558 (35.8)**	**1580 (39.5)**	2138 (38.5)	
	Fall	**486 (31.2)**	**812 (20.3)**	1298 (23.4)	
	Stab/cut	**226 (14.5)**	**857 (21.4)**	1083 (19.5)	
	Blunt	**107 (6.9)**	**417 (10.4)**	524 (9.4)	
	Poisoning	**46 (3.0)**	**48 (1.2)**	94 (1.7)	
	Burns	94 (6.0)	158 (4.0)	252 (4.5)	
	Gunshot	**5 (0.3)**	**43 (1.1)**	48 (0.9)	
	Others	35 (2.2)	83 (2.1)	118 (2.1)	
Type of transportation					**0.10**
	Ambulance	552 (35.6)	1525 (38.3)	2077 (37.5)	
	Private car	940 (60.6)	2337 (58.6)	3277 (59.2)	
	Others	59 (3.8)	124 (3.1)	183 (3.3)	

[a] : Bold indicates column proportions that differ significantly at the 0.05 level

admission was RTC (12,18,22). Iran had an age-standardized fatality rate for RTC that was more than double the global average (23-25). The most frequent reasons for RTCs on Iranian roads were poor road conditions and violation of traffic laws (23). In our study, patients with RTC-related injuries had more ICU admission and death rates than most other trauma causes. Rasouli et al. showed the same result and expressed that RTC was the primary reason for injury-related mortality in Iran (29). In a study by Sharif-Alhoseini et al. injuries due to fall and RTCs had higher ICU admission rates (12). Naghavi, et al.'s study, showed that fall- and RTC-related injuries were the leading causes of ICU admission (35).

The study also found that older age was associated with increased mortality and ICU admission. This finding is consistently observed in other studies. The NTRI's pilot study showed that the chance of mortality increased for each extra year of life (15). GCS, ISS, and mechanical ventilation were all associated with mortality and ICU admission in patients. The wide confidence intervals can be due to a small number of patients with ISS≥16 and GCS≤12 and patients who underwent mechanical ventilation. This finding is aligned with previous studies that have shown the importance of these factors in predicting outcomes in trauma patients. In a study by Khaleghi-Nekou et al. low GCS and high ISS scores were predictors of ICU admission in trauma patients (15). Saberian et al.'s study introduced higher ISS and intubation status as predictors of in-hospital mortality following trauma (14). According to the NTRI's Kashan center findings, ISS≥9, age≥65, and blunt trauma were all significant factors of ICU admission (18). Macleod et al. conducted a five-year research on 14,397 patients and concluded that older age and ISS were major predictors of mortality (24). Furthermore, after controlling other factors, older age, severe GCS, and higher ISS scores were associated with higher ICU admission rates. Healthcare professionals should consider the above factors when prioritizing resources in managing trauma patients in order to improve patients' outcomes. We could not report the multiple logistic regression model for death outcome as we had only 53 cases of in-hospital deaths.

In this study, the type of transportation 37.5% was via ambulance, while 62.5% of the patients were conveyed through non-specialized vehicles. Patients brought in by ambulance had greater mortality and higher rates of ICU admission compared to those transported by private transportation. Our finding is in conjunction with previous studies (25-29). The study of Wandling et al. was a retrospective cohort study from the national trauma data bank which included 103,029 patients. The study concluded that private

Table 2 Associated factors in ICU admission and mortality

		In-hospital mortality		Crude OR (95% CI)	P-value	ICU admission		Crude OR (95% CI)	P-value
		Alive N (%) (N= 5502)	**Dead N (%) (N= 53)**			**No N (%) ((N= 4986)**	**Yes N (%) (N= 569)**		
Age									
	<18	1346 (99.7)	4 (0.3)	1	-	1285 (95.2)	65 (4.8)	1	-
	18-64	3664 (99.0)	38 (1.0)	**3.48 (1.24,9.79)**[a]	0.01	3351 (90.5)	351 (9.5)	**2.07 (1.57 to 2.71)**	<0.001
	≥65	486 (97.8)	11 (2.2)	**7.61 (2.41, 24.03)**	<0.01	345 (69.4)	152 (30.6)	**8.70 (6.36 to 11.92)**	<0.001
Gender									
	Male	3958 (99.0)	40 (1.0)	1	-	3603 (90.1)	395 (9.9)	1	-
	Female	1544 (99.2)	13 (0.8)	0.83 (0.44, 1.56)	0.56	1383 (88.8)	174 (11.2)	1.14 (0.95, 1.38)	0.15
Time of admission									
	Day (6AM-6PM)	2488 (99.0)	26 (1.0)	1	-	2253 (89.6)	261 (10.4)	1	-
	Night (6PM-6AM)	2995 (99.1)	27 (0.9)	0.86 (0.50, 1.48)	0.59	2714 (89.8)	308 (10.2)	0.97 (0.82,1.16)	0.81
Type of transportation									
	Ambulance	2035 (98.0)	42 (2.0)	**6.12(3.14, 11.92)**	<0.001	1681 (80.9)	396 (19.1)	**4.44 (3.67, 5.37)**	<0.001
	Private car	3266 (99.7)	11 (0.3)	1	-	3112 (95.0)	165 (5.0)	1	-
	Others	183 (100.0)	0 (0.0)	1	-	175 (95.6)	8 (4.4)	0.86 (0.41, 1.78)	0.68
Cause of trauma									
	Road traffic crash	2105 (98.5)	33 (1.5)	1	-	1790 (83.7)	348 (16.3)	1	-
	Fall	1289 (99.3)	9 (0.7)	**0.44 (0.21, 0.93)**	0.03	1136 (87.5)	162 (12.5)	**0.73 (0.60, 0.89)**	<0.01
	Stab/ cut	1083 (100.0)	0 (0.0)	1	-	1065 (98.3)	18 (1.7)	**0.08 (0.05,0.14)**	<0.001
	Blunt	523 (99.8)	1 (0.2)	**0.12 (0.01, 0.89)**	0.03	511 (97.5)	13 (2.5)	0.13 (0.74, 0.22)	<0.001
	Poisoning	94 (100.0)	0 (0.0)	1	-	86 (91.5)	8 (8.5)	**0.47 (0.22,0.99)**	0.04
	Burns	243 (96.4)	9 (3.6)	**2.3 (1.10,4.90)**	0.02	251 (99.6)	1 (0.4)	**0.02 (0.002, 0.14)**	<0.001
	Gunshot	48 (0.0)	0 (0.0)	1	-	40 (83.3)	8 (16.7)	1.02 (0.47,2.21)	0.94
	Others	117 (99.2)	1 (0.8)	0.54 (0.07,0.02)	0.50	107 (90.7)	11 (9.3)	**0.52 (0.28,0.99)**	0.04
ISS[b]									
	Mild (1-8)	4139 (99.7)	11 (0.3)	1	-	3920 (94.5)	230 (5.5)	1	-
	Moderate (9-15)	846 (97.1)	25 (2.9)	**11.11 (5.45, 22.68)**	<0.001	586 (67.3)	285 (32.7)	**8.28 (6.82,10.06)**	<0.001
	Severe (≥16)	77 (81.9)	17 (18.1)	**33.53 (37.65, 183.26)**	<0.001	59 (62.8)	35 (37.2)	**10.11 (6.51, 15.67)**	<0.001
Mechanical ventilation									
	No	5383 (99.7)	18 (0.3)	1	-	4968 (92.0)	433 (8.0)	1	-
	Yes	119 (77.3)	35 (22.7)	**87.95 (48.42, 159.75)**	<0.001	18 (11.7)	136 (88.3)	**86.68 (52.51, 143.11)**	<0.001
GCS[c]									
	13-15	5330 (99.7)	17 (0.3)	1	-	4914 (91.9)	433 (8.1)	1	-
	9-12	88 (88.9)	11 (11.1)	**39.19 (17.83, 86.10)**	<0.001	39 (39.4)	60 (60.6)	**17.45 (11.52, 26.43)**	<0.001
	3-8	59 (70.2)	25 (29.8)	**132.85 (68.15, 258.95)**	<0.001	8 (9.5)	76 (90.5)	**107.81 (51.69,224.86)**	<0.001

[a] : Bold indicates column proportions that differ significantly at the 0.05 level; [b] : Injury severity score;
[c] : Glascow coma score; ICU: Intensive care unit; OR: Odds ratio; CI: Conficence interval

Table 3 Association between injury site with ICU admission and mortality

Body region	In-hospital mortality		Crude OR (95% CI)	P-value	ICU admission		Crude OR (95% CI)	P-value
	Alive N (%) (N= 5502)	Dead N (%) (N= 53)			No N (%) (N= 4986)	Yes N (%) (N= 569)		
Head/neck/ face	830 (98.5)	13 (1.5)	**6.9 (2.85,16.70)**[a]	<0.001	726 (86.1)	117 (13.9)	**2.25 (1.77,2.85)**	<0.001
Thorax	208 (99.0)	2 (1.0)	4.23 (0.89,20.08)	0.06	182 (86.7)	28 (13.3)	2.14 (1.41,3.26)	<0.001
Abdomen	149 (98.7)	2 (1.3)	**5.91 (1.24,28.10)**	0.02	127 (84.1)	24 (15.9)	**2.64 (1.67,4.16)**	<0.001
Spine	77 (97.5)	2 (2.5)	**11.44 (2.39, 54.79)**	<0.01	62 (78.5)	17 (21.5)	**3.83 (2.20,6.65)**	<0.001
Upper limb	2098 (100.0)	0 (0.0)	1	-	2056 (98.0)	42 (2.0)	1	-
Lower limb	1428 (99.4)	8 (0.6)	1	-	1242 (86.5)	194 (13.5)	1	-
Unspecified	304 (97.1)	9 (2.9)	**13.04 (4.99, 34.06)**	<0.001	307 (98.1)	6 (1.9)	**0.27 (0.12,0.61)**	<0.01
Multiple trauma	408 (96.0)	17 (4.0)	**18.36 (7.87, 42.81)**	<0.001	284 (66.8)	141 (33.2)	**6.93 (5.45,8.83)**	<0.001

[a] : Bold indicates column proportions that differ significantly at the 0.05 level; ICU: Intensive care unit; OR: Odds ratio; CI: Confidence interval

Table 4 Multiple logistic regression model for ICU admission

		Adjusted OR	95% CI	P-value
Age				
	<18	1	-	-
	18-64	1.95	**(1.36,2.80)**[a]	<0.001
	≥65	8.15	**(5.42,12.25)**	<0.001
Type of transportation				
	Private car	1	-	-
	Ambulance	1.69	**(1.31,2.19)**	<0.001
	Other way	1.32	(0.59,2.93)	0.48
Cause of injury				
	Road traffic crash	1	-	-
	Fall	0.99 (0.73,1.32)	0.94	
	Stab/cut	0.24	**(0.14,0.41)**	<0.001
	Blunt	0.34	**(0.18,0.64)**	0.001
	Poisoning	0.03	**(0.01,0.12)**	<0.001
	Burns	0.02	**(0.002,0.32)**	<0.01
	Gunshot	0.66	(0.22,1.94)	0.46
	Others	0.88	(0.39,1.97)	0.76
ISS[b]				
	Mild (1-8)	1	-	-
	Moderate (9-15)	4.14	(3.28,5.22)	<0.001
	Severe (≥16)	4.37	(2.07,9.24)	<0.001
GCS[c]				
	13-15	1	-	-
	9-12	15.39	**(8.16,29.04)**	<0.001
	3-8	54.56	**(22.88,130.12)**	<0.001
Body region				
	Upper and lower extremities	1	-	-
	Head/neck/face	1.73	**(1.23,2.42)**	<0.01
	Thorax	2.35	**(1.40,3.93)**	<0.01
	Abdomen	6.95	**(3.46,13.94)**	<0.001
	Spine	3.07	**(1.57,6.00)**	<0.01
	Unspecified	0.62	(0.13,2.89)	0.55
	Multiple trauma	3.12	**(2.27,4.27)**	<0.001

[a] : Bold indicates column proportions that differ significantly at the 0.05 level; [b] : Injury severity score; [c] : Glascow coma score; ICU: Intensive care unit; OR: Odds ratio; CI: Confidence interval

vehicle transfer was associated with a significantly decreased risk of death compared to ground emergency medical services (EMS) transport for persons with gunshot and stab/cut wounds (30). Zafar et al. demonstrated that patients with gunshot wounds brought to the hospital by EMS had greater mortality than similar patients transported by private vehicles (31). Likewise, Demetriades et al. compared 4856 EMS with 926 non-EMS major trauma patients. The study revealed that critically injured patients transferred by non-EMS vehicles had reduced adjusted mortality (32). However, some studies presented different results. A study by Band et al. demonstrated no difference in adjusted odds of mortality in a large population of penetrating injury patients who were brought to the hospital by either police transport or the EMS (33). In another study, Cornwell et al. found no significant differences in ICU admission, mortality, complications, and length pf stay (LOS) between matched EMS and non-EMS groups of seriously injured patients (34). Al-Shaqsi et al. also found no significant differences in outcomes between patients brought by emergency medical services versus private transport in Oman (35).

Several indicators, including variations in prehospital care, time and distance differences, different severity of injuries, and mode of prehospital transportation, including air ambulance, ground ambulance, police transport, and private cars, can result in the discrepancy. Our findings contributed to the debate over the best prehospital strategy for trauma, which has been discussed in the literature (28,29,36-38). Whether aggressive prehospital care or timely patient transfer is more crucial has long been a challenging issue. Prior articles indicated that the patients brought by non-EMS vehicles arrived more quickly at the hospital than those referred to the hospital by EMS (39). It was determined that a brief overall time spent outside the hospital when patients are transported by private vehicle may benefit patient survival in critical cases (34,39).

Another study inferred that prehospital stays longer than 60 minutes were statistically linked to higher mortality rates (40).

Furthermore, there are conflicting viewpoints about the value of prehospital interventions. Advanced trauma life support (ATLS) resulted in greater fatalities in patients with comparable injuries than basic life support (BLS) (36,37). Additionally, trauma patients who received prehospital interventions had a higher mortality risk (41).

We obtained the same result after controlling for age, GCS, cause of trauma, ISS, and body site of injury. It is possible that the risk-adjustment process was unable to take into account all potential confounding risk variables, like the prehospital time for ICU admission. The ambulance periods might impact the results as an unmeasured confounder. It is preferable to adjust the prehospital time for patients who are transported to the hospital by ambulance or private car.

5. Limitations

This study had some limitations. It was conducted in a single center, therefore it may not be applicable for the entire population of Iran. Also, due to our lack of knowledge of the exact arrival time of ambulances at the accident scene, time spent on the scene, time spent for transportation and the overall out-hospital EMS timings, delay in patient care could not be studied as a variable in trauma outcome.

This registry based study at one of the NTRI's centers, the Imam Khomeini hospital in Urmia, Iran showed that majority of patients were males, and RTCs followed by falls were the leading causes of trauma injuries. The odds of mortality were higher in older patients who underwent mechanical ventilation with lower GCS and a greater ISS. Older age, higher ISS, lower GCS, injured body site, and cause of trauma were all significant predictors of ICU admission. These findings can help to improve our healthcare system by personalizing patient care to their unique clinical and demographic characteristics. The research can be repeated beyond the sample limit of one hospital and on larger scales in other hospitals to ensure the generalizability of the findings. We suggest further studies to better understand trauma patterns in the Iranian population.

6. Conclusion

This registry based study at one of the NTRI's centers, the Imam Khomeini hospital in Urmia, Iran showed that majority of patients were males, and RTCs followed by falls were the leading causes of trauma injuries. The odds of mortality were higher in older patients who underwent mechanical ventilation with lower GCS and a greater ISS. Older age, higher ISS, lower GCS, injured body site, and cause of trauma were all significant predictors of ICU admission. These findings can help to improve our healthcare system by personalizing patient care to their unique clinical and demographic characteristics. The research can be repeated beyond the sample limit of one hospital and on larger scales in other hospitals to ensure the generalizability of the findings. We suggest further studies to better understand trauma patterns in the Iranian population.

7. Declarations

7.1. Acknowledgement

None.

7.2. Authors' contribution

All the authors met the standards of authorship based on the recommendations of the International Committee of Medical Journal Editors.

7.3. Conflict of interest

The authors declare that they have no potential conflict of interest related to this study.

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