



Original article

Patterns of road traffic accident, nature of related injuries, and post-crash outcome determinants in western Ethiopia - a hospital based study

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ABSTRACT

Introduction: Ethiopia is one of the countries with the worst road traffic accident records in the world and it ranks second among east African countries. There have not been sufficient studies that mainly reflect the post-crash determinants of deaths and this study was therefore done to assess the overall nature of injuries and the post-crash outcome determinants of road the traffic accident in western part of Ethiopia.

Methods: This was a hospital-based prospective study conducted from 1 January 2019 to 31 December 2019 using an area sampling technique. Five administrative zones in west Ethiopia were initially selected as a geographical cluster; out of which, four zones were randomly selected. Then, a total of four hospitals were conveniently selected. Finally, 327 people injured in road traffic accidents and brought to the selected hospitals were consecutively included.

Results: Overall, 189 (66.1%) of the casualties have sustained multiple injuries and 65 (24.0%) of them have got severe injuries. About 38.8% and 13.6% have respectively died and discharged with permanent disabilities. A longer distance from receiving hospital (AOR: 1.4, 95% CI [0.48–4.08]), singleness in the number of injury (AOR: 4.3, 95% CI [2.08–9.8]), and lack of receiving pre-hospital care (AOR: 4.072, 95% CI [1.197–13.85]) had statistical associations with increased number of death. On the other hand, injured people who were taken to the hospitals by police officers (AOR: 0.371, 95% CI [0.160–0.860]) than emergency medical technicians and those who were transported by other vehicles (AOR: 2.58, 95% CI [1.21–5.52]) than ambulance have ironically survived more.

Conclusion: This study concludes that the road traffic accidents related deaths occur largely due to the seriousness of injuries and are exacerbated by lack of adequate pre-hospital emergency care services, costing the lives of many Ethiopians.

African relevance

- The post-crash events associated with deaths reported in this study call for the need for improvement of trauma care system
- The death rate of car accidents in this study is higher than the report from many African countries usually derived from a police report indicating that under reporting is a problem
- The findings of this study is relevant to many African countries with poorly organized emergency service system

Introduction

Road traffic injuries are a major but preventable global public health problem. Worldwide, the number of people killed in road traffic crashes each year is estimated to be 5 million, while the number of injured could be as high as 50 million [1]. Recent pieces of literature reveal that road traffic accidents are expected to have moved from ninth to third place in the world ranking of the burden of disease. World Health Organization report indicates that the road traffic accident is the leading cause of death among people aged 5–44 which has a greater impact on the global economy and health of the population. The organization has calculated the risk of dying in a road traffic crash by continent and Africa is the

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leading followed by the eastern Mediterranean [2,3].

For its only 4% of the world's motor vehicles, the African road fatality exceeds 10% of the total fatalities. With increasing motorization among African countries, road traffic crashes and injuries are expected to grow at a fast rate, threatening the economic and human development of this poor and promising land. Road crashes in developing countries are more than two-fold of that of developed countries at 13.4/100,000 and 32.2/100,000 people in Europe and Africa respectively. A breakdown of the figure indicates that about 90% of the deaths occur in developing countries. Currently, it is the tenth leading cause of disease burden in the developing countries, especially in the Sub-Saharan African countries [4,5].

According to reported road deaths in selected African countries by region, Ethiopia ranked second next to Kenya among east African countries. The greater percentage of Ethiopia's transportation system is covered by the natural modes like walking and animal transport system leaving only a very negligible share for the motorized aspect. Despite the low rate of motorization in the country, the issue of road safety has already become a critical concern [1,4,5]. Yet through organized and responsive pre-hospital and hospital emergency services, it is possible to potentially reduce deaths due to road traffic accidents that are occurring before the victims reach the hospital.

Due to road transport with poor road infrastructure, low traffic enforcement, and other factors, road traffic accidents remain high in Ethiopia. As such, tragedy from road traffic accidents is steadily increasing and the country is experiencing a tremendous loss of life and property each year probably leading the worst accident record in the world [6,7]. Local reports indicate that more than three thousands of Ethiopians die and ten thousand people are injured because of road traffic accidents. A very recent study in Addis Ababa showed that the fatality rate as a result of the road traffic accidents in the city was 16.1% [8,9].

Geographically, the Oromia regional state serves as the nucleus of the country and is the dominant region in terms of land area and the population. The state accounts for about 14.5% of all accidents and 24% of fatalities which has a high traffic movement next to Addis Ababa in the country [10]. Although there has been no clear picture of road traffic accident-related deaths and disability, it is believed that western Ethiopia also shares its significant burden of the problem.

Beyond the actual seriousness of injuries sustained in road traffic accidents, numerous factors could determine a post-crash fate of casualties. The potential help towards recovery that victims can receive may be viewed as a chain with several links: Delay in detecting crash; difficulty in rescuing and extracting people from vehicles, unprofessional manner of transportation of those injured to a health facility; lack of appropriate pre-hospital care are among crucial determinants of death and survival [11].

In Ethiopia, including the western part of the country, there have been no data indicating mainly post-crash determinants of death from road traffic accidents. Previous studies have largely addressed the mechanics of road traffic accidents. There have been very limited studies carried out to characterize the road traffic accident-related injuries, detect clinical outcomes and predict why the casualties die beyond the seriousness of the actual injury. Moreover, the data on traffic crashes, injuries, and deaths are mostly derived from police reports which do not provide a complete picture of the problem. Therefore, it is with this in mind that this research has motivated to assess road traffic accident patterns, related injury characteristics, severity, post-crash outcome determinants in Western Ethiopia.

Methods

Study setting

This study was conducted in four hospitals selected from five administrative zones, namely, Buno Bedele, Kelem Wollega, West

Wollega, East Wollega and Horo Guduru Wollega, located in Western Oromia, Ethiopia.

Study design

A hospital-based prospective cross-sectional study was conducted from 1 January 2019 to 31 December 2019.

Population

The source population for this study was all age group people injured and brought to the selected hospitals. The study populations were all injured people in road traffic accidents and presented to the selected hospitals during the specified study period.

Sampling techniques and sampling procedures

Area sampling technique was used to select the hospitals included in the study. Five administrative zones in west Oromia, namely, Buno Bedele, Kelem Wollega, West Wollega, East Wollega, and Horo Guduru Wollega, were primarily selected as geographical clusters. Out of which four zones (Buno Bedele, Kelem Wollega, West Wollega, and East Wollega) were purposively selected. Then, a total of four zonal hospitals was selected (one from each zone). The selected hospitals were similar in their level of services including number of beds and overall standard of services. Finally, consecutive sampling was used to collect the required data from all road traffic accident cases presented and treated in the selected hospitals.

Inclusion and exclusion criteria

Inclusion criteria

All road traffic accident victims presented to the respective hospitals that were able to communicate or presented with attendants, treated and followed in the respective hospitals at least for 24 h were included. In addition, victims who have died at the scene or on the way to hospitals were included in the study.

Exclusion criteria

Due to inability to know what events had happened at the scene and on the road all critically injured patients who did not have attendants were excluded from the study. Since the aim of this study was to observe patients' clinical outcome determinants starting from accident time to the end of the treatment period, all the referred cases from other facilities were not considered in this study. Furthermore, since it was difficult to know their fate, all victims who have got slight injuries and sent to home or to other health facilities were not included in this study.

Research tool and data collection techniques

Data was collected using a comprehensively organized interviewer-administered questionnaires and checklists which were adopted and modified [11]. The tools were comprised of questions used to assess seasonal patterns, injury characteristics, severity and outcome determinants. One characteristic of injury was presence of visceral injuries. This was diagnosed using different diagnostic modalities like ultra sound. Injury severity was measured using the Kampala Trauma Score (KTS) [12]. One more question regarding the main cause of deaths which was responded by two doctors and one nurse was included in the questionnaires. Data was collected by 8 trained nurses (two for each hospital) who have ever worked in the emergency rooms.

Data quality control

The initial tool prepared in English language was translated into the local language (Afan Oromo) and translated back to English by different

language experts. Before conducting the main study, data tool testing was carried out in one of the non-selected similar hospital. Based on the findings obtained, further modifications have been made. In addition, investigators have closely supervised the data collection process and necessary corrections were considered on all data collection sites. Moreover, the collected data was checked for completeness before data entry. The cleaning process was done by running simple frequency after data entry to maintain consistency of data. Further checks were done for inconsistency by referring to the hard copy of the study tools.

Data processing and analysis

Data was initially entered into Epi-data version 3.2 by data clerks after several steps of the check for completeness and accuracy. Then, the entered data was exported to SPSS program version 22 for analysis. Descriptive outputs were generated describing the frequency counts and percentages. Binary logistic regression was performed to see the association between certain variables and study outcomes on $p < 0.05$ for all statistical tests. The variables selected to be included in the multivariate analysis were variables with $p < 0.25$ in the univariate analysis. Odds ratio and 95% confidence interval was used as a measure of association. Finally, the results of the study were presented using texts, tables, charts, and graphs.

Results

A total of 327 of road traffic accident victims were included in this study and data from 286 participants was analysed; making the response rate of 87.64%. The remaining 41 data were discarded as they were incomplete and inconsistent. The male to female ratio was nearly equal (1.08:1). Age-wise, 117 (40.9%) of the casualties were in the age group of 16–30 years. Relative to the other category, the highest proportion [84 (29.4%)] of the respondents were students in their occupation (Table 1). More than half 170 (59.4%) of the incidents occurred during morning to mid-day and about 3.8% happened at mid-night. Regarding the types of vehicles involved in the accidents, minibus 50(18.7%) and

Table 1
Socio demographic characteristics of road traffic accident casualties in western Ethiopia, 2019.

No	Variables(N = 286)	Category	Frequency	Percent
1	Age of the patient	<15 years	39	13.6
		16–30 years	117	40.9
		31–45 years	37	12.9
		46–55 years	16	5.6
		>55 years	77	26.9
2	Sex	Male	149	52.1
		Female	137	47.9
3	Religion	Christian	192	67.1
		Muslim	42	14.7
		Wakefata	29	10.1
		Other	23	8.0
4	Marital status	Married	124	43.4
		Divorced	18	6.3
		Widowed	23	8.0
		Single	121	42.3
5	Level of education	No schooling	51	17.8
		Primary school	90	31.5
		Secondary school	78	27.3
		College and above	67	23.4
6	Residence	Town	85	29.7
		Rural	201	70.3
7	Occupation	Government employee	63	22.0
		Off sick	18	6.3
		Student/trainee	84	29.4
		House keeper/servant	7	2.4
		Retired	8	2.8
		Business	43	15.0
		Farmers	63	22.0

high roof 48(18%) have contributed to the larger percentages. One hundred ninety seven (68.9%) of the accidents were occurred by single vehicles (in which only one car was involved in a particular incident). A higher proportion (49.7%) of the casualties was transported to the receiving hospitals by other vehicles than ambulances (Table 2).

Patterns occurrences, injury characteristics, severity and level of basic cares

The seasonal pattern of road traffic accidents occurrences at this study area appears to be fluctuating with seasonal changes with a peak of occurrence in the months from May to August (Fig. 1). The vast majority [189 (66.1%)] of the casualties have sustained multiple injuries. Head [55(19.2%)] and chest [55(19.2%)] were the frequently affected body regions relative to others. One hundred sixty one (56.3%) and 156 (54.5%) of the casualties had visceral injuries and bone fractures respectively (Table 3). In this study, injury severity was determined for a total of 269 casualties who have reached the hospitals alive. On spot death (7.7% of total deaths) was conventionally considered as severe injury without considering other physiologic criteria. Out of 269 injured people, 24.16% of them including the 22 and 43 casualties who have died respectively on-scene and during treatment (Table 4). Nearly two-third, 112(74.1%) of injured people did not receive the required

Table 2
Distribution of respondents by their base line information, Nekemte, Ethiopia, 2019.

No	Information(N = 286)	Category	Frequency	Percent
1	Time of incidents	Morning to mid-day	170	59.4
		Afternoon	75	26.2
		Mid-night	11	3.8
		Mid-night to morning	30	10.5
2	Type of vehicle in which the patient was injured	Sino track	15	5.6
		Isuzu	16	6.0
		High roof	48	18.0
		Bus	46	17.2
		Minibus	50	18.7
		Bajaj	17	6.4
		Motor cycle	43	16.1
3	Number of vehicles involved	Other	32	12.0
		Single vehicle	197	68.9
4	Situation of the victim during accident	Multiple vehicles	89	31.1
		Walking on the road	42	14.7
5	Purpose of vehicle involved in an incident	Fall from a moving vehicle	72	25.2
		Rolled vehicle	90	31.5
		Vehicle collision	71	24.8
		Other	11	3.8
		For private travel	126	44.1
6	Victims role at the time of accident	For public transportation	149	52.1
		Public services provision	11	3.8
		Pedestrian	73	25.5
7	Distance of scene from receiving hospital	Passengers	117	40.9
		Driver	56	19.6
		Driver assistant	40	14.0
		<10 Km	118	41.3
8	Time elapsed until help arrived in minutes	11–20 Km	63	22.0
		21–30 km	34	11.9
		41–50Km	50	17.5
		>51Km	21	7.3
		<15 min	188	65.7
9	Means of transportation to receiving hospital	>15 min	98	34.3
		Ambulance	134	46.9
		Other vehicles	142	49.7
10	Accompanying personnel to receiving hospital	Carried by people	10	3.5
		Emergency Medical Technicians	84	29.4
		Traffic police	192	67.1
		Bystanders	10	3.5

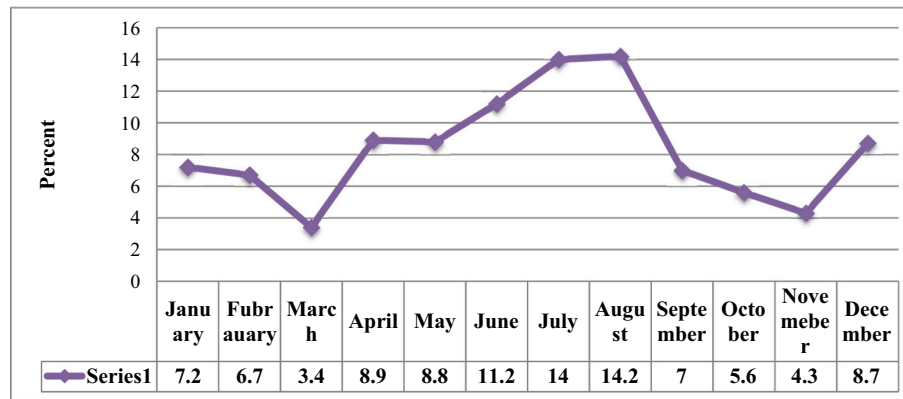


Fig. 1. Seasonal patterns of road traffic accident occurrence in west Ethiopia, 2019.

Table 3
Road traffic accident related injury characteristics in Western Ethiopia, 2019.

No	Injury characteristics	Category	Frequency	Percent		
1	Number of injury	Single injury	97	33.9		
		Multiple injuries	189	66.1		
2	Types of injured body parts	Head and musculo-facial	55	19.2		
		Neck	53	18.5		
		Chest	55	19.2		
		Abdomen	44	15.4		
		Pelvis	39	13.6		
		Extremities	40	14.0		
		Visceral injury encountered	161	56.3		
3	Types of visceral injury encountered (N = 161)	Not encountered	125	43.7		
		Spleen	45	27.9		
4	Types of visceral injury encountered (N = 161)	Liver	26	16.2		
		Heart	17	10.5		
		Lung	18	11.1		
		Gastric contents	32	19.8		
		Others	23	14.3		
		5	Bone fracture	Fractured	156	54.5
				Not fractured	130	45.5
6	Specific bone fractures encountered (N = 156)	Skull	35	21.7		
		Clavicle	27	16.8		
		Spinal	32	19.8		
		Rib	26	16.1		
		Pelvic	20	12.4		
		Lower limb	16	9.9		
		Upper limb	25	21.7		
7	Presence of open wound	Present	139	48.6		
		Not present	147	51.4		

minimum emergency care at the scene or during transportation (Table 5).

Out of all injured patients, 38.8% of them have died and 13.6% were discharged with permanent disabilities (Fig. 2). Total of (36.1%) have arrived dead (20.4% and on spot death and 15.7% in route death). Thirty one point four 8% of victims died in the emergency department, and the rest of the deaths occurred in the ward/ICU (Fig. 3). Information obtained from the treating physicians and nurses who have also participated on death confirmation was used to identify the main reason of the road traffic accident related deaths. The death occurred outside of the hospitals were considered as death secondary to the seriousness of the injuries and this was 60.2% of all deaths (Fig. 4). The outcome determinants were viewed from three events surrounding road traffic accidents. These were: events that happened immediately after the crash until the victims reach the initial hospitals, the injury characteristics, and the level of treatments provided. Type of vehicle (AOR: 0.292, 95% CI [0.292–0.862]), longer distance from receiving hospitals (AOR: 1.4, 95% CI [0.048–408]) and accompanying personnel (AOR: 0.371, 95% CI [0.160–0.860]) were events associated with the reported number of deaths. Injured people who were taken to the hospitals by police officers

Table 4
Description of Kampala Trauma Score and road traffic accident injury severity in west Ethiopia, 2019.

No	Parameter	Value	Kampala Trauma Severity Score		
			Category	Frequency	Percent
1	Age in years	<5	Mild(13–16)	21	7.81
		6–55			
		>55			
2	Number of serious injuries	None	Moderate (9–12)	183	68.03
		One			
		Two or more			
3	Systolic blood pressure in mmHg	>89	Severe/fatal (5–8)	65	24.16
		50–89			
		1–49			
		Undetectable			
		Respiratory rate breath per minute			
4	Respiratory rate breath per minute	10–29	Alert	4	
		>30			
		<9			
5	Neurologic status	Alert	Responds to verbal stimuli	3	
		Responds to verbal stimuli			
		Responds to pain stimuli			
		Unresponsive			
Total				269	100

(AOR: 0.371, 95% CI [0.160–0.860]) than emergency medical technicians and those who were transported by other vehicles (AOR: 2.58, 95% CI [1.21–5.52]) than ambulance ironically survived more (Table 6). Similarly, presence of visceral injury (AOR: 2.03, 95% CI [1.021–3.93]) and singleness in number of injury (AOR: 4.3, 95% CI [2.08–9.8]) had statistical significance with number of death (Table 7). Similarly, a longer time elapsed until help arrives (AOR: 4.072, 95% CI [1.197–13.85]) and lack immobilization before transportation (AOR: 2.003, 95% CI [1.021–3.931]) had statistically proved associations with negative outcomes. The need for provision of further airway management (AOR: 1.79, 95% CI [1.045–3.088]) was also associated with chance of dying (Table 8).

Discussion

Numerous studies have revealed that there has been a consistent increase in the absolute number of road traffic accidents in many of the developing nations over the last several decades. This study has

Table 5
Level of basic cares provided for patients injured in road traffic accidents in western Ethiopia, 2019.

No	Level of basic cares	Category	Frequency	Percent
1	Was emergency care given at the scene/during transportation?	Given	74	25.9
		Not given	212	74.1
2	Was the victims immobilized before transportation?	Immobilized	60	20.9
		Not immobilized	226	79.1
3	Further airway intervention	Needed and done	110	38.5
		Needed, but not done	62	21.7
		Not needed	114	39.9
4	Treatment of tension pneumothorax	Yes, chest drain was placed	55	19.2
		Yes, but chest drain was not placed	191	66.8
		Not evident	40	14.0
		Yes, placed and was functional	246	86.0
5	Was pulse-oximeter placed and functioning?	Available, but not placed	40	14.0
		Needed and given	110	38.5
6	Was oxygen administration needed and given?	Needed, but not given	62	21.7
		Not needed	114	39.9
7	Did full survey for and control of bleeding performed?	Performed	194	67.8
		Not performed	92	32.2
8	Was large IV bore placed and fluid started?	Placed and started	110	38.5
		Needed, neither placed nor started	62	21.7
		Not needed	114	39.9
9	Was blood transfusion needed and given?	Needed and given	108	37.8
		Needed but not given	39	13.6
		Not needed and not given	139	48.6
11	Does neurovascular status of all four limbs checked?	Checked	178	62.2
		Not checked	108	37.8
12	Was hypothermia likely and prevented?	Likely and prevented	53	18.5
		Likely but not prevented	178	62.2
		Was not likely	55	19.2
13	Was imaging needed and done?	Needed and done	79	27.6
		Needed but not done	108	37.8
		Not needed not done	99	34.6
14	Was referral needed and given?	Needed and referred	55	19.2
		Given but patient did not go	53	18.5
		Referral was not needed	178	62.2

examined the injury characteristics, seasonal patterns of occurrences, injury severity, and outcome determinants of road traffic accidents in the western part of Ethiopia. The key findings of this study related to injury characteristics, determinants of clinical outcome are compared and contrasted with and against the existing works of literatures. The findings of this study in general and the key findings stressed in this discussion section in particular are aimed to provide essential information as to what post-crash factors have contributed to the reported death from road traffic accidents in the present study.

The potential help towards recovery that victims can receive may be viewed as a chain of several links: actions or self-help at the scene of the crash by the victims themselves, or more frequently by bystanders; Access to the emergency medical system, helps provided by rescuers of the emergency services; delivery of medical care before arrival at the hospital, and the hospital trauma care services [10,11]. In the present study, higher proportions (49.7%) of casualties were transported to the

receiving hospitals by other vehicles than ambulances and 192(67.1%) of the victims were accompanied by traffic polices than emergency care personnel, indicating lack of appropriate pre-hospital emergency help.

Injury severity is often used as a measure of the health consequences of road traffic crashes. Injuries are classified as fatal, serious or slight on the basis of information available to the police within a short time after the crash. Classifications may not reflect the results of a medical examination and are largely influenced by whether a casualty is hospitalized or not [13]. As a secondary motive, this study determined road traffic accident-related injury severity. According to Kampala Trauma Score classification of trauma severity, the majority (68.02%) of injured people in this study sustained moderate injury and 24.0% sustained severe (fatal) injury.

The final injury outcome of road traffic accidents was measured in terms of death versus survival, complications developed and length of hospital stay. The high percentage of fatalities indicates a critical lack of pre-hospital and emergency medical services [11,14,15]. In Ethiopia, of the total traffic accidents occurring yearly, more than 20% of the total traffic accident injuries are fatal [6]. In the current study, out of all injured patients who have admitted to the selected hospitals, 38.8% of them have died. This finding is much higher as compared to findings reported from similar other studies carried out in Ethiopia [9–11,16]. The observed discrepancy, on one hand, might be due to the fact that many of the reports by traffic police are only limited to on spot death which is usually subjected to an undercount of the actual numbers of fatalities. On the other hand, many of the victims who have sustained minor injuries and who have not met the admission criteria were excluded from this study which might have contributed to relatively a higher records of death reported in this study.

The duration of hospital stay has been viewed as an important measure of morbidity among trauma cases [17,18]. Prolonged hospitalization, especially in a setting like Ethiopia where resource is critically limited could pave the way for unnecessary severe nosocomial infections; which at the end negatively affects patient outcomes. The overall mean length of stay (11.16 days) of this study was slightly higher compared to the duration of days reported from comparable studies [19,20].

Delays in detecting crash and in the transport of those injured to a health facility; lack of appropriate pre-hospital care; lack of appropriate care in hospital emergency rooms are among important determinants of potential injury outcomes [13]. Transporting mass casualty without communicating to the receiving facility before casualty's arrival could also affect the end outcome of the injured people. This is because of the fact that the earlier the facilities get informed about the incoming victims, the sooner and the better they get prepared. Minimizing delay in the initiation of care and treatment option related confusions will ultimately benefit the patients. In this study, 21.7% of the injured people were transported without reporting to the hosting hospitals.

Most importantly, the pre-hospital care of trauma patients has been reported to be the most important factor in determining the ultimate outcome after the crash [21]. Nearly two-third (74.1%) of injured people in this particular study did not receive the required minimum Emergency care at the scene or during transportation.

The special emphasis of this study was to find out possible determinants of injury outcomes both before and after hospital arrival. In this study, the outcome determinants were viewed from three events surrounding road traffic accidents. There have been statistically approved correlations between death and selected events immediately after the crash until the victims reach or admitted to the initial hospitals.

The long distance from receiving hospital (p -value <0.00) has increased the likelihood of dying. The patients who were accompanied by police officers than emergency medical technicians (p -value <0.021) and who were transported by other vehicles (p -value: 0.00) than ambulance have survived more. These findings are inconsistent with the findings reported from similar studies conducted elsewhere [21–24]. The reason for this could be due to the reality that number of

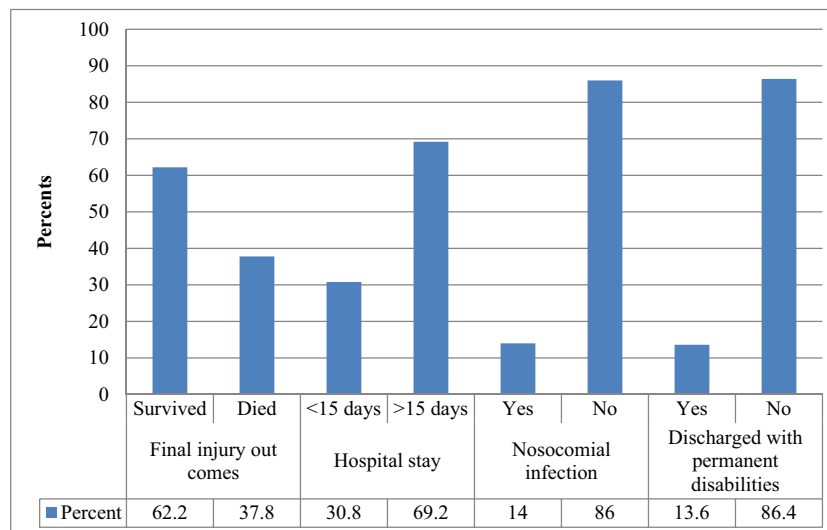


Fig. 2. Road traffic accident related injury outcomes in western Ethiopia, 2019.

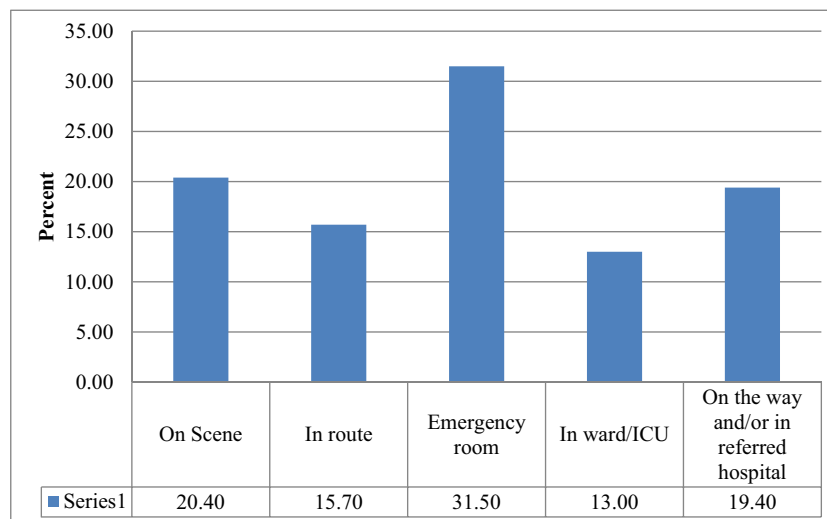


Fig. 3. Place of death among road traffic accident fatalities in west Ethiopia, 2019.

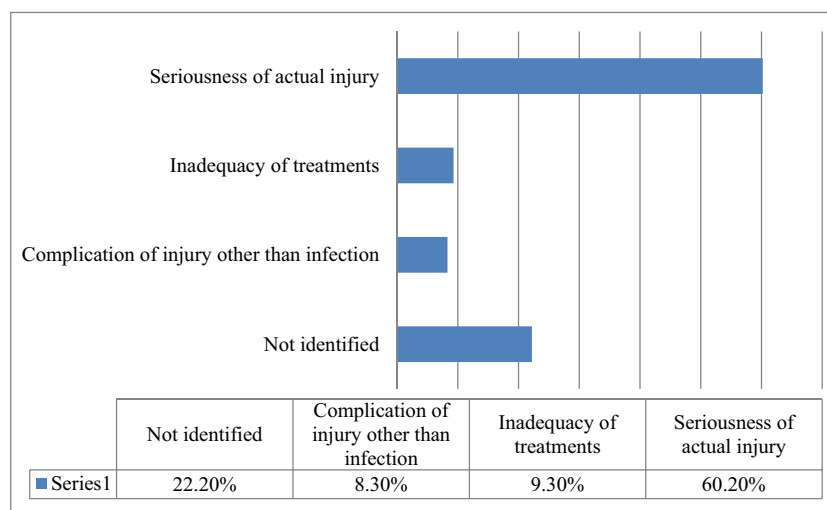


Fig. 4. Approved main reasons of death among road traffic accident victims in west Ethiopia, 2019.

Table 6

Multivariate logistic regression analysis between pre accident events and final injury outcomes of road traffic accident in western Ethiopia, 2019.

Events	Category	Outcome		Univariate analysis			Multivariate analysis		
		Survived	Died	P-value	COR	CI (95%)	AOR	CI (95%)	P-value
Season pattern	Autumn	20.8%	29.6%	1(R)	1(R)	1(R)	1(R)		
	Winter	35.4%	36.1%	0.037*	2.626	[0.1.062–6.494]	1.29	[0.658–2.565]	0.451
	Spring	14.6%	27.8%	0.003*	5.567	[0.1.768–17.525]	2.05	[0.808–5.216]	0.131
	Summer	29.2%	6.5%	0.458	1.429	[0.557–3.669]	0.706	[0.346–1.441]	0.339
Time of occurrence	Morning to mid-day	55.6%	65.7%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	Afternoon	38.2%	6.5%	0.024*	8.844	[0.1.335 58.603]	3.47	[0.658–18.329]	0.143
	Mid-night	6.2%	00.0%	0.037*	0.354	[0.134–0.134]	0.35	[0.352–1.391]	0.308
Type of vehicle	Mid-night to morning	00.0%	27.8%	0.010*	4.418	[0.1.429–13.655]	1.88	[0.755–4.704]	0.175
	Sino track	00.0%	13.9%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Number of vehicles	Isuzu	00.0%	14.8%	0.060*	0.536	[0.280–0.280]	0.292	[0.292–0.862]	0.012**
	High roof	30.9%	00.0%	0.205*	0.551	[0.219–1.385]	0.45	[0.208–0.988]	0.047**
	Bus	3.9%	36.1%	0.034*	2.030	[1.056–3.903]	1.79	[1.045–3.088]	0.034**
	Minibus	30.9%	00.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	Bajaj	10.7%	00.0%	0.071*	1.789	[0.951–3.364]	1.477	[0.832–2.624]	0.183
	Motor Cycle	23.6%	35.2%	0.24	0.51	[0.12–1.96]	0.47	[0.09–2.34]	0.30
	Single vehicle	58.4%	86.1%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Victims situation	Multiple vehicles	41.6%	13.9%	0.024*	8.844	[0.1.335 58.603]	3.47	[0.658–18.329]	0.143
	Walking on the road	10.7%	21.3%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	Fall from a moving vehicle	19.1%	35.2%	0.071*	1.789	[0.951–3.364]	1.477	[0.832–2.624]	0.183
Purpose of vehicle on travel	Rolled vehicle	28.7%	36.1%	0.051*	0.086	[0.007–1.006]	0.657	[0.139–3.106]	0.597
	Collision	35.4%	7.4%	0.728	0.589	[0.030–11.581]	4.326	[0.461–40.637]	0.200
	Other	6.2%	00.0%	0.058*	0.072	[0.005–1.095]	0.524	[0.074–3.699]	0.517
	Private affair	54.5%	26.9%	0.071*	1.789	[0.951–3.364]	1.477	[0.832–2.624]	0.183
Victim's role	Public transportation	39.3%	73.1%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	Gov./non-govt services	6.2%	00.0%	0.051*	0.086	[0.007–1.006]	0.657	[0.139–3.106]	0.597
	Pedestrian	23.6%	28.7%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Distance from receiving hospital	Passengers	43.8%	36.1%	0.284	0.133	0.058–1.387	0.337	0.074–1.763	0.189
	Driver	19.1%	20.4%	0.099*	0.361	[0.108–1.212]	0.350	[0.110–1.117]	0.076
	Driver assistant	13.5%	14.8%	0.324	1.348	[0.744–2.441]	1.471	[0.840–2.576]	0.177
	<10 Km	41.0%	41.7%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Means of transportation	11–20 Km	22.5%	21.3%	0.010*	4.418	[0.1.429–13.655]	1.88	[0.755–4.704]	0.175
	21–30 km	14.6%	7.4%	0.050*	0.407	[0.166–1.000]	0.408	[0.193–0.864]	0.019**
	41–50Km	10.1%	29.6%	0.00*1	0.142	[0.045–0.445]	1.40	[0.048–408]	0.000**
	>51Km	11.8%	00.0%	0.602	0.806	[0.358–1.814]	0.814	[0.374–1.771]	0.604
	Ambulance	44.4%	50.9%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Accompanying personnel	Other vehicles	50.0%	49.1%	0.008*	0.259	[0.095–0.70]	0.258	[0.121–0.552]	0.000**
	Carried by people	5.6%	00.0%	0.016*	0.243	[0.077–0.768]	0.22	[0.098–0.510]	0.000**
	EMT	11.8%	58.3%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Communication of emergency personnel to hospitals	Traffic police/Bystanders	82.6%	41.7%	0.003*	0.358	[0.183–0.702]	0.391	[0.205–0.748]	0.005**
	Yes	65.2%	100.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	No	34.8%	00.0%	0.037*	0.354	[0.134–0.134]	0.35	[0.352–1.391]	0.308

Key: * = significant at P-value <0.25, ** = significant at P-value<0.05, EMT = Emergency Medical Technicians.

ambulances and emergency personnel are critically limited in this region and the existing ambulances are usually reserved for special transportation like for delivering mothers.

Similarly, injury characteristics including but not limited to majorly injured body parts (p-value <0.040), presence of visceral injury (p-value <0.043), and a single number of injuries (p-value <0.037) had statistically significant associations with the number of death. These findings are generally in line with the findings that have been reported from different countries across Africa and India [25–27].

Conclusion

This study concludes that the road traffic accidents related deaths occurring largely due to the actual seriousness of injuries that are evidently exacerbated by lack of adequate pre-hospital emergency care services, are still costing the lives of many Ethiopians. Therefore, instituting a sound primary prevention strategies and establishing a strong pre-hospital emergency system are further works yet to be done.

Although this is a prospective study, the sample size of 286 may not be a satisfactory reflection of the true nature of the problem under study. Additional limitation is that the difficulty to account for all confounders, some missing data that might skew the data one way or the other, and

the % dead may actually be less given exclusion of patients with minor injuries discharged from the hospitals. Moreover, this study has used information from the treating physicians and nurses than a standard way to report for reasons of deaths (post-mortem). On the other hand, the prospective nature of study design has enabled the researchers to deal with the actual outcome determinants which might otherwise impossible to achieve using retrospective type.

Dissemination of results

Results from this study were shared with Wollega University Ethics committee and staff members through formal presentation. The results were also published in the service's newsletter.

Authors' contribution

Authors contributed as follow to the conception or design of the work; the acquisition, analysis, or interpretation of data for the work; and drafting the work or revising it critically for important intellectual content: AHW contributed 60%; WDH 25%; and NHT, and BKM contributed 15% each. All authors approved the version to be published and agreed to be accountable for all aspects of the work.

Table 7
Multivariate logistic regression between injury characteristics and final injury outcomes of road traffic accident in western Ethiopia, 2019.

Injury characteristics	Category	Outcome (%)		Univariate analysis			Multivariate analysis		
		Survived	Died	P-value	COR	CI (95%)	AOR	CI (95%)	P-value
Majorly injured body part	Head and Neck	00.0%	50.9%	0.083*	0.324	[0.090–1.160]	2.88	[0.83–10.01]	0.040**
	Chest	30.9%	00.0%	0.227*	0.590	[0.251–1.37]	0.574	[0.251–1.312]	0.188
	Abdomen	24.7%	00.0%	0.285	0.545	[0.179–1.658]	0.540	[0.184–1.580]	0.260
	Pelvis	21.9%	00.0%	0.966	1.03	[0.224–4.71]	1.110	[0.248–4.972]	0.891
	Extremities	22.5%	00.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Presence of visceral injury	Yes	77.5%	50.9%	0.010*	2.57	[1.253–5.38]	2.003	[1.021–3.93]	0.043**
	No	22.5%	49.1%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Presence of open wound	Yes	41.0%	100.0%	0.060*	0.536	[0.280–0.280]	3.0	[2.92–0.862]	0.012**
	No	59.0%	00.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Presence of open wound	Yes	47.2%	50.9%	0.294	0.451	[0.102–1.96]	0.467	[0.098–2.234]	0.340
	No	52.8%	49.1%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Number of injury	Single	24.7%	49.1%	0.205*	0.51	[0.219–1.35]	1.43	[0.208–1.98]	0.037**
	Multiple	75.3%	50.9%	1(R)	1(R)	1(R)	1(R)	1(R)	1®
Mental status before hospital arrival	Alert	100.0%	00.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	To voice	100.0%	00.0%	0.388	3.500	[0.203–60.21]	2.965	[0.166–53.098]	0.460
	To pain	100.0%	00.0%	0.204	3.897	[0.478–31.72]	3.533	[0.416–29.98]	0.247
	Unresponsive	00.0%	100.0%	0.247	3.733	[0.401–34.74]	2.626	[0.266–25.892]	0.408
Mental status after hospital arrival (GCS)	<8	00.0%	100.0%	0.285	0.545	[0.17–1.658]	0.530	[0.184–1.560]	0.160
	9–12	100.0%	00.0%	0.966	1.34	[0.224–4.71]	1.110	[0.248–4.972]	0.791
	13–15	100.0%	00.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)

Key: * = significant at P-value <0.25, ** = significant at P-value<0.05.

Table 8
Multivariate logistic regression between treatment level and final injury outcomes of road traffic accident in western Ethiopia, 2019.

Treatment	Responses	Outcome		Univariate analysis			Multivariate analysis		
		Survived	Died	P-value	COR	CI (95%)	AOR	CI (95%)	P-value
Time elapsed until help arrives	<15 min	75.3%	50.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	>15 min	24.7%	50.0%	0.314	0.2280	048–2.067	0.358	0.051–2.511	0.302
Emergency care before arrival	Given	6.2%	58.3%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	Not given	93.8%	41.7%	0.256	0.024**	0.079–0.833	4.072	1.197–13.85	0.02**
Length of hospitals stay	<7 days	00.0%	100.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	8–14 days	53.4%	00.0%	0.96	1.34	[0.24–4.71]	1.110	[0.248–4.72]	0.891
	>15 days	46.6%	00.0%	0.29	0.51	[0.12–1.96]	0.467	[0.08–2.234]	0.340
Immobilization at the scene	Immobilized	14.9%	85.1%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	Not immobilized	78.8%	21.2%	0.010*	2.570	[1.23–5.26]	2.003	[1.0213.93]	0.043**
Survey for bleeding control	Done	71.6%	28.4%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	Not done	42.4%	57.6%	0.314	0.2280	048–3.067	0.358	0.051–2.511	0.203
Infection after admission	Acquired	100.0%	00.0%	0.284	0.122	0.058–1.397	0.337	0.064–1.763	0.198
	Not acquired	56.1%	43.9%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Further air way management	Needed and done	50.0%	50.0%	0.20*	0.551	[0.219–1.385]	1.45	[2.08–9.88]	0.047**
	Needed, but not done	43.5%	56.5%	0.034*	2.030	[1.056–3.90]	1.79	[1.04–3.08]	0.034**
	Not needed	84.2%	15.8%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Presence of Tension pneumothorax and it treatment	Yes, chest drain was placed	00.0%	100.0%	0.458	1.429	[0.557–3.669]	0.706	[0.346–1.41]	0.339
	Yes, chest drain was not placed	72.3%	27.7%	0.037*	2.626	[0.1.06–6.44]	1.29	[0.658–2.55]	0.451
	Not evident	100.0%	00.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Need and provision of pulseoximeter	Available and placed	56.1%	43.9%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	Available, but not placed	100.0%	00.0%	0.22*	0.590	[0.251–1.387]	0.574	[0.251–1.31]	0.188
Need and provision blood transfusion	Needed and given	00.0%	100.0%	0.099*	0.361	[0.108–1.212]	0.350	[0.110–1.17]	0.076
	Needed, not given	100.0%	00.0%	0.324	1.348	[0.744–2.441]	1.471	[0.840–2.56]	0.177
	Not needed	100.0%	00.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Hypothermia and prevention	Likely and prevented	00.0%	100%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	Likely but not prevented	69.1%	30.9%	0.045*	2.030	[1.056–3.90]	1.79	[1.04–3.08]	0.034**
Neurovascular check	Checked	69.1%	30.9%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	Not Checked	50.9%	49.1%	0.285	0.545	[0.179–1.658]	0.540	[0.184–1.50]	0.260
Need and provision of imaging	Needed and done	100.0%	00.0%	0.728	0.589	[0.030–11.1]	4.326	[0.61–40.67]	0.200
	Needed but not done	00.0%	100.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
	Not needed not done	100.0%	00.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)
Referral to better centre	Needed and referred	00.0%	100.0%	0.204	3.87	[0.478–31.72]	3.533	[0.416–29.98]	0.247
	Given but did not go	00.0%	100.0%	0.96	1.03	[0.224–4.71]	1.110	[0.248–4.92]	0.891
	Referral not needed	100.0%	00.0%	1(R)	1(R)	1(R)	1(R)	1(R)	1(R)

Key: * = significant at P-value <0.25, ** = significant at P-value<0.05.

Declaration of competing interest

The authors declare no conflict of interest.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.afjem.2020.09.008>.

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