The role of pre-hospital ambulance care in the management of road traffic injuries in Addis Ababa (Ethiopia)

Mulugeta Bonsa Regasa,[1] Tesfaye Girma Legesse,[2] Birhanu Asrat Wudineh,[3] Helina Bogale Abayneh[3]

[1]Department of Adult Emergency, Butajira General Hospital, Butajira; [2]Department of Nutrition, St Paul Hospital Millennium Medical College, Addis Ababa; [3]Department of Emergency and critical care Nursing, St Paul Hospital Millennium Medical College, Addis Ababa, Ethiopia

Correspondence: Helina Bogale Abayneh, Department of Emergency and critical care Nursing, St Paul Hospital Millennium Medical College Addis Ababa, Ethiopia, P.O.Box: 1271.
Tel.: +251912218245, Fax: +251112774787
E-mail: helinabogale2005@gmail.com

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Abstract

It is estimated that 1.35 million people die each year as a result of road traffic injuries worldwide, with Africa having the highest annual rate. Ethiopia has the highest fatality rate in road traffic accidents, at 79%. There is no well-established emergency medical system in Ethiopia to provide pre-hospital trauma care. A cross-sectional study was conducted at selected public hospitals in Addis Ababa. Purposive sampling was used to select the victims who arrived at the emergency department by ambulance. Data was gathered through structured questionnaires administered by an interviewer and a review of victims' medical records. SPSS Version 25 was used to analyze the data. In this study, 262 victims took part, with a 94% response rate. Patient positioning (50.8%) was the most commonly provided service, followed by bleeding control (43.5%). Within the first 24 hours, 8.4% of the victims died. The first 24-hours of injury-related death were significantly associated with head/neck/spine injury and total pre-hospital time. Action should be taken to increase the availability of necessary equipment in ambulances and the number of paramedic personnel.

Introduction

It is estimated that 1.35 million people die and more than 50 million are injured in road traffic accidents worldwide each year.[1] Road Traffic Injury (RTI) is the eighth leading cause of death, accounting for 2.46% of all deaths worldwide, according to the Global Burden of Disease Study report.[2] RTIs have a significant social and economic impact due to the victims' suffering, loss of life, and loss of productivity.

RTI-related deaths are at least twice as common in low- and middle-income countries as in high-income countries. RTI mortality rates have remained relatively stable globally since 2007, despite rising rates in many developing countries.[3] Surprisingly, Africa has the highest annual rate of road fatalities in the world, with 27 deaths per 100,000 people.[3]

Ethiopia, one of the African countries with the highest rate of road traffic injury-related fatalities in the world, has a 79% road traffic injury-related fatality rate.[4] Furthermore, global burden of disease study reports from 1990 to 2017 revealed that the incidence and mortality rate of road injuries are increasing at an alarming rate, and this has become a growing national concern in Ethiopia.[5] In the fiscal year 2014/15, there were 15,086 road traffic crashes,[6] while the road traffic mortality rate per 100,000 population in Ethiopia was 26.7 in 2016.[7]

For the finding report of a high pre-hospital mortalities for road traffic crash injured individuals in Ethiopia, several studies recommended research investigation to provide appropriate corrective measures.[8,9]

Investing in and developing pre-hospital emergency care is one of the primary strategies for reducing the burden of injuries, particularly those caused by RTIs.[10] However, many developing countries lack pre-hospital emergency medical service systems, and road traffic deaths occur due to a lack of timely post-crash responses and access to hospitals.[11]

Despite efforts to train emergency personnel, Ethiopia lacks a well-established emergency medical system to provide pre-hospital trauma care.[12] The only available emergency service is infrequent ambulance transportation, which is insufficiently supported by healthcare professionals and supplies.[13]

According to reports, pre-hospital care services in Ethiopia have not been prioritized and are characterized by insufficient coordination among actors. In comparison, only 20.3% of patients in Addis Ababa, Ethiopia's capital, were transported to hospitals by ambulance services, with the remainder handled by bystanders and public transportation services.[14]

As a result, it is timely and important to examine pre-hospital ambulance care for road traffic crash victims in order to improve informed management and gain a better understanding of how to improve the quality of pre-hospital care. As a result, the purpose of this study is to evaluate pre-hospital ambulance care and factors associated with the first 24 hours of injury outcome among road traffic accident victims visiting emergency departments of selected public hospitals in Addis Ababa, Ethiopia.

Addis Ababa is the capital city of Ethiopia, with a current estimated population of 3,384,569. The city has a total of 48 hospitals; thirteen of them are public hospitals. Fire and emergency department, Red Cross association and Tebita private ambulance company are organizations providing pre-hospital care services in the city. Addis Ababa Burn, Emergency and Trauma (AaBET) hospital, All Africa Leprosy, Tuberculosis, Rehabilitation and Training Center (ALERT) hospital, Tikur Anbessa Specialized Teaching Hospital (TASTH), Menilik II hospital, Yekatit 12 hospital, Zewditu Memorial Hospital, Ras Desta Hospital and Tirunesh Beijing hospital are currently providing emergency medical care to road traffic collision victims. AaBET hospital, Menilik II hospital, Yekatit 12 hospital, and Zewditu Memorial hospital were randomly selected for this study. Based on each hospitals' statistics report, the average number of RTI victims attended by an ambulance were 191, 50, 42, and 58 respectively.

Materials and Methods

Study design

From December 25, 2021 to January 25, 2022, an institution-based cross-sectional study was designed and carried out in the emergency departments of selected public hospitals in Addis Ababa. The total study sample was allocated proportionally to the emergency departments of each selected hospital based on their monthly average number of RTI patients.

The sample size was calculated using the single population proportion formula, assuming a 95% confidence interval, 5% margin of error (d), taking the proportion ambulance utilization at Dessie referral hospital, Ethiopia, 21%,[15] and adding a non-response rate of 10% yielded a total sample size of 279. A total of 279 participants, who were transported by ambulance, who agreed to participate, and who were live at the hospital presentation were included. Those with any form of memory (psychiatric) problems and with no relatives/bystander, patients transferred from other hospitals after initially treated, and unconscious victims with no relatives/bystander were excluded from the study. The number of study units to be sampled from each facility is determined using the proportional size allocation formula: $n= n_f \times n_i / N$

Where: n_i = number of RTI patients in each hospital; n_f = final sample of the study; N = total number of RTI patients in all selected hospitals, yielded 129, 50, 41, 58 for AaBET hospital, Menilik II hospital, Yekatit 12 hospital, and Zewditu Memorial hospital respectively.

Structured interviewer questions and a review of medical records at the ED were used to collect data. The questionnaire was pretested, adapted, and modified from previous studies,[14-17] and includes questions about socio-demographic characteristics, injury characteristics, pre-hospital time, pre-hospital ambulance care, and injury outcomes after 24 hours. Following the arrival of the ambulance at the emergency department of each selected hospital, data were collected by trained BSc nurses after informed consent was obtained from each study participant (victims, relatives, bystanders, and pre-hospital ambulance accompanied health care provider). Data for the first 24-hours of injury outcomes were obtained from medical records/charts by tracing the patient's medical record number. On a daily basis, the principal investigator and supervisors collected completed questionnaires and checked for missing values and completeness.

Statistical analysis

Data were cleaned, coded, and entered into Epidata 3.1 before being exported and analyzed in SPSS version 25. For continuous data, descriptive statistics such as mean, range, and standard deviations were computed, as well as percentage and frequency tables for categorical data. To summarize the data, descriptive statistics such as percent, pie chart, graphs, proportion, and ratio were used. To investigate the effect of independent variables on dependent variables, bivariate logistic and multiple logistic regression were used. The Crude Odds Ratio (COR) for each independent variable was initially calculated at 95% Confidence Intervals (CI). Variables with p-value <0.25 on bivariate logistic regression analysis were subjected to multiple logistic regression analysis. A p-value of less than 0.05 was regarded as significant.

Result

Socio-demographic characteristics of participants

Two hundred and seventy-nine people were approached, and 262 of them agreed to participate in this study, with a 94% response rate. Males made up more than half of the injured victims, 162 (61.8%). The average age of the study participants was 31, with a standard deviation of 16 years, and 78 (29.8%) of the injured victims were between the ages of 31 and 44. The majority of the participants, 218 (83.2%), were from Addis Ababa; 55 (21.0%) were students, and 123 (46.9%) had completed primary school (Table 1).

Characteristics of the road traffic injury victims

The majority of the 182 (69.5%) road traffic injured victims studied sustained their injuries on the street. The victims with the highest proportion, 87 (33.2%), were pedestrians. On the other hand, more than half of the accidents, 150 (57.3%), occurred dur-

ing the day. More than half of the victims, 142 (54.2%), had a single injury, with the extremity being the most common anatomic site of injury (138 (52.7%). More than half of the patients, 144 (55.0%), had open wounds, while 68 (26.0%) had open bone fracture injury (Table 2).

The condition of the victims upon arrival at the emergency departments revealed that more than three-quarters, 206 (78.6%), were unstable, and more than half, 135 (51.1%), arrived at the health facility within an hour of injury.

According to the victim's triage category given at ED, the majority, 114(43.5%) were classified as red patients.

More than half of the 262 injured patients studied were admitted for further treatment, with 168 (64.1%) admitted for further treatment, 72 (27.5%) treated and discharged to home, and approximately 22 (8.4%) dying within the first 24 hours (Table 3).

Table 1. Socio-demographic characteristics of road traffic injury victims transported by ambulance from the scene to emergency department of selected public hospitals, Addis Ababa, Ethiopia, 2022 (n=262).

Variable	Alternatives	Frequency	Percent (%)
Gender	Male	162	61.8
	Female	100	38.2
Age (in years)	≤15	63	24.0
	16 – 30	64	24.4
	31 – 44	78	29.8
	≥45	57	21.8
	Mean age (SD)	31.3(16.3)	
Address	Addis Ababa	218	83.2
	Out of Adds Ababa	44	16.8
Educational status	No formal education	33	12.6
	Primary (1- 8)	123	46.9
	Secondary (9-12)	51	19.5
	College and above	55	21.0
Occupation	Merchant	45	17.2
	Student	55	21.0
	Civil servant	44	16.8
	Farmer	34	13.0
	Driver	48	18.3
	Others*	36	13.7

*daily laborers, driver assistance, housewife.

Table 2. Characteristics of road traffic injury victims transported by ambulance from scene to emergency department of selected public hospitals, Addis Ababa, Ethiopia, 2022 (n=262).

Variable	Alternatives	Frequency	Percent (%)
Site of injury	Street	182	69.5
	Others[a]	80	30.6
Mode of injury	Car driving	50	19.1
	Motor cyclist	56	21.4
	Pedestrian	87	33.2
	Passenger	49	18.7
	Driver assistant	10	3.8
	Others[b]	10	3.8
Time of incident	Morning to mid-day	83	31.7
	Afternoon	67	25.6
	Mid-night	83	31.7
	Mid-night to morning	29	11.1
Number of injuries	Single injury	142	54.2
	Multiple injuries	120	45.8
Injured body part	Head /Neck/Spine	69	26.3
	Chest/Abdomen/Pelvis	55	21.0
	Extremities	138	52.7
Open bone fracture	Yes	68	26.0
	No	194	74.0
Open wound	Yes	144	55.0
	No	118	45.0

[a]rural roads, workplace, public gathering places. [b]road janitor, street boys, shoeshine boy.

Pre-hospital care provided for road traffic injury victims

From the road traffic injury victims included in this study, 81(30.9%) were trapped in the wreck and only 9 (11.1%) were removed from the wreck by health professionals, while more than half 45 (55.6%) were removed from the wreck by people around them or bystanders. Finding on type of pre-hospital care provider showed that Nurses 121 (46.2%) were the most frequent care provider (Table 4). Patient positioning was the most frequently provided type of pre-hospital ambulance care (133.8%), followed by bleeding control, splinting/immobilizing 56 (21.4%), analgesics 39 (14.9%), fluid resuscitation 36 (13.7%), and suctioning 15 (5.7%).

According to the Kampala Trauma Score-II results, the majority of patients (143 (54.6%) who presented to the emergency department had severe injury, 69 (26.3%) had moderate injury, and 50 (19%) had mild injury. 17 (11.9%) of the severely injured patients died. The standard deviation of the Kampala Trauma Score-II of the road traffic accident victims was 2.5 (Table 5).

Factors associated with the first 24-hours of road traffic injury outcomes

Bivariate logistic regression was used to determine which variables should be included in the final multiple regression model, with injury to the head/neck/spine, injury to the chest/abdomen/pelvic, bleeding control, and total pre-hospital arrival time having p-values of 0.25 and being considered for multiple logistic regression. The final multiple regression model discovered that head/neck/spine injury and total pre-hospital arrival time were significantly associated with first-day road traffic injury mortality.

Victims with head/neck/spine injuries were four times more likely to die from a road traffic injury within 24 hours than their peers [AOR= 3.76; 95% CI (1.29, 10.96)]. Similarly, total pre-hospital arrival time greater than sixty minutes increases the odds of death within the first 24 hours by four times when compared to total pre-hospital arrival time less than or equal to sixty minutes [AOR= 4.31; 95% CI (1.39, 13.36); Table 6].

Discussion

According to this study, 8.4% (95% CI: 5.0%, 11.8%) of victims died within the first 24 hours of sustaining a road traffic injury. This finding is higher than studies conducted in Japan,[18] India,[19] and Addis Ababa, Ethiopia,[17] which reported 5.1%, 6%, and 4.9% of road traffic injury victims died within the first 24 hours, respectively. However, this finding was lower than studies conducted in Wolaita Sodo, Ethiopia,[20] which found that 14.1% of road traffic injury victims died within the first 24 hours, and Gondar 22.5% died within the first 24 hours. The difference in the prevalence of survival of road traffic injury victims could be attributed to differences in socio-demographic characteristics, testing methods, the Emergency Medical Service (EMS) system, the quality of pre-hospital and in-hospital care provided, and the types of

Table 3. Characteristics of road traffic injury victims transported by ambulance from scene to emergency department of selected public hospitals, Addis Ababa, Ethiopia, 2022 (n=262).

Variable	Alternatives	Frequency	Percent (%)
Condition of the victim on the arrival to the ED	Stable	56	21.4
	Unstable	206	78.6
Response time (min)	<16 min	13	5.0
	16 - 30 min	70	26.7
	>30 min	179	68.3
Total pre-hospital time (min)	<60 min	127	48.5
	≥60 min	135	51.5
Victim's triage category at ED	Green	29	11.1
	Yellow	45	17.2
	Orange	74	28.2
	Red	114	43.5
The first 24 hrs. injury outcome	Died	22	8.4
	Survived	240	91.6

Table 4. Pre-hospital Ambulance care provided for road traffic injury victims transported by Ambulance from scene to emergency department of selected public hospitals, Addis Ababa, Ethiopia, 2022 (n=262).

Variable	Alternatives	Frequency	Percent (%)
The victim in wreck or entrapped	Yes	81	30.9
	No	181	69.1
The victim removed from wreck or extricated by (n=81)	Health professionals	9	11.1
	Police	18	22.2
	Bystanders	45	55.6
	Relatives/Friends	9	11.1
Pre-hospital care provider	Nurse	121	46.2
	EMT	27	10.3
	First responder	106	40.5
	Other health prof *	8	3.1

*Other health prof= Health officer, midwife, pharmacist.

affected anatomic body parts during the injury.

According to the study, 43.5% of victims received pre-hospital bleeding control. This is higher than the 33.9% found in a previous Addis Ababa[21] study. This finding, however, is lower than that of a study conducted in western Ethiopia,[22] which reported 67.8%. This disparity may be due to differences in the nature of the injury and the service provider.

In this study, head/neck/spine injury and total pre-hospital time were found to be significantly associated with first-day mortality. Victims with head/neck/spine injuries were four times more likely to die within the first 24 hours of a road traffic accident than victims with other types of injuries. This finding was consistent with a study conducted in Spain[23] and China,[24] which revealed that victims with head/neck/spine injuries had a higher chance of dying within the first 24 hours when compared to survivors. This could be due to the severity and characteristics of a head/neck/spine injury, which could result in a serious complication with no way to intervene.

Furthermore, compared to total pre-hospital time less than or equal to sixty minutes, total pre-hospital time greater than sixty minutes increases the odds of death within the first 24 hours by four times. This finding is consistent with research from Peru,[25] China,[24] and Gondar.[26] A delay in hospital arrival after an injury may increase the risk of complication and death, which is related to heavy blood loss and major organ damage.

Conclusions

In conclusion, only one-tenth of road traffic injuries and trapped in wreck victims were removed from the wreck by health professionals. The victims' most common pre-hospital ambulance care was bleeding control. During pre-hospital trauma care, nearly half of the victims received pre-hospital ambulance care from first responders. More than half of the victims arrived at the hospital after golden hour. 8.4% of the victims studied died within the first 24 hours. The first 24 hours of road traffic injury death were significantly associated with head/neck/spine injury and total pre-hospital time. The establishment and strengthening of advanced pre-

Table 5. Description of Kampala Trauma Score II (KTSII) and road traffic accident injury severity of victims on arrival to emergency room in Addis Ababa, Ethiopia, 2022.

Variable	Label Description /Score	Frequency	Percent (%)
Systolic BP	>89 mmHg (2)	163	62.2
	50 – 89 mmHg (1)	80	30.5
	≤49 mmHg (0)	19	7.3
Respiration rate	10 – 29/ min (2)	151	57.6
	≥30/min (1)	73	27.9
	≤9/min (0)	38	14.5
Neurological status	Alert (3)	49	18.7
	Responds to verbal stimuli (2)	70	26.7
	Responds to painful stimuli (1)	88	33.6
	Unresponsive (0)	55	21.0
Serious injuries	None (2)	61	23.3
	One injury (1)	55	21.0
	More than one injury (0)	146	55.7
Age (in year)	5 – 55 (1)	238	90.8
	<5 or >55 (0)	24	9.2
Total Kampala Trauma Score	Mean (SD)	6(2.5)	
Kampala Trauma Score Category	Mild (9 –10)	50	19.1
	Moderate (7 – 8)	69	26.3
	Severe/fatal (≤6)	143	54.6

Table 6. Stepwise logistic regression, assessing factors associated with road traffic injury first 24-hour mortality among victims transported by Ambulance to emergency department of selected public hospitals, Addis Ababa, 2022.

Variables	24hrs Mortality		COR (95%CI)	AOR (95%CI)	P value
	Yes	No			
Sites of injury					
Head/Neck/Spine	10	58	4.55 (1.49, 13.90)*	3.76 (1.29, 10.96)**	0.015
Chest/Abdomen/Pelvic	7	50	3.69 (1.12, 12.18)*	4.31(0.52, 6.48)	
Extremities	5	132	1	1	
Bleeding control					
Yes	5	109	0.35 (0.12, 0.98)*	0.36 (0.13, 1.05)	0.062
No	17	131	1	1	
Total pre-hospital time (minute)					
≤ 60	4	123	1	1	
>60	18	117	4.73 (1.55, 14.39)*	4.31 (1.39, 13.36)**	0.011

Abbreviations: COR, crude odds ratio; AOR, adjusted odds ratio; CI, confidence interval. NB. 1: reference, *Remained significant at p-value <0.25, **Remained significant at p-value <0.05.

hospital ambulance care, as well as the reduction of pre-hospital trauma time, should be prioritized. The study's findings suggest a course of action to improve access by increasing the availability of necessary equipment in ambulances while also increasing the number of paramedics and first responders through the implementation of various training programs.

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