Epidemiology and outcomes of injuries among trauma patients in Ethiopia: A 5 -years retrospective Analysis

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Abstract

Background: Injury becomes life threatening community health problem associated with significant mortality and morbidity worldwide. Road traffic accident is the most commonly encountered trauma and the leading cause of death and disability from injuries in Ethiopia. The aim of this study is to assess the epidemiology and outcomes of injury in Ethiopian University Hospital.

Methods: Institutional based retrospective cross-sectional study was conducted from January 2015 to June 2019. Data was collected using questionnaire adapted from WHO injury surveillance guideline. Bivariate and multivariate logistic regressions were performed to determine factors associated with hospital mortality.

Results: A total of 376 trauma cases were included in the study. The majority of 196(52.1%) victims were in the age range of 20-40 years. Road traffic accident was the commonest mechanism of injury 178(47.3%) followed by interpersonal violence 113(30.1%). The majority of patients 135(35.9%) had associated with lower extremity injury and there was 23(6%) mortality in this study. Revised trauma score (RTS) < 10 (AOR=2.5; 95% CI, 1.8-25.6), Glasgow coma scale (GCS) (AOR =0.3; 95% CI, 0.13-0.5), Length of hospitalization (LOS) 1-7 days (AOR=0.1; 95% CI, 0.01-0.8), and Time to arrival >24hr were predictors of mortality in a patient with injury.

Conclusion: A lower extremity injury was common and mostly associated with RTA. Length of hospitalization > 7 days, RTS<10, decrease GCS and time to arrival >24hr were factors associated with mortality. Pre-hospital emergency medical service system and trauma registry needs to be established to decrease burden of injury.

Keywords: Injury, Epidemiology, Outcome, Ethiopia

Background

Injury becomes life threatening community health problem associated with significant mortality and morbidity worldwide[1,2,11–18,3–10]. According to WHO injury and violence surveillance, more than 5 million people die per year associated with injury which accounts for 9% of world's death[19]. This figure is more than the combined fatalities resulting from HIV/AIDS, malaria and tuberculosis. Approximately, 90% of injury related mortality occurred in low and middle income countries. Road traffic injuries are one of the leading causes of death which accounted for a quarter of 5 million injury death, specifically in 15-29 age categories[19]. It is predicted to be the seventh leading causes of death by 2030 in the world[19]. In Sub-Saharan Africa, injury related mortality and morbidity is very high specifically in low and middle income countries from which road traffic injury takes the lion share[10,20,21]. Recent Global Burden of Disease (GBD) showed that mortality related with injury in Sub-Saharan Africa is estimated to be 14.6/100000 persons in 2020 as compared to 97/100000 persons worldwide[21].

In Ethiopia, Epidemiological studies showed that the pattern and outcomes of injury is variable in different regions of the country. A study conducted in University of Gondar revealed that the prevalence of injury was 25% and from which 82% were young males. The commonest mechanism of

injury was Assault (49.9%) and road traffic accidents (48%)[7]. Another multicenter study conducted in Amhara regional state showed that the prevalence of injury in the region was 55.5%[6]. Those who are young and daily laborers, substance abusers and those who are with low monthly incomes were the most likely injury victims[6]. A study conducted in Tikur Anbesa Specialized and teaching Hospital showed that the prevalence of injury was 32.5%. In this cross sectional study, road traffic accident was the most common mechanism of injury (38%) followed by violence (31.5%). Young population (20-29 years) and those with low monthly income (less than 650 Ethiopian Birr) were more likely to sustain injury incidents when compared to the other population groups[22]. Another study conducted in Yirglem General Hospital reported the prevalence of injury as 49.9% and the most common mechanism of injury was road traffic accident[2].

In Ethiopia, there is no national prevalence of trauma and national database injury registry for health planners and policy makers who are in need of the national prevalence of injury. Therefore, there it is a need to have the prevalence and outcomes of trauma from different areas of the country for planning and management strategies of injury. The aim of this study is to assess the epidemiology and outcomes of injury in this catchment area.

Methods

Study Area

The study was conducted in Dilla University Teaching and Referral Hospital which is found in Dilla Town, Gedeo Zone on the main road from Addis Ababa to Kenya 360km South of Addis Ababa, 90km South of Hawassa (capital of SNNPR) and has a longitude and latitude of $6^0$24¢30N 38°18¢30E with an elevation of 1570 meters above sea level. It is one of the public university hospitals providing health services to more than 4 million population of Gedeo Zone and neighboring catchment areas of Sidama and Oromia Region with 500 hospital beds. The hospital has four main departments (Medical, Surgical, Pediatrics and Gynecology/Obstetric wards), three special care units (Medical Intensive Care Unit, Neonatal Intensive Care Unit and Surgical recovery Room) and five clinics (Eye, Anti-retro viral Treatment, Dental, TB and MDR-TB clinics).

Study design and period

This was a five-year retrospective study on the pattern and outcome of trauma patients visited the emergency department of DURH from January, 2015 to June, 2019. A hospital-based retrospective

chart review was conducted on the pattern and outcome of trauma patients visited the emergency department of DURH from January, 2015 to June, 2019.

Source population: All trauma patients who visit DURH emergency department

Study population: All trauma patients during the past five year who visited DURH emergency department.

Inclusion criteria

- Injured patients charts' with complete clinical and socio-demographic information

Exclusion Criteria

- Patients who referred to other center after admission and non-traumatic Patients visiting emergency department were excluded.

Sample size: The required sample size was calculated using single proportion formula to obtain sample size needed to estimate the prevalence injury. The Prevalence of injury was taken from previous study conducted in the region, P = 0.494 [8], confidence interval = 95% and margin of error (d) = 5%. Hence, the required sample size was 384 injury patients visiting surgical emergency department.

Sampling technique: All patients with injury within the study period were identified (N=4390) and this gave us the sampling frame. The required sample size was selected by systematic random sampling technique with skip interval (K=11). Finally, 376 patients were included in the study while the rest eight cases were excluded due to incomplete records (Figure-1).

Figure 1 flow diagram of sampling procedure

Data Collection procedures

A structured questionnaire adapted from WHO injury surveillance validated for low and middle-income countries was used to collect the information. We included in the questionnaire the following: socio-demographic data (age, sex, level of education, place of residence, income, living condition, and occupation); injury mechanism; interval time from injury to admission; systolic blood pressure (BP); diastolic blood pressure (DB); pulse rate (PR); respiratory rate (RR); type, mechanism and pattern of injury; revised trauma score; Glasgow Coma Score (GCS) and length of stay (LOS). The outcome was status on discharge.

Study variables

Dependent variable

Patient status on discharge from Hospital

Independent variables

Socio-demographic characteristics include Age, Gender, residence, educational status, income and living condition. Patient clinical parameters such as Blood pressure, GCS, RTS, Respiratory rate, Heart rate and Injury characteristics and triage including types of injury, mechanism of injury, mode of transportation, time to arrival to institution, hospitalization, surgery, ICU admission/duration, mechanical ventilation.

Data Quality Assurance: The structured questionnaire were prepared in English first and translated to the local language, Amharic and again back to translation to English was made to ensure that the consistency of the questionnaire. Pretest was done on 5% of sample size. Data collectors and supervisors were trained on each items included in the study tools, objective, relevant of study. During data collection, regular supervision and follow up were made. Investigator cross checked for completeness and consistency of data on daily basis.

Statistical analysis and processing: After completeness of the data was crosschecked manually, it was entered into epi info version 7 computer programs and transported to SPSS version 22-computer program for further analysis and cleaning. Descriptive statistics was used to summarize tables and figures and statistical summary measures were used for presentation. Outlier of the data was checked using standardized residual tests and multi-collinearity for continuous data was checked by VIF and tolerance. Linearity of the continuous variables with respect to the logit of the dependent variable was

assessed via the Box-Tidwell procedure and all continuous independent variables were found to be linearly related to the logit of the dependent variable. Association of trauma injury related variables and demographic characteristics with outcome of patient on discharge were analyzed using chi-square, fisher's exact test and binary logistic regression with odds ratio and 95% CI in the univariate analysis. Multivariate logistic regression analysis was used to determine association of combination of risk factors for patient outcome on discharge (died or improved). All variables with a $p < 0.20$ in the univariate analysis were entered in the logistic regression model. Odds ratios (OR) and 95% confidence intervals were then calculated. A p value less than 0.05 was considered significant. Additionally continuous trauma related variable were checked for association with dependent variable by area under the curve of a receiving operating curve analysis(ROC) with a confidence interval of 95% and p-value.

Ethical Consideration: Ethical clearance and approval was obtained from ethical review board (IRB). As the study was retrospective, the IRB waived that the research could be done based on record review without contacting the patients. A support letter was obtained from the medical director office of the hospital for retrieving retrospective data from the database and records. All the information was kept confidential, and no individual identifiers were collected.

Results

A total of 9420 cases were received in surgical emergency department of Dilla University Teaching and Referral Hospital from January 2008-June 2019, from which 4390 patients were trauma cases. 376 cases had complete documentation from 384 included samples giving a response rate of 98%.

Socio-demographic characteristics

The mean and SD of ages of study participants was 24.5(±10.3). In this study, the youngest and the oldest trauma victims were 3 years and 66 years old respectively. The majority of victims were in the age range of 20-40 years, 196(52.1%) whereas 29(7.7%) cases were in the age range of greater than 40 years old. The majority of cases experiencing trauma were rural dwellers 225(59.8%) compared to urban dwellers who were 151(40.2%). In this study, patients with low socioeconomic status accounted the majority of trauma incidents compared to middle and high socioeconomic status. More than half of the study participants were single 243(62.2%) whereas there was only one divorced trauma victim. On

the other hand, students accounted the majority of trauma incidents 161(42.8%) followed by farmers 80(22.1%), **(Table 1)**

Table-1: socio-demographic characteristics of patients visiting surgical emergency department, DHURH, 2016-2019, (n=376)

Characteristics	Category	Number	Percent
Age	≤ 20	151	40.2
	20-40	196	52.1
	≥40	29	7.7
Gender	Male	267	71
	Female	109	29
Place of Residence	Urban	151	40.2
	Rural	225	59.8
Educational status	Illiterate	76	20.2
	Read and write	73	19.4
	Primary school	124	33
	Secondary school	93	24.7
	College and above	10	2.7
Marital status	Single	243	62.2
	married	137	36.4
	Widowed	4	1.1
	Divorced	1	0.3
Occupation	Student	161	42.8
	Civil servant	11	2.9
	Driver	35	9.3
	Farmer	83	22.1
	Unemployed	80	21.3
	Others	6	1.6
Income	Low	280	74.5
	Middle	90	23.9
	High	6	1.6
Living condition	Home	373	99.2
	Street	3	0.8

Epidemiology of trauma

In this study, the overall prevalence of trauma was 46.6%. Road Traffic Accident was the commonest mechanism of injury 178(47.3) followed by assault 113(30.1%) whereas burn injury was the lowest mechanism of injury 22 (5.9**), (Figure 2).**

Figure 2 Mechanism of Injury

The commonest types of injury was lower extremity injury 135(35.9%) followed by upper extremity 74(19.7) and Polytrauma 58(15.4) whereas chest trauma was the found to be the lowest types of injury, **(Figure 3).**

Figure 3 Types of Injury

Outcomes of trauma

In this study, there was 23(6%) death from included samples visiting surgical emergency department. Mortality of cases were more prevalent in 20-40 age groups 13(56.5%) and who are male 12(52.2%). There was more death in rural dwellers 16(69.6%) compared to the one who lives in Urban 7(30.4). The majority of deaths occurred in students 6(20.1%) and who are male 12(52.2) when compared to the other groups**.** Besides, the mortality of cases was very high in low socioeconomic status when compared to middle and high socioeconomic status, (**Table 2)**

Table-2: socio-demographic characteristics and outcomes of patients visiting surgical emergency department of Dilla University Teaching and Referral Hospital, 2016-2019, (n = 376)

Variable	Category	Outcome		Number (%)
		Improved	Died	
Age	<20	145	6	151(40.2)
	20-40	183	13	196(52.1)
	>40	25	4	29(7.7)
Gender	Male	255	12	267(71)
	Female	98	11	109(29)
Place of residence	Urban	144	7	151(40.2)
	Rural	209	16	225(59.8)
Educational status	Illiterate	66	10	76(20.2)
	Read and write	118	5	123(32.7)
	Primary school	69	4	73(19.4)
	Secondary school	90	4	94(25)
	College and above	10	0	10(2.7)
Marital status	Single	223	13	236(62.8)
	Married	125	10	135(35.9)
	Widowed	4	0	4(1.1)
	Divorced	1	0	1(0.3)
Occupation	Student	155	6	161(42.8)
	Civil servant	10	1	11(2.9)
	Driver	34	1	35(9.3)
	Farmer	75	8	83(22.1)
	Unemployed	73	7	80(21.3)
	Others	6	0	6(1.6)
Income	Low	264	16	280(74.4)
	Medium	87	3	90(24)
	High	2	4	6(1.6)
Living condition	Home	351	22	373(99.2)
	Street	2	1	3(0.8)

Road Traffic Accident was the commonest cause death 12(52.2%) followed by assault 8(34%) and the least was found in burn patients. Polytrauma was responsible for the majority of death 10(43.5%) followed by head injury 9(39.1). The mortality of cases with lower trauma score at admission was very high. The mortality of cases that arrived in health institution after one hour was very high, **(Table 3).**

Table-3: epidemiology of trauma and outcomes of patients visiting surgical emergency department of Dilla University Teaching and Referral Hospital, 2016-2019, (n = 376)

Variable	Category	Outcome		Number (%)
		Improved	Died	
Mechanism of injury	RTA	166	12	178(47.3)
	Assault	105	8	113(30.1)
	Fall	58	3	61(16.2)
	Burn	9	0	9(2.4)
	Others	15	0	15(4)
Types of injury	Head	35	9	44(11.7)
	Chest	21	1	22(5.9)
	Abdomen	42	1	43(11.4)
	Upper extremities	74	0	74(19.7)
	Lower extremities	133	2	135(35.9)
	Polytrauma	48	10	58(15.4)
Revised trauma score	<10	10	10	20(5.3)
	≥10	343	13	356(94.7)
Glasgow Coma scale	Mild	349	14	363(96.5)
	Moderate	4	2	6(1.6)
	Severe	0	7	7(1.9)
Time to arrive institution	Immediate(<1hr)	162	2	164(43.6)
	Within hrs(1-24hrs)	190	13	203(54)
	Within days(>24hrs)	1	8	9(2.4)
Mode of transportation	Ambulance	27	7	34(9)
	Bajaj	141	6	147(39.1)
	Taxi	169	8	177(47.1)
	Others	16	2	18(47.8)
Operated on	Yes	10	5	15(4)
	No	343	18	361(96)
Hospitalization	Less than one day	1	0	1(0.3)
1-	7days	329	11	340(90.4)
	>7days	23	12	35(9.3)

Determinants of patient mortality after injury

Using ROC curve, we assessed the individual performance of age of respondent, Glasgow coma scale, revised trauma score, time to arrival, systolic blood pressure and length of hospitalization to predict trauma outcome. In assessing the acceptable discrimination for predicting trauma injury outcome both time to arrival and length of hospitalization are above the reference line and the other variable like Glasgow coma scale, revised trauma score and systolic blood pressure are below the reference line. The ROC analysis curve yielded an area under cure (AUC) =0.96, 95% CI: 0.92-1.00 for time to arrival which showed the highest predictive ability and excellent at discrimination of trauma patient mortality.

The AUC for the length of hospitalization was 0.59, 95% CI: 0.46-0.72, which is poor at discrimination of patient outcome (figure 4)

Figure 4 the receiver operating characteristic curve of age, GCS, RTS, SBP, time to arrival and hospitalization

Bivariable logistic regression with crude odds ratio on various clinical characteristics in injury patients and potentially confounding factors that affected the relationship between primary predictor variables and a dichotomous categorical outcome (dead or improved) were considered, with a 95% confidence interval and $P < 0.05$. Patients with associated abdominal injury, lower extremity injury, time to arrival > 24hrs, being admitted for 1-7 days in hospital, revised trauma score <10, decrease GCS and operation had higher odd of mortality on bivariate analysis

Sex, income, age group, type of injury, time to arrival, revised trauma score (RTS), operated on and Glasgow coma scale (GCS) were the variables that had p-value <0.2 and were considered for multiple logistic regression. After adjustment for multiple logistic regression, Mortality after injury is three times more likely in a patient with revised trauma score less than ten, (AOR] =2.5, 95% CI= [1.8, 25.6]). One unit in decreasing GCS was associated with three times [AOR] =0.3, 95% CI= [0.13, 0.5]) higher odds of predicting mortality. Being admitted for 1-7 days in hospital were 90% [AOR] =0.1, 95% CI= [0.01, 0.8] less likely to predict mortality compared with those admitted for >7 days. Being middle income was also another associated factor with less likely to develop hospital mortality than their counterpart. With regard to time to admission, those with time to arrival <1hr and 1-24hr was associated with less likely to have hospital mortality compared with time to arrival >24hr (table 4).

Table-4: bivariate and multivariate output on factors associated with injury outcomes

Variable	Category	Outcome		COR	P-value	AOR	P-value
		Improved	Died				
Age	<20	145	6	0.26(0.70-0.98)	0.04	1.87(0.09-39)	0.68
	20-40	183	13	0.44(0.13-1.47)	0.18	0.51(0.25-10)	0.66
	>40	25	4	1		1	
Gender	Male	255	12	0.42(0.18-0.98)	0.04	0.54(0.08-3.8)	0.54
	Female	98	11	1		1	
Income	Low	264	16	0.03(0.01-0.18)	<0.001	0.09(0.002-3.5)	0.2
	Medium	**87**	**3**	**0.02(0.002-0.13)**	**<0.001**	**0.003(0-0.4)**	**0.02**
	High	2	4	1		1	
Time to arrival	Immediate(<1hr)	**162**	**2**	**0.002(0-0.02**	**<0.001**	**0(0-0.011)**	**<0.001**
	Within hrs(1-24hrs)	**190**	**13**	**0.009(0.001-0.07)**	**<0.001**	**0(0-0.016)**	**<0.001**
	Within days(>24hrs)	1	8	1		1	
Types of injury	Head	35	9	1.23(0.45-3.35)	0.68	1(0.09-10.5)	0.99
	Chest	21	1	0.22(0.02-1.9)	0.17	0.28(0.01-8.7)	0.46
	Abdomen	42	1	0.11(0.01-0.9)	0.04	0.35(0.02-5)	0.44
	Upper extremities	74	0	-	-	-	-
	Lower extremities	133	2	0.07(0.02-0.34)	0.001	0.07(0.002-2)	0.12
	Polytrauma	48	10	1		1	
Operated on	Yes	10	5	9.53(2.0-30.8)	0.0002	2(0.06-60)	0.69
	No	343	18	1		1	
Hospitalization	Less than one day	1	0	-	-	-	-
	1-7days	**329**	**11**	**0.06(0.03-0.16)**	**<0.0001**	**0.1(0.01-0.8)**	**0.038**
	>7days	23	12	1		1	
RTS	<10	**10**	**10**	**26.4(9.35-74.41)**	**<0.0001**	**2.5 (1.8-25.6)**	**0.04**
	≥10	343	13	1		1	
GSC Median(IQR)	15(0)			**0.45(0.34-0.58**	**<0.0001**	**0.3(0.13-0.5)**	**0.001**

COR: Crude Odd Ratio, AOR: Adjusted Odd Ratio, GCS: Glasgow Coma Scale, RTS: Revised Trauma Score

Discussion

The prevalence of injury in this study was 46.6% which is comparable with a study conducted in Yirgalem (49%)[2]. But it was higher than studies conducted University of Gondar (25%)[7] and Tikur Anbesa Hospital (32%)[22] and this discrepancy might be due to poor road safety, more motorcycle transportation in our study area. It was lower than a study conducted in Amhara regional State (55.6%)[6] and Jimma University Referral Hospital[5] and this is explained by study setting and large sources of population compared to this study area. The prevalence of injury in one of Nigerian Tertiary Hospital was lower than half of ours and this might be due to better mode of transportation and road safety[23].

This study revealed that male gender and young age groups, 20-40 age groups, were the most commonly injured ones who are supposed to be the gear changers of the economic activities of the country. This finding is consistent with findings of WHO injury and violence surveillance facts and other studies conducted in Sub-Saharan African countries[10,19–21]. The majority of patients were primary School attendants and student in regard to occupational status. This finding is comparable with a study conducted in Yirgalem, Nigeria and Tanzania[2,23,24]. A multicenter study conducted in Amhara regional state found that illiterate and Farmer were the most likely injured patients in contrary to this study finding[6].

In this study, patients from rural area are more affected with injury as compared to urban and this finding is consistent with a study done in University of Gondar and Yirgalem[2,7]. However, patients residing in Urban are affected more likely as compared to patients from rural in multicenter study conducted in Amhara regional state and Sub-Saharan African countries[6,20]. This discrepancy might be due involvement of multicenter from big towns in the region.

Road traffic accident was the commonest types of injury (47.3%) followed by inter-personnel violence (30.1%) which is comparable with findings of Sub-Saharan African countries and WHO reports[1,20,21,25,26]. In this study, lower extremity injury is the most common types of injury unlike other studies conducted in Africa which was head injury[5–8,22,27,28]. This discrepancy might be due to Head injury case referral as our hospital didn’t have neurosurgical facilities.

The study showed that the prevalence of death was high (6%) as compared to a study conducted in University of Gondar (2.11%) and the difference might be explained by study setting, referral linkage and admission.

This study showed that patients who arrived in greater than twenty four hours after injury are more likely to die as compared to patients arrived in less than twenty four hours. This finding is consistent with a study conducted in Tanzania[24] and Ruanda[8]. This study revealed that duration of Hospitalization greater than seven days was an independent predictor of hospital mortality as compared to patients hospitalized for less than seven days. This finding is in line with a study done in Tanzania[24]. This study showed that Revised Trauma Score and Glasgow Coma scale was significantly associated with patient mortality. The patient mortality increases three times in reduction of Glasgow Coma scale by one unit whereas patient mortality was three times more likely in patients with revised trauma score less than ten

Limitations

This study has a number of limitations despite its significant contribution as a source of information for prevention and management strategies. As this is a cross-sectional hospital based study, the findings are not generalizable to the general population. Besides, lack of trauma registry and incomplete patient charts were the major challenges.

Conclusions

The prevalence of injury in this study is very high and took the lives of the most productive age groups of the population. Road traffic injury and violence are the two most common causes of injury which counted for more than eighty-percent of deaths (20/23). Patients with low trauma score and came late are more likely to have significant mortality and morbidity. In this study, there were more deaths associated with head injury and Polytrauma. There is a need to have urgent injury preventive and management strategies along with establishment of Pre-hospital Emergency Medical service System.

Abbreviations

AOR	Adjusted Odd Ratio
AUC	Area Under the curve
BP	Blood Pressure
CI	confidence interval
COR	Crude Odd Ratio
DURH	Dilla University Referral Hospital
GBD	Global Burden of Disease
GCS	Glasgow Coma Scale
HIV/AIDS	Human Immunovirus/Acquired Immino Defficiency Syndrome
ICU	Intensive Care Unit
IRB	Institutional Board Review
LOS	length of Stay
OR	Odd Ratio
PR	Pulse Rate
ROC	receiving operating curve
RR	Respiratory Rate
RTS	Revised Trauma Score
SBP	systolic Blood Pressure
SD	Standard Deviation
SNNPR	South Nations, Nationalities, peoples' Region
WHO	World Health Organization

Declarations

Ethics approval and consent to participate

Ethical clearance and approval was obtained from ethical review board of College of Health Science and Medicine.

Consent for publication

Not applicable

Availability of data and materials

Data and material can be available where appropriate.

Competing interests

The Authors declare that there are no any competing interests

Funding

No funding was obtained from any organization

Authors' contributions

SA and BJ conceived the idea design the project. SA, BJ, HM and BB involved in data collection, interpretation, analysis and manuscript preparation

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Figures

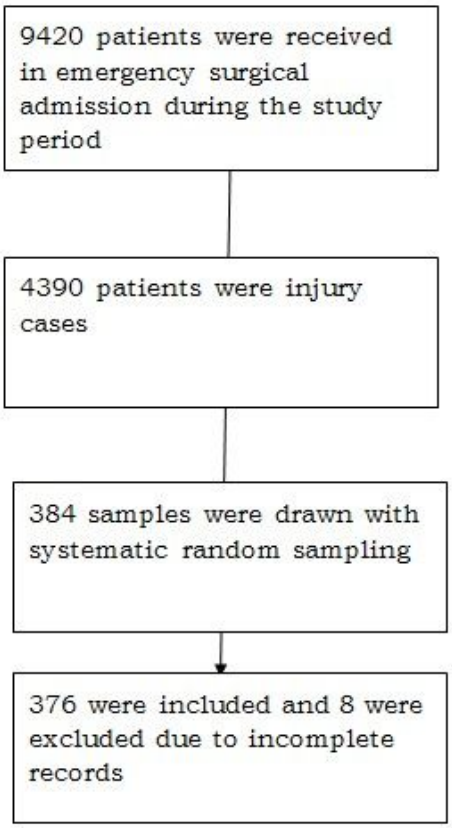


Figure 1

flow diagram of sampling procedure

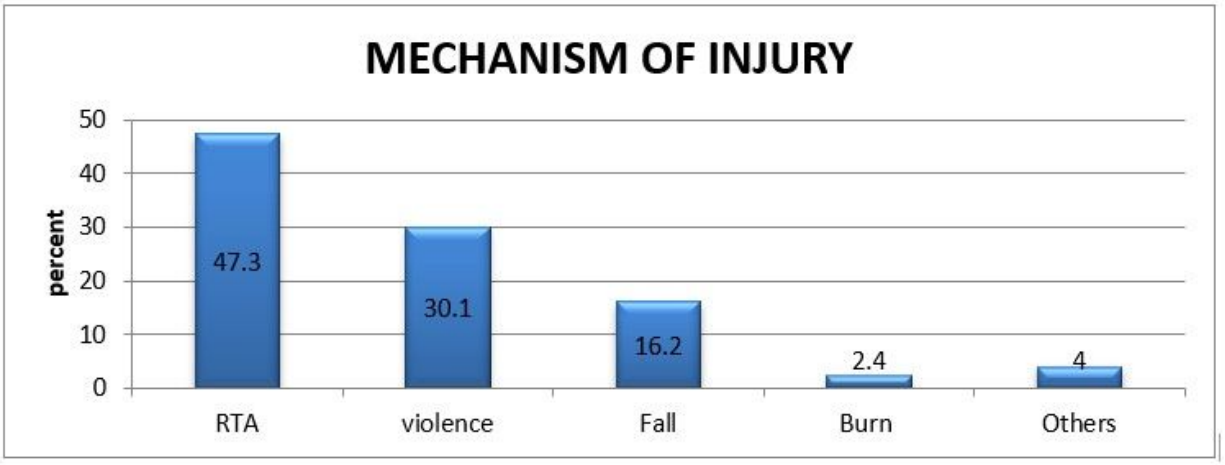


Figure 2

Mechanism of Injury

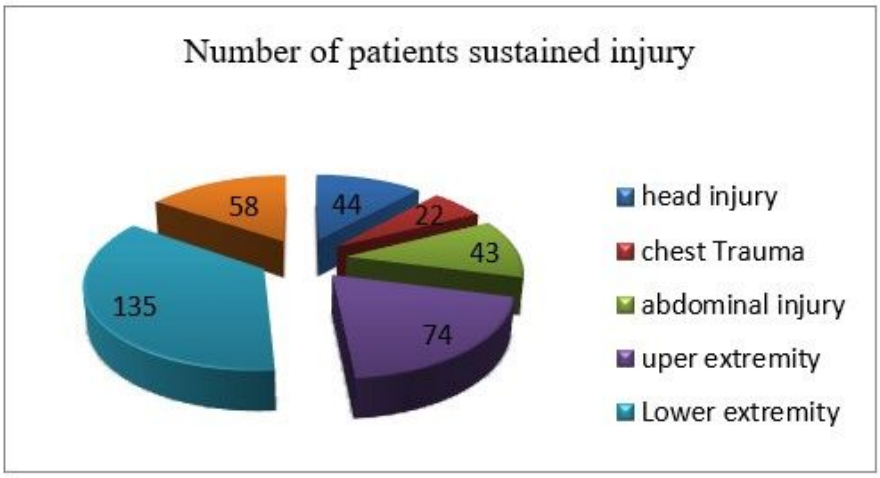
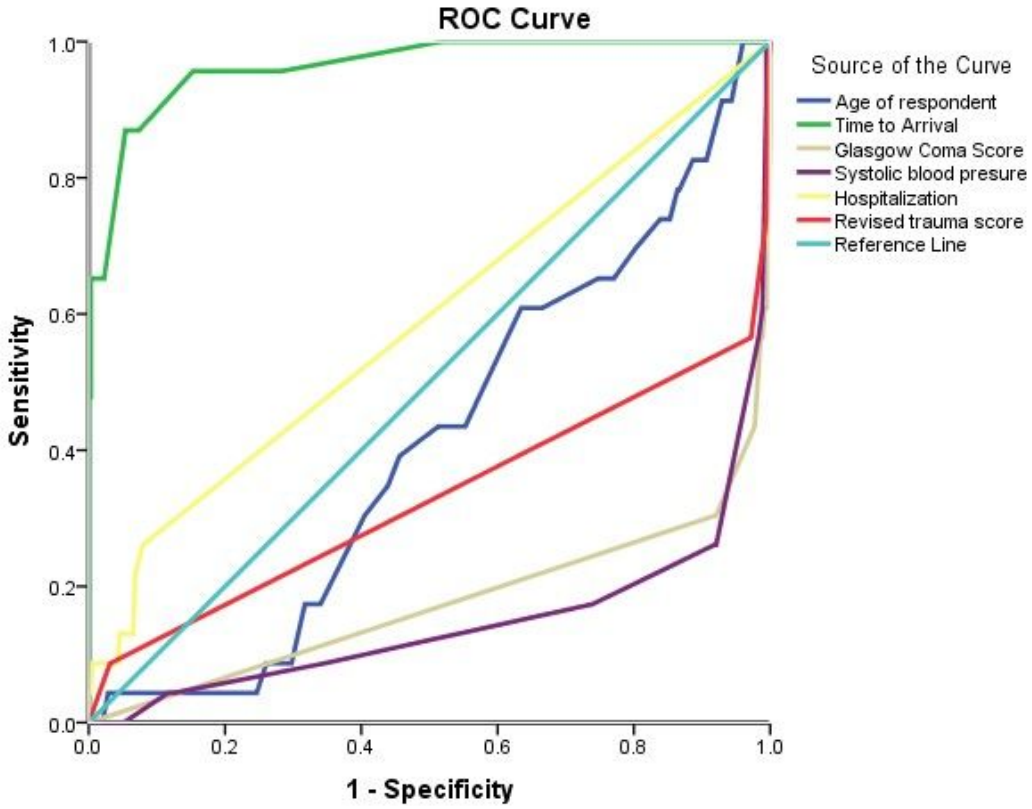


Figure 3

Types of Injury



[redacted]

Figure 4

the receiver operating characteristic curve of age, GCS, RTS, SBP, time to arrival and hospitalization