**ADDIS ABABA UNIVERSITY**

**COLLEGE OF HEALTH SCIENCE**

**School of Graduate Studies Department of Anatomy**

# Common Types and Patterns of Bone Fractures and Their Prevalence in Road Traffic Accident Victims Visiting Governmental Hospitals in Addis Ababa, Ethiopia.

A Thesis Submitted to the School of Graduate Studies of Addis Ababa University, Department of Anatomy in Partial Fulfillment of the Requirements for Masters of Science Degree in Human Anatomy

**By Adisu Asefa (BSc)**

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## DECLARATION

This is to certify that the thesis prepared by Adisu Asefa, entitled: “Common Types and Patterns of Bone Fractures and Their Prevalence in Road Traffic Accident Victims Visiting Governmental Hospitals in Addis Ababa, Ethiopia “and submitted in partial fulfillment of the requirements for the Degree of Masters of Science in Medical Anatomy complies with the regulations of the university and meets the accepted standards with respect to originality and quality. This thesis has not been presented for a degree in any other university, and that all sources of materials used for the thesis have been duly acknowledged. The thesis has passed with…….remark.

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| Adisu Asefa | ---------- | ---------- |
| Candidate | Signature | Date |

## Signed by the Examining Committee:

| | Name | Signature | Date |
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| Examiner | ---------- | ---------- | ---------- |
| Principal Advisor | ---------- | ---------- | ---------- |
| Co-advisor | ---------- | ---------- | ---------- |

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# LIST OF ABBREVIATION AND ACRONYMS

| | |
|---|---|
| AAU | Addis Ababa University |
| CDC | Centers for Diseases Control and Prevention |
| DALYs | Disability Adjusted Life Years |
| DRERC | Department Research Ethics Review Committee |
| ED | Emergency Department |
| ETB | Ethiopian Birr |
| GBD | Global Burden of Diseases |
| GNP | Gross National Product |
| IHME | Institute of Health Metrics and Evaluation |
| IRB | Institute Review Board |
| MDGS | Millennium Development Goals |
| MRN | Medical Record Number |
| OTA | Orthopedic Trauma Association |
| RTA | Road traffic Accident |
| RTI | Road Traffic Injury |
| STI | Soft tissue injury |
| TAH | Tikur Anbessa Hospital |
| WHO | World Health Organization |

# ABSTRACT

**Background**: Road traffic injuries are among the leading causes of preventable death and life-long disability globally. The World Health Organization (WHO) reports that about 1.24 million people die annually on the world's roads, with 20–50 million sustaining non-fatal injuries. **Objective of the study**: The objective of this research was to assess common types and patterns of bone fractures and their prevalence in RTA victims visiting Addis Ababa Governmental Hospitals.

**Materials and Methods**: Institution based retrospective cross sectional study was carried out in in Addis Ababa Governmental Hospitals. The sample size was 384 and 5 hospitals were selected from 11 governmental hospitals in Addis Ababa. The data was entered into EPI data manager version 3.3 and analyzed using IBM SPSS Statistics version 22. The results were summarized in the form of proportions and frequency tables for categorical variables. P-values were computed for categorical variables using Chi-square ($\chi 2$) test. Bivariate analysis was carried out to distinguish the relationship between dependent and independent variables.

**Results:** Out of 13,526 road traffic accident victims, 384 road traffic accident victims were included in the study. The study participants comprised of 263 (68.5 %) men and 121 (31.5 %) women. Majority of the injured victims were pedestrians (232, 60.4%). Extremities and the head were the most common body regions injured accounting for 45.1 % and 20.6 % of cases respectively. Soft tissue injuries accounts for 227(59.1%) and fractures 92(24%) were the most common patterns of injured regions. The most common site of fracture was the lower limb which accounted for (55.6%). There was statistically significant association between the age of RTA victims and multiple site bone fractures; (Pearson correlation (r=+ 0.264) and P= 0.037).

**Conclusion:** The current study shows diverse injury characteristics among the victims of RTA attending Addis Ababa Governmental Hospitals. The findings reflect that road traffic accident is a major public health problem. The age group that is most frequently involved in RTAs is the 15-34 years old group. Majority of the victims in this study were pedestrian. The extremities and the head were the most common body regions injured.



**Keywords**: Road traffic accident, Injury characteristics, Fractures, Prevalence, Addis Ababa, Ethiopia.

# 1. INTRODUCTION

## 1.1 Background

A road traffic accident can be defined as “a fatal or non-fatal injury incurred as a result of a collision on a public road involving at least one moving vehicle” (1). According to Safe Car Guide, road traffic accident can be defined as “an accident that occurs on a way or street open to public traffic, results in one or more persons being killed or injured, and at least one moving vehicle is involved. Therefore, RTA is a collision between vehicles, between vehicles and pedestrians, between vehicles and animals, or between vehicles and fixed obstacles” (2).

Road traffic injuries are among the leading causes of death and life-long disability globally. Globally, RTIs are reported as the leading cause of death among young people aged 15–29 years and are among the top three causes of mortality among people aged 15–44 years (3). The Institute for Health Metrics and Evaluation (IHME) estimated about 907 900, 1.3 million and 1.4 million deaths from road traffic injuries in 1990, 2010 and 2013, respectively (5).

Road traffic injures (RTIs) are responsible for a substantial proportion of deaths and injuries and are responsible for more years of life lost than most human diseases. Human behavior factors, vehicle factors, and road factors contribute to the causation of road traffic crushes (6). Although the numbers of lives lost in road crushes in high-income countries indicate a downward trend in recent decades, for most of the world’s population, the burden of road-traffic injury in terms of societal and economic costs is rising substantially (8).

In many developing countries, not only is the incidence of various injuries increasing but also the causative factors are changing from the historical patterns such as falling from trees to injuries due to occupational hazards, interpersonal violence and road traffic injuries, which appear to be the leading cause of traumatic injuries (9).

Statistics from many developing countries ascertain to these changes. In Mexico for example, as deaths from infectious diseases declined from 43% to 17%, deaths from injuries rose from 4% to 11% of all deaths, with road traffic injuries contributing to most of the deaths (10).

The situation in Africa shows a similar trend. Nigeria with one of the highest road traffic injury rates, recorded an increase of 43% in road traffic injuries with 110% increase in death rates, between 1977 and 1983(10).

The corresponding populations increase during the same period was only 2.7%. Another study in Nigeria found that the proportion of death from road traffic injuries increased from 38.2% to 60.2% within ten years (8).

RTA related bone fractures contribute to an increase in morbidity, death, disability, and health expenditures across the age span. The incidence of bone fracture is impacted by many factors including age, race, gender, biology, physiology, body habitus, and environmental exposure to fracture-producing injury mechanisms and access to prevention programs (10).

## 1.2 Statement of the problem

Road traffic injuries are among the leading causes of preventable death and life-long disability globally. The World Health Organization (WHO) reports that about 1.24 million people die annually on the world's roads, with 20–50 million sustaining non-fatal injuries (3).

Globally, road traffic crashes are a leading cause of death among young people, and the main cause of death among those aged 15–29 years (3).

RTIs are currently estimated to be the ninth leading cause of death across all age groups globally, and are predicted to become the seventh leading cause of death by 2030 (3).

Road traffic injures (RTIs) are responsible for a substantial proportion of deaths and injuries and are responsible for more years of life lost than most human diseases. The costs of fatalities and injuries due to road traffic accidents have a tremendous impact on societal well-being and socioeconomic development. Moreover, for each fatality resulting from a road traffic crash there are numbers of serious injuries, which may lead to permanent disability (6).

RTA related bone fractures contribute to an increase in morbidity, death, disability, and health expenditures across the age span.

In Ethiopia, road traffic accident has been one of the top ten causes of death. For example, in 2013, the number of people killed by road traffic accident was equivalent to those who died due to malarial (which is 9th cause of death) throughout the country (7). Road traffic deaths and injuries has therefore been the key public health and development challenges of the country and will continue to adversely affect the livelihood of community and the economy of the country unless effective measures are taken to control the problem (8).

## 1.3 Significance of the study

Locally the prevalence of bone fracture following RTA and the magnitude is unknown. Data on the prevalence of fracture will help us to focus on orthopedic management of patients, eventually minimize the morbidity /disability and mortality of the victims.

This study will aim to determine the prevalence of common types of bone fracture and their patterns among road traffic accident victims in Addis Ababa Governmental Hospitals.

The result of this study will lead to an organized bone fracture and road traffic accident data in Addis Ababa Governmental Hospitals that provide good information. The result of this study may influence policy especially on resource and budget allocation for hospital equipment to facilitate management of fracture patients. The result of the current study may enables a health care professional to predict fracture and site of injury.

Finally, this study will also provide a baseline information to other researcher to conduct further research related issues.

# 2. LITERATURE REVIEW

## 2.1 Road Traffic Accident World Wide

RTIs are among the leading causes of death and life-long disability globally. According to the World Health Organization report, every year more than 1.25 million people now die on the world's road and about 50 million people are injured or disabled as a result of road traffic crashes (3). Principally, injured people have occupied 30 to 70 percent of orthopedic beds in developing countries hospitals (4). If business as a usual continuous, according to WHO, "road traffic injuries are estimated to be the ninth leading cause of death across all age groups globally, and are predicted to be the seventh-leading contributor to the global burden of disease and injury by 2030 (5)."

Globally, RTIs are reported as the leading cause of death among young people aged 15–29 years and are among the top three causes of mortality among people aged 15–44 years (3). The Institute for Health Metrics and Evaluation (IHME) estimated about 907 900, 1.3 million and 1.4 million deaths from road traffic injuries in 1990, 2010 and 2013, respectively (5).

The costs of fatalities and injuries due to road traffic accidents have a tremendous impact on societal well-being and socioeconomic development. Moreover, for each fatality resulting from a road traffic crash there are numbers of serious injuries, which may lead to permanent disability. The Global Burden of Disease project in 2000 estimated that around 20 to 50 million people are being injured or disabled each year. Furthermore, if no interventions were implemented to decrease road traffic crashes, the fatalities and injuries due to RTAs are expected to increase by about 65% by 2020 compared to 2000 (6). According to WHO data, road traffic crashes caused about 25% of all deaths from injury worldwide in 2004 (9). RTAs were ranked as the eleventh leading cause of deaths and the ninth leading cause of disability-adjusted life years lost in 2002. By 2020, RTCs are expected to rise to become the sixth leading cause of death internationally. Most of the increase is in low-income and middle-income countries, where RTA-related deaths are expected to increase by over 80% on average. (4, 11, 13).

## 2.2 Road Traffic Accident in Africa

In Africa, the number of road traffic injuries and deaths have been increasing over the last three decades (10). According to the 2015 Global status report on road safety, the WHO African Region had the highest rate of fatalities from road traffic injuries worldwide at 26.6 per 100 000 population for the year 2013 (3,4). In 2013, over 85% of all deaths and 90% of disability adjusted life years (DALYs) lost from road traffic injuries occurred in low- and middle-income countries, which have only 47% of the world's registered vehicles (3,4). The increased burden from road traffic injuries and deaths is partly due to economic development, which has led to an increased number of vehicles on the road (10, 11).

The 2009 Global status report on road safety presented the first modelled regional estimate of a road traffic death rate, which was used to statistically address the underreporting of road traffic deaths by countries with an unreliable death registration system (11). In the 2009 report, Africa had the highest modelled fatality rate at 32.2 per 100 000 population, in contrast to the reported fatality rate of 7.2 per 100 000 population (12). The low reported death rate reflects the problem of missing data due to non-availability of road traffic data systems, which has a direct impact on health planning including prehospital and emergency care and other responses by government agencies.

## 2.3 Road Traffic Accident in Ethiopia

Road traffic crashes pose a significant burden in Ethiopia, like in the case of other developing countries. In Ethiopia, the number of deaths due to traffic accidents is reported to be amongst the highest in the world. According to the WHO, in 2013 the road crash fatality rate in Ethiopia was 4984.3 deaths per 100,000 vehicles per year, compared to 574 across sub-Saharan African countries (13). Besides, the number of people injured or killed in one crash in Ethiopia is about 30 times higher than that in the US (14).

According to the latest WHO data published in May 2014 RTA deaths in Ethiopia reached 15,015 or 2.5% of total death (17).

According to WHO, Ethiopia has the highest rate of fatalities per vehicle in the world .Uganda ranks 2$^{nd}$ in road fatalities rate in the world behind Ethiopia (18).

According to Ethiopia police reported six years (July 2005-June 2011) of police reported crashes data were analyzed, consisting of 12,140 fatal and 29,454 injury crashes on the country's road network. The 12,140 fatal crash involved 1,070 drivers, 5,702 passengers and 7,770 pedestrians, total of 14,542 fatalities, an average of 1.2 road users' fatalities per crash (19).

Addis Ababa, the capital city of Ethiopia takes the lions shares of the risk, with an average 20 accidents being reported every day and even more going unreported.

## 2.4 Bone Fracture Definition

Bone is the main constituent of the adult skeleton, bone tissue provides solid support for the body, protects vital organs such as those in the cranial and thoracic cavities, and harbors cavities containing bone marrow where blood cells are formed. A typical bone ailment is the fracture, which occurs when the bone is not able to withstand outside force like direct blows, twisting injuries and falls.

Fractures are cracks in bones and are defined as a medical condition in which there is a break in the continuity of the bone. Fractures can happen in a variety of ways, but there are three common causes: Trauma fractures (Accidents), Osteoporosis and Stress or overuse (20, 21 and 23).

### 2.4.1 Fracture Types

All fractures can be broadly described as closed or open. Simple fractures (more recently called "closed") are not obvious as the skin has not been ruptured and remains intact. Compound fractures (now commonly called "open") break the skin, exposing bone and causing additional soft tissue injury and possible infection. A single fracture means that one fracture only has occurred and multiple fractures refer to more than one fracture occurring in the same bone. Fractures are termed complete if the break is completely through the bone and described as incomplete or "greenstick" if the fracture occurs partly across a bone shaft. This latter type of fracture is often the result of bending or crushing forces applied to a bone. A complicated fracture is a fracture of the bone combined with a lesion of an organ, artery, nerve bundle, or joint (23).

Fractures involving the long bones in adults should be described using certain universally accepted descriptive conventions. Transverse fractures are those that run at right angles orthogonal to the long axis of the affected bone. Oblique fractures, cross the shaft at an angle.

If the inciting injury involved significant torsion, a spiral fracture may occur; the fragments created by a spiral fracture are often very sharp and pointed, and may cause significant soft tissue injury. Any fracture that divides the bone into more than two separate fragments is said to be comminuted; the degree of comminution is often directly related to the force of the injury. Although it may seem obvious, the location of the fracture should be described in precise terms. In general, the location of fractures involving the shaft of a long bone can be described by dividing the shaft into thirds (proximal, middle, and distal), and placing the injury by reference to this division (e.g. 'junction of the proximal and middle third of the shaft', 'mid-shaft').The type of fracture is important. Fractures extending right across a bone (i.e. involving 'both cortices' radio graphically) are called complete fractures. Similarly, fractures that do not extend all the way across the bone are referred to as incomplete (24).

2.5 Magnitude of Bone Fracture among RTA victims

An international evaluation of the Global Burden of Diseases, Injuries, and Risk Factors Study 2010 (GBD 2010), identifying all available data on causes of death for 187 countries from 1980 to 2010, showed that the fraction of global deaths due to injuries was marginally higher in 2010 (9.6%) compared with two decades earlier (8.8%). This was driven by a 46% rise in worldwide deaths due to road traffic accidents and a rise in deaths from falls (25).

By 2020, WHO projects 8.4 million people will die annually following injury. Road traffic accidents being third to ischemic heart disease and unipolar major depression as the commonest causes of mortality and morbidity world-wide. Fifth in the developed countries for mortality and second in the developing countries (25, 26, 27 and 29).

Low and Middle income countries account for 85% of deaths and 90% of (disability-adjusted life-years) DALYs lost annually (26). The major unintentional injury-related causes of DALY's lost annually include road traffic injuries and falls (25). The worldwide burden of injuries is disproportionately concentrated in the low and middle- income countries with unintentional injuries accounting for over 9% total DALY's, often occurring in countries with the weakest evidence to guide intervention strategies, the fewest resources and least developed infrastructure to effect change(29-31).

Annually, the average number of injuries resulting in restriction of activities is 30.6 million. Among these 13.4 million are severe enough to require bed rest. This translates into 1.54 million acute hospitalizations for an average duration of 7.1 days and about 45000 deaths over one year period (33, 34). DALY's 2743 per 100,000 (34).

In the USA, 5,838 admissions of an academic Level I trauma center registered over 10 years were reviewed and showed that there were 1,136 patients (19.4%) 14 years old or less, 3,741 (64.1%) who were 15 to 55 years old, 420 (7.2%) 56 to 65 years old, and 541 (9.3%) older than 65 years. Overall mortality was 7.7% and ranged from 3.2% in the age group of 14 years or less to 25.1% in patients over 65 years (35). In the USA, another National Trauma Databank study during a 5-year period including 12,429 admissions revealed that there were 4,095 patients (32.9%) ≤14 years, 3,806 (30.7%) 15 to 35 years old, 3,413 (27.5%) 36 to 55 years old, 688 (5.5%) 56 to 65 years old, and 427 (3.4%) >65 years old, The overall mortality was 3.7% and ranged from 2.4% in the age stratum of ≤14 years to 12.2% in the stratum of >65 years (36).

A cross-sectional study in India showed that fractures were the commonest injury among the victims of nonfatal road traffic accidents, and majority of the victims were in the age group of 18–37 years (36). A road trauma analysis based on Data of the Trauma Registry in the United Arab Emirates showed that injuries of the extremities and head were frequent among pedestrians, motorcyclists, and bicyclists; the mean hospitalization was 9.7 days and overall mortality was 4% (37).

In China, the data of 2213 inpatients with traffic trauma showed that fracture of extremities (53.3%) occurred most often, craniocerebral trauma (19.4%) next, then followed in turn by thoracoabdominal visceral injury (6.56%), spine fracture (5.37%), fracture of ribs (4.88%), and pelvic fracture (4.18%) (37). In Africa, a retrospective analysis of nonfatal road traffic crash victims still showed that the commonest injuries were fractures (69.0%) with the tibia/fibula being the most fractured bones (30.3%). Age group of 15–44 years was the most affected (81.9%) (39).

In Pakistan, of the 132,504 victims of road traffic crashes (RTCs), there were 67% males and 65% aged 16–35 years, and minor injuries (65%) and fractures (25%) were the most reported (40).

Another hospital-based study of 450 cases admitted due to traffic accidents in India revealed that the commonest type of injury was fracture (49.33%) and the most common site of fracture was lower limb (48.2%), and several risk factors such as age, sex, type of vehicle, use of alcohol, absence of driving license, nonuse of helmets, and casual attitude are associated with increased occurrence of road traffic accidents (41).

Among the Nigerian population, 65% of patients with limb injuries were riders of motorcycles (44). The commonest injury as seen with other studies, were tibia –fibula fractures combined, femur and humerus in descending order of prevalence. Open fractures accounted for 53.3% among the motorcyclists with the tibia commonly involved. This is thought to be so as the tibia is a subcutaneous bone with minimally soft tissue coverage anteriorly.

Associated injuries were in 20% of patients. Head injury was common and contributed to 62.5% fatality, others included hypovolemic shock, chest injury (44-48).

In motorcycle accidents, head injuries and limb injuries are the most common injuries sustained. Lower extremity injuries are the most frequent injuries seen accounting for 32.2% of total injuries at Mulago Hospital, Uganda. Of these tibial fractures (open and closed) accounted for 64.3%, foot injuries 14.3% (49.1% metatarsal fractures) (45) and femoral fractures 21.4% of lower extremity injury (44). The lower limbs are prone to injury due to squeezing of the limb between the motorcycle and impacting vehicle, the ground of some other fixed object (43, 45, and 47).

Study done at Addis Ababa University , Medical Faculty" Tikur Anbessa " Hospital (TAH) shows that from the total of 422 adult patients who presented to the to the emergency department of TAH and had musculoskeletal injuries, in nearly half, 49.7% (202 patients) the cause of injury was road traffic accident (RTA). The highest frequency of fractures occurred in the femur 32 (15.8%) followed by tibio-fibular 29 (14.4%) and humerus 26 (12.9%). Incomplete fractures comparatively accounted smaller proportions, 23(11.4%).Transverse fractures stand out the first 125 (61.9. %) followed by oblique 38 (18.8%) and comminuted 29 (14.4%) fractures. Road traffic injuries (RTI) were responsible for almost half of the musculoskeletal injuries. Machine injuries and fall injuries were second and third respectively (50).

# 3. OBJECTIVES

## 3.1 General Objective

To assess common types and patterns of bone fractures and their prevalence among road traffic accident victims visiting Addis Ababa Governmental Hospitals July 1, 2015- July 1, 2017 G.C.

## 3.2 Specific Objective

- To determine the prevalence of bone fractures among road traffic accident victims.
- To determine the patterns of common types of bone fractures.
- To describe the characteristics of RTA victims visiting Addis Ababa Governmental Hospitals.

# 4. METHODS AND MATERIALS

## 4.1 Study area

Addis Ababa, the capital city of the Federal Democratic Republic of Ethiopia. It is also home to the African Union, the Economic Commission for Africa and other international organizations. According to Ethiopia Demographics Profile 2017, Addis Ababa has a total of 54,000 hectares and 3.238 million populations. It also represents about 26% of the urban population of Ethiopia. Addis Ababa has an aggregate population density of 4,847.8 persons per square kilometer.

The city has ten sub city and 116 woreda. There are 51 hospitals of which 6 are owned by Addis Ababa City Administration Health Bureau, 4 by Federal Ministry of Health, 1 by Addis Ababa University, 3 by Nongovernmental organization, 3 by Defense Force and Police and 34 by private owners.

The study was conducted in emergency and orthopedics wards of five public hospitals in Addis Ababa, Ethiopia; Tikur Anbesa Specialized Hospital, Zewditu Memorial Hospital, St. Paul's Millennium Hospital, Yekatit 12 Hospital and Menilik II Referral Hospital. All these hospitals serve as a teaching hospitals and referral centers both at city administration and federal level.

## 4.2 Study period

The study was conducted from August 2017- September 2017 G.C

## 4.3 Study design

Institution based retrospective cross sectional study was carried out. Data were obtained from hospitals patient charts of all RTA victims admitted to emergency and accident unit of these hospitals during the period of July 2015- July 2017 G.C.

## 4.4 Source population

All road traffic accident victims visiting Addis Ababa Governmental Hospitals.

## 4.5 Study population

All road traffic accident victims of both gender and aged 15 years and above attending the selected Governmental Hospitals during the two years study period.

4.6 Sample size determination and Sampling method

4.6.1 Sample size determination

There was little, if any, published data on the prevalence of fractures occurring in RTA victims in Ethiopia. Therefore, the estimated prevalence was 50%.

The minimum number of sample required for this study was determined by using single population proportion formula.

$$n_i = \frac{(Z\alpha/2)^2\, p\,(1-p)}{d^2}$$

Where:

ni= minimum sample size required for the study

Z= standard normal distribution (Z=1.96), CI of 95% = 0.05

P= prevalence of bone fractures among Victims of road traffic accidents is unknown; Hence; p=50 %( 0.5) was used.

d=Absolute precision or tolerable margin of error= 5 % (0.05)

$$n_i = \frac{(1.96)^2 \times 0.5(1-0.5)}{(0.05)^2} = 384$$

Since the sample was taken from a relatively large population which was 13,540 there was no need for sample size correction formula. Thus the final sample size was set at 384.

## 4.7 Sampling Procedure

From a total of eleven Governmental Hospitals in Addis Ababa five were selected by patient load, serving as a teaching and referral hospital. The selected Governmental Hospitals include Tikur Anbesa Specialized Hospital, Zewditu Memorial Hospital, St. Paul's Millennium Hospital, Yekatit 12 Hospital and Menilik II Referral Hospital. The medical record number (MRN) of RTA victims were selected by using a systematic sampling technique, after identifying an initial starting card, by using a simple random sampling method (lottery method).

The total number of RTA victims in the study hospitals from July 2015 up to July 2017 were 13,526. Since the sample was taken from a relatively large population; the final sample size was 384 RTA victims. This sample was taken proportionally from each hospital based on the number of RTA victims visiting the selected hospital. Then systematic random sampling technique was applied in each hospital to select MRN. Every $8^{th}$ card was selected.

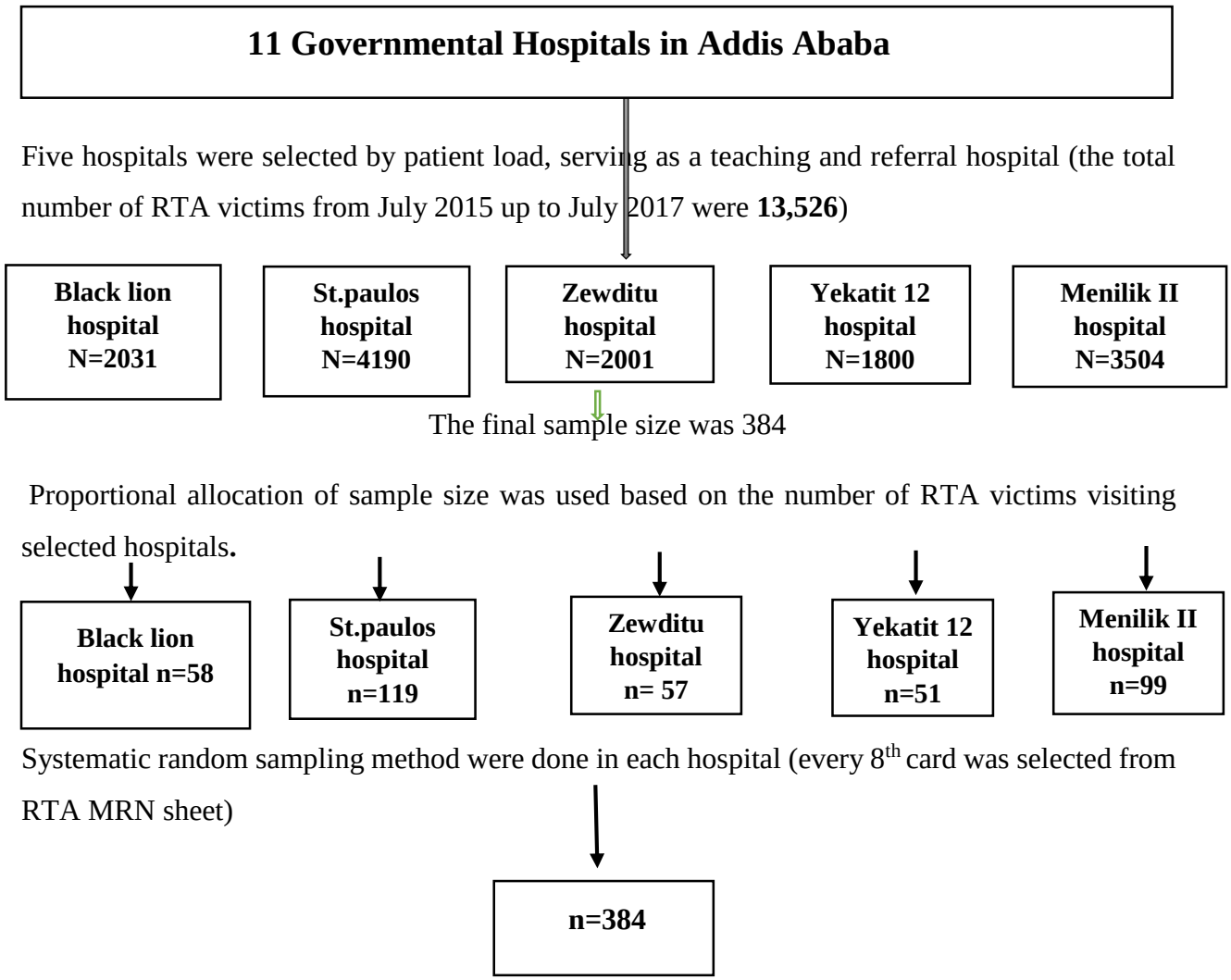


Figure 1. Schematic representation of sampling procedure in Addis Ababa Governmental Hospitals, 2017 G.C.

4.8 Inclusion and Exclusion criteria

4.81 Inclusion criteria

- All RTA victims who visited the selected governmental hospitals during the study period.

4.82 Exclusion criteria

- RTA victims with incomplete records.
- RTA victims who were under the age of 15 years.
- RTA victims who died at the hospital on arrival.
- RTA victims referred from one selected hospital to the other selected hospital and cases referred from outside of Addis Ababa and other parts Ethiopia.

4.9 Data Collection Tool and Procedures

Data was collected by using a well-structured questionnaire using MRN as a baseline. The information about the patients admitted as cases of RTAs were ascertained from the emergency triage cards. Case sheets of RTAs victims from the medical records number were read and the necessary details were sought in terms of age, sex, type, site, nature and pattern of injury. Finally, based on the inclusion and exclusion criteria of the study, a card which had all variables for the study was used. Then; all variables were collected from the main card information.

Ten nurses were assigned to collect the data from medical cards and two nurses was supervise the data collectors in the process of data collections. Timely supervision was under taken by the principal investigator during the data collection period.

4.10 Study variables

4.10.1 Dependent variable

Prevalence and types of bone fracture

4.10.2 Independent variables

Age, Sex and Mechanisms of RTA

### 4.11 Data analysis and Interpretation

The data were checked after each data collection for completeness. The data were entered into EPI data manager version 3.3 and analyzed using IBM SPSS Statistics version 22. The results were summarized in the form of proportions and frequency tables for categorical variables. Continuous variables were summarized using means, median, mode and standard deviation. P-values were computed for categorical variables using Chi-square ($\chi 2$) test. Bivariate analysis using Pearson's correlation Coefficient (r) was carried out to distinguish the relationship between dependent and independent variables.

### 4.12 Data quality control

To maintain data quality, training was given for data collectors and for supervisors for 2 days. Properly designed data collection materials were developed. Supervision was carried out on daily based to check completeness, consistency by both the supervisor and the principal investigator to assure the quality of data. Pretest was performed in 10% of patients' card prior to the actual data collection time and correction was carried out if necessary.

### 4.13 Ethical consideration

Ethical clearance was obtained from Department Research Ethics Review Committee (DRERC), Institutional Review Board (IRB) of St. Paul's Millennium Medical College and Addis Ababa Public Health Research and Emergency Management Core Process. This letter of ethical clearance as well as a letter of cooperation was sent for the study hospitals to give consent for data collection.

### 4.14 Dissemination of results

After completion of this research, the results of the study will be presented during thesis defense and the final result will be submitted to Addis Ababa University Human Anatomy Department.

In addition to this, the final result of this thesis will be disseminated to Addis Ababa regional health bureau, federal ministry of health, those selected Governmental Hospitals in Addis Ababa and other responsible bodies. Beside to this, the findings of the study will be disseminated through publications and presentation in scientific conferences and workshops.

4.15 Operational Definition

Injury: The physical damage that results when the human body is suddenly or briefly subjected to intolerable levels of energy.

Car accident: An occupant of a vehicle either the driver or the passenger or both who were sustained road traffic accident.

Death on arrival: Death causation at one hour of arrival to hospital.

Pedestrian: A person walking rather than travelling in a vehicle.

Road traffic accidents: Road traffic accident is a collision between vehicles, between vehicles and pedestrians, between vehicles and animals, or between vehicles and fixed obstacles.

One DALY: loss of 1 year of healthy life.

STI: Soft tissue injury refers to those injured part which are not bone or cartilage. It includes the skin, muscles, tendons, ligaments, blood vessels and nerves.

# 5. RESULT

Out of 13,526 road traffic accident victims who visited Adult Emergency Department of selected hospitals between July 2015 and July 2017, 384 road traffic accident victims were included in the study and analyzed. The study participants comprised of 263 (68.5 %) men and 121 (31.5 %) women, resulting in a male to female ratio of 2.2: 1. The patients' ages ranged from 15 to 85 years with the mean and standard deviations of 32.6 and ± 14.06 years respectively. The median and the mode were 28 and 25 years respectively.

The majority of the injured victims were pedestrians (232, 60.4%), followed by car occupants (126, 32.8%) and the least injured victims were heavy vehicle occupants (2, 0.5 %).

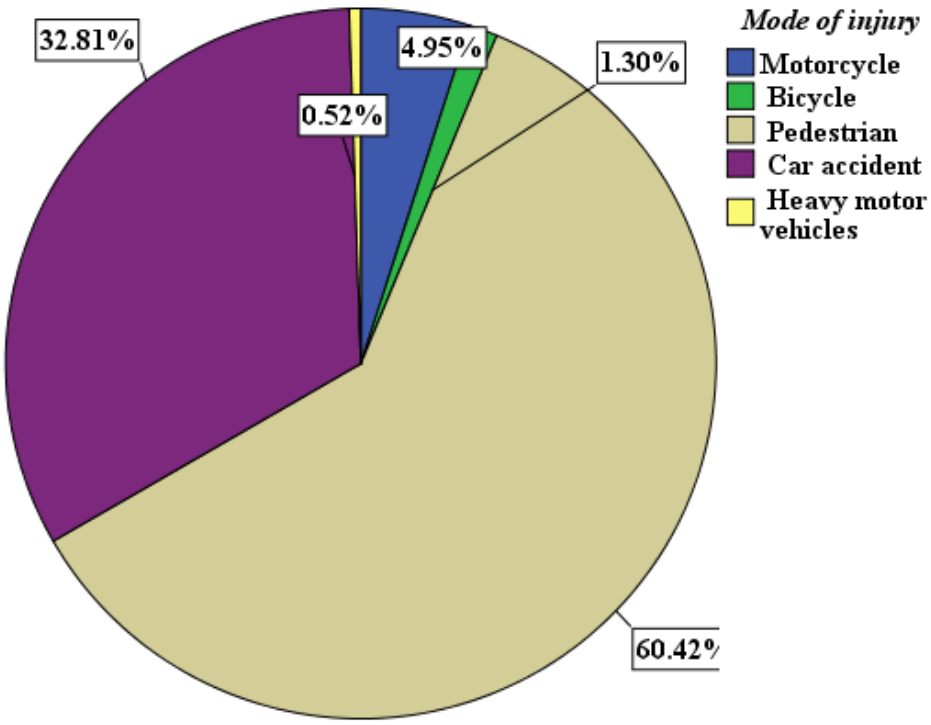


Figure 2: The mode of injury of RTA victims visiting Addis Ababa Governmental Hospitals.

Table 1: Comparison of the mode of injury and the gender of RTA victims visiting Addis Ababa Governmental Hospitals.

| Mode of injury | Gender ( n= 384 ) | | P-value |
|---|---|---|---|
| | Male ( n= 263) | Female (n=121) | |
| Motorcyclists | 15 | 4 | 0.441 |
| Bicyclists | 5 | 0 | |
| Pedestrians | 156 | 76 | |
| Car Accidents | 86 | 40 | |
| Heavy Vehicle accidents | 1 | 1 | |

There was statistically no significant difference between the mechanisms of injury and gender of RTA victims (Table-1).

Extremities and the head were the most common body region injured accounting for 45.1 % and 20.6 % of cases respectively.

Musculoskeletal injuries commonly affected the lower limbs (33.6 %) and upper limbs (11.5%). Isolated injuries occurred in 302 (78.7%) patients while two region of injuries happened in 15 (3.9 %) patients and 67 (17.4%) patients had multiple region injuries.

In pedestrian accident, limb injuries (51.8%) were the most common injuries sustained while in car accident the common sustained region were extremities (40.3%), head and neck (25.8%) and chest (12.1%).

The most injured age group was 25-34 years old group accounting for 127(34.4%) injuries followed by 15-24 age group accounts 113(30.6%) injuries, and the least injured age group were 75-84 years old accounting for 3(0.8%) injuries. There was no statistically significant difference (P=0.195) between the age groups and the injured regions.

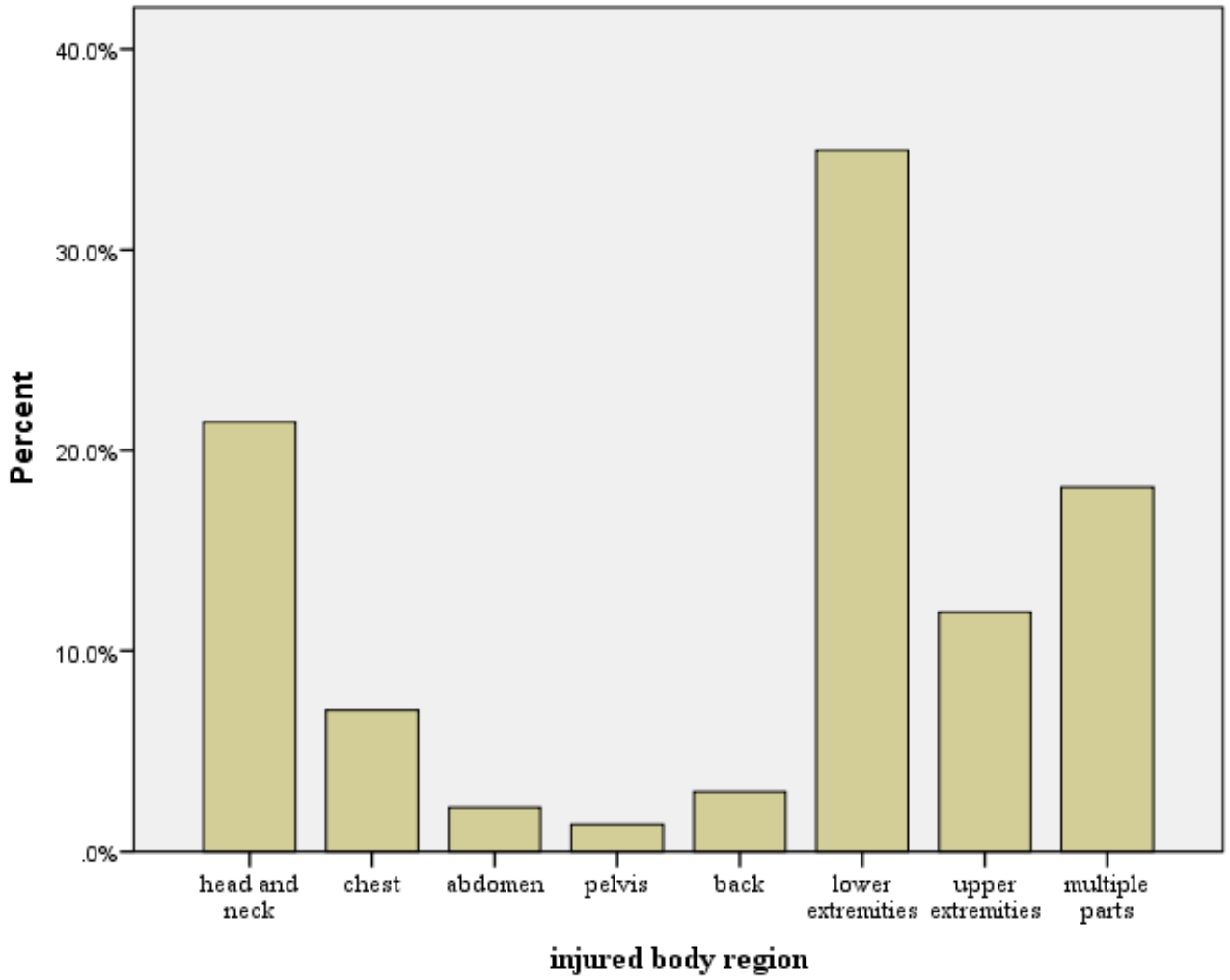


Figure 3: The injured body regions of RTA victims visiting Addis Ababa Governmental Hospitals.

Soft tissue injuries (STI; bruises, abrasions, lacerations, crush wounds, etc.) accounts 227(59.1%), fractures and combined STI and fractures were the most commonly injured regions and accounted for 227(59.1%), 92(24%) and 22(5.8%), respectively.

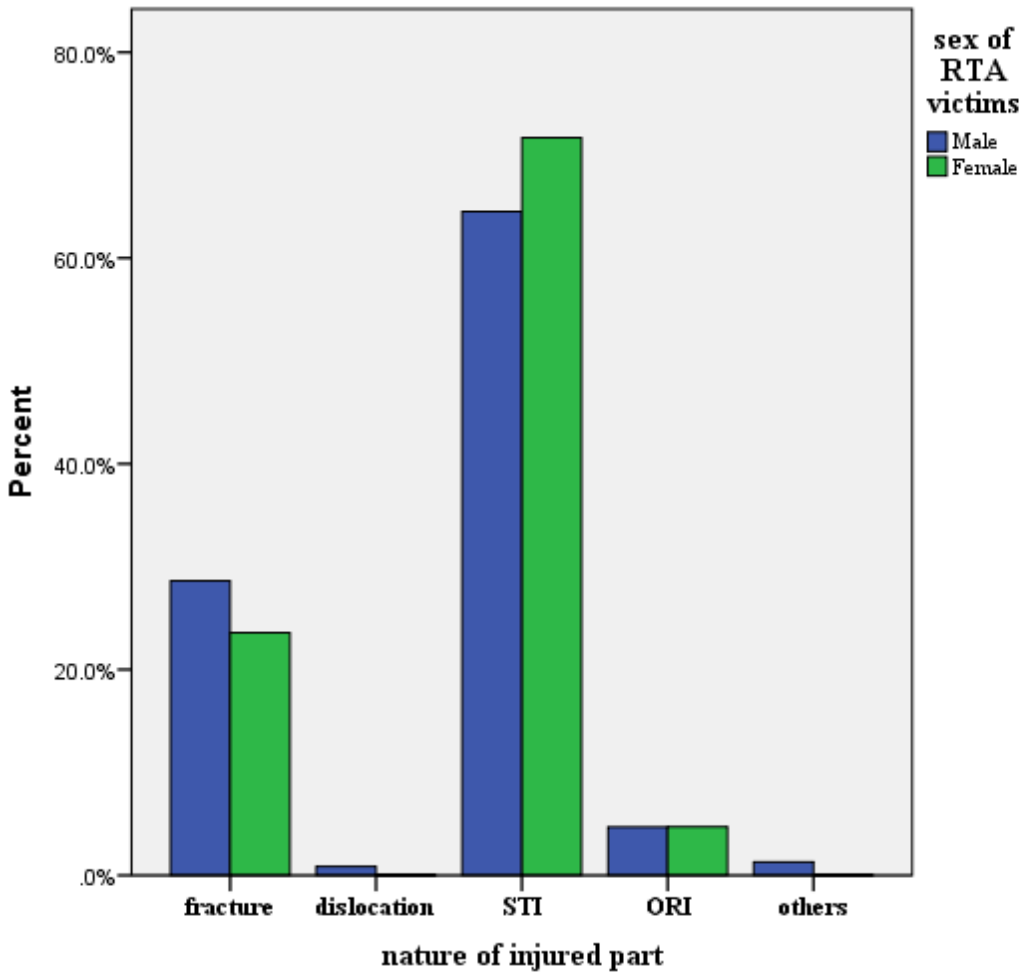


Figure 4: The nature of injured regions by gender in RTA victims visiting Addis Ababa Governmental Hospitals.

In total, 128 cases of orthopedic fracture accounted for (33.3%) of road traffic accident cases.

The most common site of fracture was lower limb which accounted for (55.6%) followed by upper limb (24.2%) and bones of the axial skeleton (20.2 %). In the lower limb, combined tibia/fibula (60.6%) attributed to the majority with no fracture seen in tarsal bones other than talus and calcaneus. In the upper limb, the humeral fracture (32.6%) attributed to the majority with no fracture seen in the metacarpal and phalangeal regions. In the axial skeleton rib bones (41.7%) attributed to the majority with no fracture seen in the sternum.

Table 2: Burden of appendicular skeleton fractures in RTA victims, Addis Ababa Governmental Hospitals.

| **Upper limb fracture (24.2%)** | **Frequency** | **Percent** |
|---|---|---|
| Humerus | 14 | 32.6 % |
| Clavicle | 10 | 23.2 % |
| Scapula | 3 | 7 % |
| Radius | 10 | 23.2 % |
| Ulna | 5 | 11.6% |
| Carpal | 1 | 2.4 % |
| Metacarpal | 0 | 0 |
| Phalanges | 0 | 0 |

| **Lower limb fracture (55.6%)** | **Frequency** | **Percent** |
|---|---|---|
| Hip bones | 10 | 10.1% |
| Femur | 20 | 20.2% |
| Tibia | 33 | 33.3% |
| Fibula | 27 | 27.3% |
| Patella | 1 | 1% |
| Tarsal bones | 4 | 4.1% |
| Metatarsal bones | 1 | 1% |
| Phalanges | 3 | 3% |

Table 3: Burden of Axial skeleton fractures in road traffic accident victims, Addis Ababa Governmental Hospitals.

| **Axial bone fractures (20.2%)** | **Frequency** | **Percent** |
|---|---|---|
| Skull | 5 | 13.9% |
| Facial bones | 8 | 22.2% |
| Sternum | 0 | 0 |
| Vertebral bones | 8 | 22.2% |
| Rib bones | 15 | 41.7% |

Single bone fracture was present in 50.8% cases of fractures and multiple fractures were seen in 49.2% the cases. Bone fractures were classified as simple, compound and both.

Simple fractures accounted for 109(85.2%) of bone fracture cases while compound fractures comprised 17(4.4%) and both types of fractures in 2(0.5%) cases. Left side bone fracture was common which accounted 52(45.2%) while right side bone fracture accounted 48(41.7%) and both sided fractures comprised 15(13.1%). The present study revealed specific patterns of fractures. Out of 128 fractures recorded, 8(6.3%) were transverse, 4(1%) oblique, 7(1.8%) Communited and 1(0.3%) spiral fracture while 108(28.1%) were unspecified fractures.

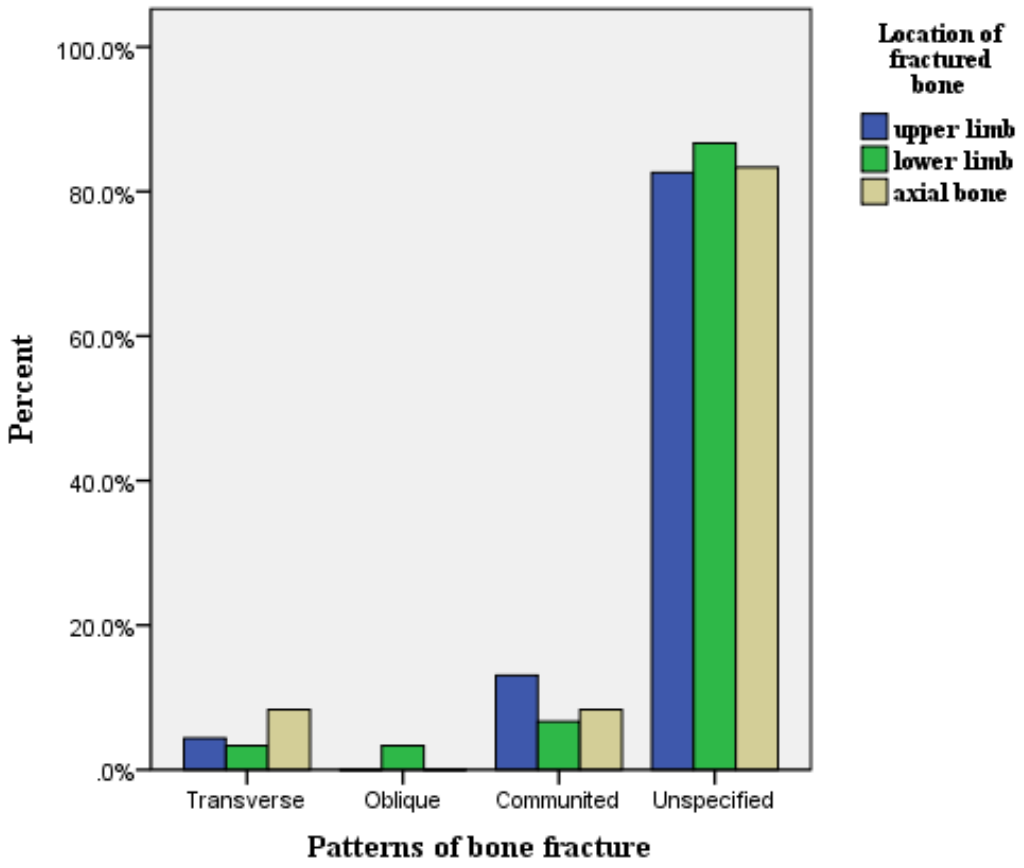


Figure 5: Patterns of bone fractures by location of fractured bones in RTA victims visiting Addis Ababa Governmental Hospitals.

Table 4: Comparisons of number of fractured bones by gender in RTA victims visiting Addis Ababa Governmental Hospitals.

| Gender | Number of fractured bones | | | |
|---|---|---|---|---|
| | Single | Multiple | Total | P-value |
| Male | 45 | 45 | 90 | 0.848 |
| Female | 20 | 18 | 38 | |

Table-4 shows comparison of the number of fractured bones by gender:-single bone fracture was common in both sexes. There was statistically no significant difference (P=0.848) between the number of fractured bones among the two sex groups regardless of whether it is single or multiple fractures (Table 4).

Table 5: Comparisons of number of fractured bone by age group in RTA victims visiting Addis Ababa Governmental Hospitals.

| **Age Group** | **Number of fractured bone** | | | |
|---|---|---|---|---|
| | **Single** | **Multiple** | **Total** | **P-value** |
| 15-24 | 18 | 14 | 32 | |
| 25-34 | 19 | 25 | 44 | |
| 35-44 | 12 | 13 | 25 | |
| 45-54 | 9 | 3 | 12 | **0.367** |
| 55-64 | 3 | 2 | 5 | |
| 65-74 | 4 | 4 | 8 | |
| 75-84 | 0 | 2 | 2 | |

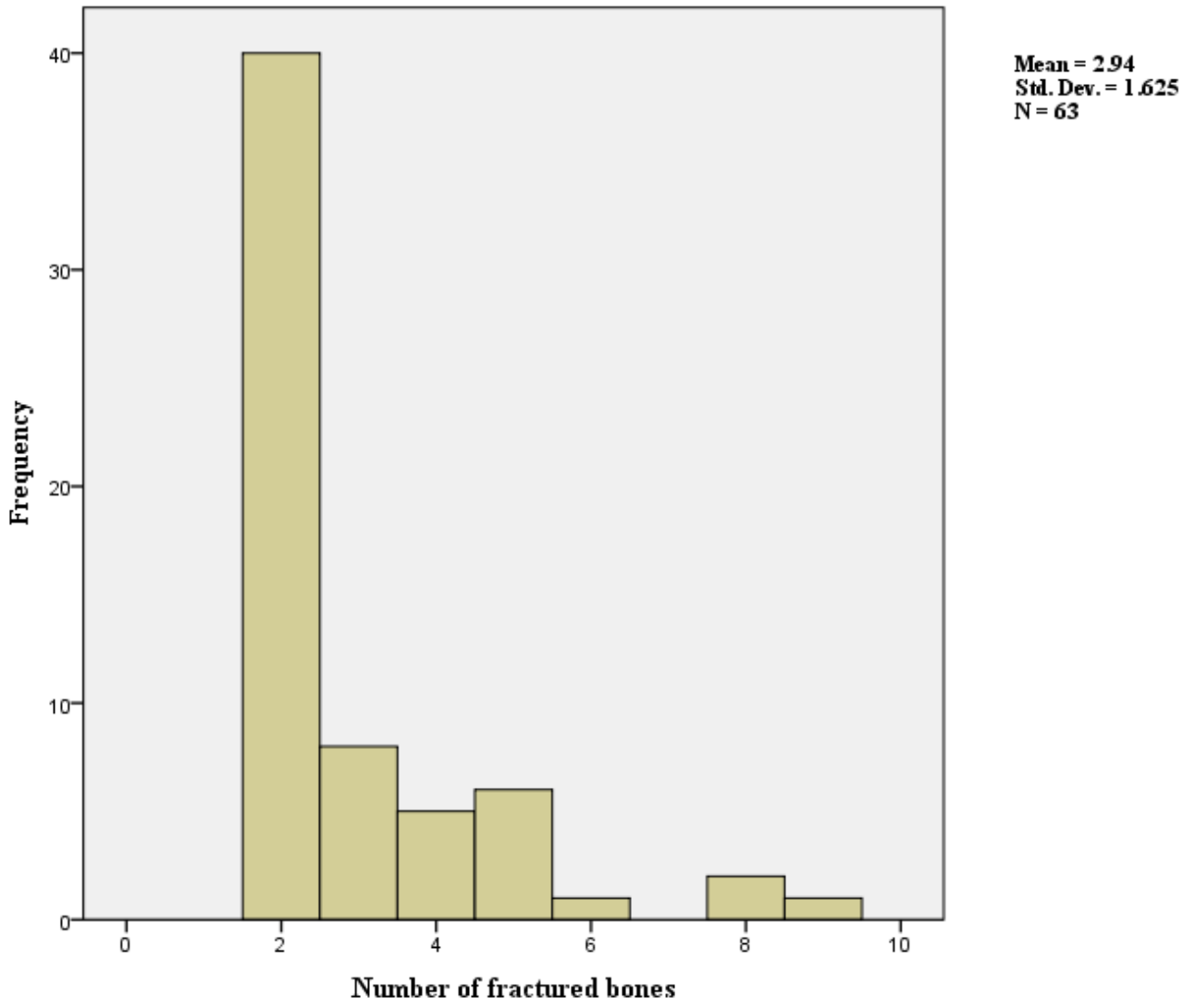


Figure 6: The frequency of multiple fractures among RTA victims visiting Addis Ababa Governmental Hospitals.

There was statistically significant difference (r=+ 0.264 and P= 0.037) between the age of RTA victims and multiple site bone fractures (Table 5).

Table 6: Number and type of fractured bones in different regions of the body in RTA victims visiting Addis Ababa Governmental Hospitals.

| **Injured regions** | **Number of fractured bones** | | | |
|---|---|---|---|---|
| | **Single** | **Multiple** | **Total** | **P- value** |
| Head and neck | 6 | 2 | 8 | **0.021** |
| Chest | 0 | 5 | 5 | |
| Abdomen | 0 | 0 | 0 | |
| Pelvis | 1 | 0 | 1 | |
| Back | 3 | 3 | 6 | |
| Lower extremities | 26 | 26 | 52 | |
| Upper extremities | 16 | 5 | 21 | |
| Multiple regions | 9 | 16 | 25 | |

Table 6: shows comparison of the number and type of fractured bones by injured region of the body. There was statistically significance difference **(P=0.021)** between the number of fractured bone and the injured region.

# 6. DISCUSSION

Road traffic accidents (RTAs) constitute a major public health problem all over the world. In the present study, the majority of RTA victims were young adults in their most reproductive and productive years. In the current study most the RTA victims were males (68.5%) with male to female ratio is 2.2:1. Similar high prevalence of RTAs in males have been reported in a study conducted in Ughelli Nigeria (51). The reason for the high prevalence of RTAs in males may be attributed to their high activity levels and linkage in high-risk activities such as recklessness driving/riding, over-speeding and drunken driving. In addition males have greater exposure on streets (52, 53, 54 and 55). The highest number of RTIs (65%) were observed in the 15 to 34 years age group. This age group represents the most productive and reproductive age group and therefore economically and socially active, participating in higher levels of economic and high-risk activities.

Pedestrians accounted for the majority of road traffic accident victims (60.4%) in this study. This finding is consistent with other earlier studies conducts elsewhere (56, 57). However, other investigations have reported that the majority of road traffic accident victims were passengers (58, 59). The high prevalence of RTIs observed in pedestrians, in the present study, may reflect the low level of community awareness on road traffic safety and road use. In addition, the absence of pedestrian walkways in most of the roads in Addis Ababa, Ethiopia, may have contributed to the higher vulnerability of pedestrians to motorized vehicles. Therefore, educating the public on RTAs and safe use of the roads is critical.

Various studies have reported different patterns of body injuries resulting from road traffic crashes. The variations in patterns may probably be due to difference in types of vehicle used, level of industrialization and economic advancement of the country including the state of the roads, safety consciousness and the use of safety gears.

In the current study, injuries of the extremities and head were the most common body regions injured accounting for 45.1% and 20.6% of the cases, respectively. This finding is in agreement with the reports of other previous studies carried out elsewhere (57, 58, 60, 61, and 62). The high prevalence of injuries of extremities could be attributed to the large number of pedestrians in the current study.

Pedestrians are unprotected road users and therefore they are highly exposed to higher risk of extremity (limb) injuries (63). Enforcement of helmet use by motorcyclists and cyclists might be helpful and may decrease head injuries.

In the current study, soft tissue injuries, such as bruises, abrasions, lacerations, crush wounds, etc., fractures and combined STIs and fractures were the most common types of injuries, accounting for 59.1%, 24% and 5.8%, respectively. Similar findings have been reported based on an investigation designed to study injury characteristics and outcome of road traffic crash victims at Bugando Medical Center in Northwestern Tanzania (64). Conversely, studies on RTAs conducted in china have documented results which were contradictory to those observed in the present study (39). This difference might be the effect of economic growth which may be associated with decreased travel and exposure to a hazardous traffic environment.

In this study the prevalence of bone fractures among road traffic accident victims was 33.3%. This finding contradicts with previous study conducted in India which was 49.33%, the high prevalence of fracture in Indian study could be attributed to a greater congestion of human and motor traffic as well as large numbers of RTA victims as a result of rapid expansion in road network and urbanization (52).

Fractures resulting from RTAs occur in bones of different regions of the body. The commonest site of fracture, in the present study was the lower limb which accounted for (55.6%) followed by the upper limb (24.2%) and bones of the axial skeleton (20.2 %). Similar order in location of fractures occurring as a result of RTAs have been observed in studies conducted in Nigeria (51) and Tanzania (64). The reason for the occurrence of fractures in the highest frequency on lower extremity may be due to interaction of gravitational force and velocity of the vehicle at the time of accidents. However, other studies have reported that the highest number of bone fractures occurred in the upper limbs followed by lower limbs and facial bones (65). There are also other studies which have shown that the commonest site of injury due to RTAs was fracture of bones of the head and face and closely followed by the lower extremity (66).

In the lower limb, the tibia and/fibula were the most frequently fractured bones. These findings are in agreement with the findings of similar investigations conducted in Nigeria (51) and Tanzania (64).

These observations make sense considering the fact that their vulnerable respective anatomical location and in the case of the tibia/ and fibula their subcutaneous location may be another predisposing factor.

In the current study, the most common fractured bone in the upper extremity was the humerus. This finding are in agreement with the finding of similar investigation conducted in Black Lion Hospital, Addis Ababa (50). The upper extremities play an essential role in mobility and control especially with the use of motorcycles. Extensive contractions of the muscles of the arm have been shown to be responsible for fractures which occur in this region of the body (50). This finding in the current study is consistent with that of the report of investigation conducted in Tanzania (64).

Simple fractures were the most frequent injuries in RTAs accounting for (85.2%) of bone fractures cases while compound fractures (4.4%) and both fracture types in (0.5%) were less common.

One sided bone fractures were more common compared to both sided fracture. The frequency of single bone fractures and multiple bone fractures were similar. These findings were similar with the findings of other investigations in West Africa (51).

The most frequent patterns of bone fractures was unspecified type followed by, transverse, communited and oblique type fractures. The least common pattern of bone fracture was spiral fracture. This finding contradicts with study done in Ughelli Nigeria (51). This difference is may be due to large number of unspecified patterns of bone fractures in the present study. The study revealed the patterns of 128 fractures recorded, 108(28.1%) were unspecified, 8(6.3%) transverse, 4(1%) oblique, 7(1.8%) Communited and 1(0.3%) spiral fracture.

# 7. LIMITATION OF THE STUDY

- Due to poor documentation of patient information and data management system in the study hospitals, it was difficult to increase the scope of this study.
- Scarcity of available literature related to RTA in Africa in general and in Ethiopia in particular make investigations related to RTA challenging.

# 8. CONCLUSION

The current study shows diverse injury characteristics among the victims of RTA attending Addis Ababa Governmental Hospitals. The findings reflect that RTA is a major public health problem. The young adult male were mostly involved. The majority of the victims in this study were pedestrians. The extremities and the head were the most common body regions injured accounting for 45.1 % and 20.6 % of cases. The age group that is most frequently involved in RTAs is the 15-34 years old group. The most common type of body injury was soft tissue injuries followed by fractures. In pedestrian accident, limb injuries were the most common injuries sustained while in car accident the common sustained region were head and neck and extremities followed by chest.

The most common site of fracture was the lower limb followed by upper limb. In the lower limb, combined tibia and fibula fracture were the most involved.

# 9. RECOMMENDATION

Based on the findings of this study, the following are recommended

- In order to reduce RTA, the road authority, traffic polices and other stakeholders should take appropriate measures, such as: enforcing speed limit, use of seat belt and educating the public to reduce the problem caused by RTAs in the region.
- Health professionals working in the hospitals should properly collect and register patient's medical information. Setting up a trauma register may solve some of the problems.
- National, multicenter, prospective and randomized study should be conducted to assess the burden of road traffic accidents.

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# 11. ANNEX

## 11.1 ANNEX I: QUESTIONAIRE

**Part-1 Socio demographic characteristics**

1. Sex Male ☐

Female ☐

2. Age ----------

**Part-2 Patterns of injury of RTA victims**

1. What was the mode of injury? 1. Motorcycle 2. Bicycle 3. Pedestrians

4. Car accident 5. Heavy motor vehicles 6. Others

2. Which part of the body was injured? 1. Head and Neck 2. Chest 3. Abdomen

4. Pelvis and perineum 5. Back 6. Lower Extremities

7. Upper Extremities 8. Multiple parts 9. Others

3. If two structure was injured which pair of structure?

1. Head and neck and lower extremities 2. Head and neck and upper extremities

3. Upper and lower extremities 4. Chest and Extremities

4. What was the characteristics /nature of the injured body part?

1. Fracture 2. Dislocation 3. Soft tissue injury

4. Organ injury 5. Multiple characteristics 6. Others (specify)

5. If the injured structure was two nature which pair of structure?

1. Fracture and STI 2. Fracture and Dislocation 3. STI and organ injury

6. If the answer for Q4 and Q5 is fracture, is/are the fracture (s)?

1. Single 2. Multiple

7. If your answer for Q4 is multiple how many in number? .....

**Part-3 Anatomical site of Bone fracture on x-ray result**

A. Patterns of bone fractures include

1. Transverse 2. Oblique 3. Communited 4. Greenstick 5. Spiral 6. Unspecified

I. Types of bone fractures in the Upper Limb

| **Upper Limb** | Right side | Left side | Both side | Simple(closed) | Compound(open) | Pattern |
|---|---|---|---|---|---|---|
| 1.Humerus | | | | | | |
| 2.Clavicle | | | | | | |
| 3.Scapula | | | | | | |
| 4.Radius | | | | | | |
| 5.Ulna | | | | | | |
| 6.Carpal | | | | | | |
| 7.Meta carpal | | | | | | |
| 8. Phalanges | | | | | | |

II. Types of bone Fractures in the Lower Limb

| **Lower Limb** | Right side | Left side | Both side | Simple(closed) | Compound(open) | Pattern |
|---|---|---|---|---|---|---|
| 1.Hip bone | | | | | | |
| 2.Femur | | | | | | |
| 3.Tibia | | | | | | |
| 4.Fibula | | | | | | |
| 5.Patella | | | | | | |
| 6.Talus | | | | | | |
| 7.Calcaneus | | | | | | |
| 8.Tarsal bones (state which) | | | | | | |

III. Types of bone Fractures in Axial Bones

| Axial bones | Simple (closed) | Compound (open) | Pattern |
|---|---|---|---|
| 1.Skull (state which) | | | |
| 2.Facial bones(state which) | | | |
| 3.Sternum | | | |
| 4.Vertebral bones | | | |
| 5.Ribs | | | |