PROFILE OF TRAUMA RELATED DEATHS AMONG ROAD TRAFFIC INJURED PATIENTS PRESENTING TO THE EMERGENCY DEPARTMENT OF MUHIMBILI NATIONAL HOSPITAL, DAR ES SALAAM-TANZANIA

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Department of Emergency Medicine

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By

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A Dissertation Submitted in Partial Fulfilment of the Requirement for the Degree of Masters of Medicine in Emergency Medicine

Muhimbili University of Health and Allied Sciences

October, 2019

CERTIFICATION

The undersigned certify that he has read and hereby recommend for acceptance of a dissertation entitled; ***"Profile of trauma related deaths among road traffic injured patients presenting to the emergency department of Muhimbili national hospital, Dar Es Salaam-Tanzania"*** in (partial) fulfilment of the requirements for the Degree of Master in Emergency Medicine of Muhimbili University of Health and Allied Sciences.

_____

Dr. Hendry R. Sawe

Supervisor

_____

Date

DECLARATION AND COPYRIGHT

I, **Dereck Kaale**, declare that this **dissertation** is my own original work and that it has not been presented and will not be presented to any other university for a similar or any other degree award.

Signature _____ Date _____

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DEDICATION

Alex, Josephine, Doris, Diana and Davies Kaale.

ABSTRACT

BACKGROUND: Road traffic injuries carry a high mortality rate worldwide and, over 90% of these deaths occur in low and middle-income countries. Trauma related deaths in low and middle-income countries are related to lack of proper pre-hospital and emergency care, poor infrastructure, lack of trained human resources, inadequate equipment and lack of data.

AIM: We aimed to describe the profile of trauma related deaths among road traffic injured patients presenting to the Emergency Medicine Department (EMD) of Muhimbili National Hospital Dar es salaam Tanzania.

METHODS: This was a retrospective study of all patients involved in road traffic accident (RTA) presenting alive at EMD-MNH from July 2015 to July 2018. The data was retrieved from the trauma registry for all RTA and they were followed up via a phone contact, we enrolled those who had died within 90 days of current injury episode. A standardized case report form was used to record demographics, presenting clinical characteristics, management and outcomes. Data capture in online data Capture Software (RED Cap) was exported and Statistical Package for Social Science. Descriptive statistics are presented as frequency, percentages and 95% Confidence intervals, mean and median as appropriate. Injury Severity Score was provider calculated through a pre-programed system in electronic medical record. Univariate analysis was used to establish the causes associated with mortality, and a p value of <0.05 was considered significant.

RESULTS: Total of 17,855 trauma patients were attended and out of these 7793 (43.6%) were RTI, and all of these RTI patients were traceable via a phone call and ward follow-up. Of those who were traceable, 153 (2%) of RTI patients died within 90 days post injury. 129 (84.3%) of all trauma related deaths were head and neck injuries. Despite this, only 6 (4.5%) of all head and neck injuries had neck collars. Total of 117 (76.5%) of all RTI patients with trauma related deaths were transferred to Muhimbili Orthopaedics Institute. Factors associated with mortality were age $\geq$55 years, GCS $\leq$12, head and neck injury pattern, admission to general wards and referral from other facilities.

CONCLUSION: Road traffic injuries constitute a significant proportion of trauma patients presenting to EMD-MNH. Age, Glasgow Coma Scale, injury patterns, disposition and referral status predicted the fatal outcomes in most RTI- related deaths. Future studies should focus building fatal injury surveillance capacities to inform on deaths that occur at the scene.

TABLE OF CONTENTS

CERTIFICATION i
DECLARATION AND COPYRIGHT ii
AKNOWLEDGEMENTS iii
DEDICATION iv
ABSTRACT v
TABLE OF TABLES viii
LIST OF ABBREVIATIONS ix
DEFINITION OF TERMS x
CHAPTER ONE 1
1.0 INTRODUCTION 1
1.1 Background 1
1.2 Literature review 3
1.3 Problem statement 8
1.4 Rationale 9
1.5 Research question 10
1.6 Objectives 11
1.6.1 Broad objectives 11
1.6.2 Specific objectives 11
CHAPTER TWO 12
2. METHODOLOGY 12
2.0 Study design 12
2.1 Study area 12
2.2 Target population 12
2.3 Accessible population 12
2.4 Study population 12
2.5 Sampling design 12
2.6 Subjects 13
Inclusion criteria 13
Exclusion criteria 13
Variables of interest 13
2.7 Sample size 13
2.8 Data collection 14
2.9 Data analysis 14

2.10 Ethical consideration 14
CHAPTER THREE 15
3.0 Study results 15
3.1 Flow chart of trauma patients presenting at EMD-MNH during the study period 15
3.2 Demographics of study population 16
3.3 Time distribution of trauma deaths among RTI patients presenting to the EMD-MNH during the study period. 16
3.4 Injury patterns among RTI patients with trauma related deaths at EMD-MNH during the study period 18
3.5 Management of RTI patients with trauma related deaths at EMD-MNH during the study period 19
3.6 Disposition of RTI patients with trauma related deaths at EMD-MNH during the study period 20
3.7 Factors associated with mortality among RTI patients with trauma related deaths at EMD-MNH during the study period 21
CHAPTER FOUR 22
4.0 Discussion 22
4.1 Study limitations 24
CHAPTER FIVE 25
5.0 Conclusion and recommendations 25
5.1 Conclusion 25
5.2 Recommendations 25
6 REFERENCES 26
7 Appendix 28

LIST OF TABLES

Table 1 Demographic characteristics of RTI patients presenting to the EMD-MNH. 16
Table 2 Overall mortality rate and time distributions of trauma deaths among RTI patients 16
Table 3 Time distribution of trauma death among RTI patients according to age, GCS and ISS.....17
Table 4 Injury severity by road user type 17
Table 5 Injury patterns among RTI patients with trauma related deaths at EMD-MNH 18
Table 6 Predominant region of injury versus road use category at EMD-MNH.....18
Table 7 Top diagnosis of RTI related deaths.....19
Table 8 Investigations done to RTI patients with trauma related deaths (N=153) at EMD-MNH. 19
Table 9 Treatments given to RTI patients with trauma related deaths at EMD-MNH.....20
Table 10 Disposition of RTI patients with trauma related deaths. 20
Table 11 Univariate analysis of factors influencing mortality among RTI patients.....21

LIST OF ABBREVIATIONS

A&E	-	Accidents and Emergency
AIS	-	Abbreviated Injury Scale
CI	-	Confidence Interval
CPR	-	Cardio-Pulmonary Resuscitation
CT	-	Computed tomography
DALY	-	Disability Adjusted Life Years
EAC	-	East African Community
ED	-	Emergency Department
EFAST	-	Extended focused assessment with sonography in Trauma
EMD	-	Emergency Medicine Department
ETT	-	Endotracheal tube
GCS	-	Glasgow Coma Scale
GDP	-	Gross Domestic Product
HDU	-	High Dependent Unit
ICU	-	Intensive Care Unit
ISS	-	Injury Severity Score
IVF	-	Intravenous Fluid
LMIC	-	Low and Middle-Income Countries
MNH	-	Muhimbili National Hospital
MOI	-	Muhimbili Orthopaedics Institute
MUHAS	-	Muhimbili University of Health and Allied Sciences
RR	-	Relative Risk
RTI	-	Road traffic injury
SD	-	Standard Deviation
WHO	-	World Health Organization

DEFINITION OF TERMS

- **Disability adjusted life years (DALY) -** the sum of years of potential life lost due to premature mortality and the years of productive life lost due to disability.
- **Low income countries-** countries with per capita income below $400.
- **Middle income countries-** countries with per capita income between $400 and $4000.
- **Road traffic fatalities-** crashes on the road ways that ends the life of a person.
- **Road traffic injury-** a collision or incident that leads to injury, occurring on a public road and involving at least one moving vehicle OR fatal or non-fatal injuries incurred as a result of a road traffic crash.
- **Sub-Saharan countries-** geographically the area of the continent of Africa that lies south of the Sahara either fully or partially.
- **Trauma related deaths-** cessation of biological function/ life potentially caused by an injury.

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Road traffic injury is one of the most common causes of trauma related deaths in the sub-Saharan region. It was one of the most neglected public health problems and it is being widely addressed by the WHO currently. WHO defines road traffic injury as either a fatal or non-fatal injured sustained as a result of a collision on a public road involving at least one moving vehicle and a pedestrian(1). Alongside communicable and non-communicable diseases, road traffic injuries carry a significant public health problem(2) with high rates of mortality and morbidity as well as resource use.

Despite the rise of road traffic injuries and related deaths, their impact on patients and emergency health-care system in the countries of East Africa has received limited attention(3). The global burden of RTI is growing significantly accounting for approximately 1.2 million deaths and up to 50 million injuries annually(4). Out of these 1.2 million deaths, 90% occur in low-income and middle-income countries(5) where 81% of the world's population live and own about 20% of the world's vehicles(1). RTI represents the leading cause of deaths among economically active adults in many low- and middle-income countries(3). Globally, RTI is reported to be the eighth leading cause of death and is predicted to rise to top five by the year 2030(5). RTI causes morbidity greater than cardiovascular or malignancies. Disability adjusted life years (DALY) defines long term morbidity from injuries: RTIs are projected to be the sixth leading cause of death and the third highest cause of DALY by 2020(3).

World report on road traffic injury showed that the number of RTIs has continued to rise in the whole world, but there has been an overall downward trend in road traffic deaths in high income countries, yet a tremendous increase in road traffic associated deaths in both low-and middle-income countries. The highest mortality rates are from the African continent with 28.3 deaths per 100,000 populations(6). Due to motorization and other factors, this problem tends to increase very fast(1). A prediction in increase in deaths related to RTI is set to increase by 83% in low- and middle-income countries and decrease by 27% in high income countries(1).

While road traffic accidents account for about one-quarter of injury-related deaths in the African continent; overall, among all deaths, in Egypt 64%, 58% in Tunisia and 51% in Morocco were injury related deaths in 2008. There were 43% deaths reported in Libya due to injuries, 42% in Djibouti, 37% in Mauritius, 36% in Namibia and 34% in Niger. Kenya has the highest road fatality rates in Africa at 68 deaths per 10,000 registered vehicles and between 45-60% of admissions to surgical wards in public hospitals as a result of road traffic injuries(1).

The economic impact of injuries in the sub Saharan countries for individuals and for the society is exponentially high. The total economic costs amount to as much as 65 billion United States dollars, more money than low-income countries receive in total assistance aid annually(3).

In the East African community countries, 2.9 people die from road traffic injuries per every 10 thousand people in the country. In these, Tanzania has the highest per capita traffic accident fatalities(7) of 3.2 deaths from RTI per 10,000 people. Rwanda follows by having 3.0 deaths per 10,000 people followed by Kenya and Uganda at 2.9 and 2.8 deaths per 10,000 people respectively. Per capita rates are closely to one another with consideration of the differences in population, infrastructures and geographic locations among the EAC countries(7).

As a unit, EAC countries rank within the top 15 most dangerous places to be on the road. Micronesia and Sweden ,with 0.2 and 0.3 deaths per annum per 10 thousand people respectively, are the safest, more than 10 times safer than EAC countries(7). Moreover, due to the increase in activities and cars, an increase of 7-9% per annum in deaths per year is projected through 2021 in the EAC(7).

In Tanzania, trauma-related complaints constitute a substantial burden among patients seeking care in acute intake areas of hospitals across the country. There is a need to develop, implement and study systems that can support the improvement of trauma care and optimize outcomes of trauma patients(8).

The opening of emergency department has provided an opportunity for the care of injured patients who are transferred to Muhimbili Orthopedics institute and other surgical disciplines. However, there is paucity of data on the trauma related deaths among the entire cohort of patients involved in road traffic injuries who present in the emergency department of Muhimbili National Hospital.

1.2 Literature review

Road traffic crash is associated with more than 1.25 million deaths annually. A global report released by the World Health Organization (WHO) in January 2018 reported that road traffic injuries are the leading cause of death among those aged of 15 to 29 years. WHO also reported that 90% of all road fatalities occur in low and middle-income countries despite the fact that these countries only hold approximately 54% of all vehicles. Where half of the
affected population are vulnerable road users, the pedestrians, cyclists and motorcyclists(6).

Injury Severity

There are different ways to categorize patients involved in road traffic accidents but the most widely used is by the validated new Injury Severity Score (ISS) (9). It uses anatomical locations to give an overall score for patients with multiple injuries. This may be used to predict the morbidity, mortality and hospitalization time after trauma(10). When calculated, an ISS greater than 15 is generally regarded as a major trauma(10).
The ISS is based on the Abbreviated Injury Scale (AIS) which assigns a score to each injury on a six-point ordinal scale which are: Minor, Moderate, Serious, Severe, Critical and Maximal (currently untreatable)(10)-10). The AIS has nine components that correspond to nine body regions(10): The Head, Face, Neck, Thorax, Abdomen, Spine, Upper Extremity, Lower Extremity, External and other (11). However, the ISS uses six regions, combining some of the components from the AIS: Head or neck – including cervical spine, Face – including the facial skeleton, nose, mouth, eyes and ears, Chest – thoracic spine and diaphragm, Abdomen or pelvic contents – abdominal organs and lumbar spine, Extremities or pelvic girdle – pelvic skeleton and External (9, 10).

To obtain the ISS score, the observer takes the highest AIS severity code in the three most severely injured ISS body regions, then squares them and sum up to get a total(11). The ISS scores ranges from 1 to 75, meaning a point of 5 in each category. If any of the three scores is a 6, the score is automatically set at 75. A score of 6 indicates that it is pointless or useless to continue with medical interventions(10). Examples of an ISS table will be seen in *appendix.*

The risk categories associated with RTI are grouped into socioeconomic status where Low- and middle-income countries are reported by the WHO to have more than 90% of all road traffic deaths. African regions rate the highest death rates among road traffic injuries, which is also seen in higher income countries as well that people of low socioeconomic status lead in RTIs deaths(6).

Another risk category is age where economically active individuals of age group between 15 and 44 accounts for approximately 48% of RTI deaths globally(6) and lastly sex where males are more affected than females. About three quarters (73%) of all road traffic deaths occur among young males under the age of 25 years who are almost 3 times as likely to be killed in a road traffic crash as young females(6).

Risk factors involved with RTI are speed which is related directly to chances of sustaining a motor crash and the severity of injuries after crashing. An increment of 1km/hour in mean speed, results in an increase of 3% likelihood to crash and 4-5% likelihood of fatal crashes. An adult pedestrian's risk of dying is less than 20% if struck by a car at 50 km/h and almost 60% if hit at 80 km/h(6).

Driving under the influence of alcohol and other psychoactive substances is another risk showing that driving under the influence of alcohol and any psychoactive substance or drug increases the risk of a crash that results in death or serious injuries. In the case of drink-driving, the risk of a road traffic crash starts at low levels of blood alcohol concentration (BAC) and increases significantly when the driver's BAC is $\geq$ 0.04 g/dl. In the case of drug-driving, the risk of incurring a road traffic crash is increased to differing degrees depending on the psychoactive drug used(6).

Nonuse of motorcycle helmets, seat-belts, and child restraints is also linked with increment of RTI. Wearing a motorcycle helmet correctly can reduce the risk of death by almost 40% and the risk of severe injury by over 70%. Wearing a seat-belt reduces the risk of a fatality among front-seat passengers by 40–50% and of rear-seat passengers by between 25–75%. If correctly installed and used, child restraints reduce deaths among infants by approximately 70% and deaths among small children by between 54% and 80%(6). There are many types of distractions that can lead to impaired driving. The distraction caused by mobile phones is a growing concern for road safety(6). Drivers using mobile phones are approximately 4 times more likely to be involved in a crash than drivers not using a mobile phone. Using a phone while driving slows reaction times (notably braking reaction time,

but also reaction to traffic signals), and makes it difficult to keep in the correct lane, and to keep the correct following distances. Hands-free phones are not much safer than hand-held phone sets, and texting considerably increases the risk of a crash(6).

Unsafe road infrastructure with the design of roads can have a considerable impact on their safety. Ideally, roads should be designed keeping in mind the safety of all road users. This would mean making sure that there are adequate facilities for pedestrians, cyclists, and motorcyclists. Measures such as footpaths, cycling lanes, safe crossing points, and other traffic calming measures can be critical to reducing the risk of injury among these road users(6).

Safe vehicles play a critical role in averting crashes and reducing the likelihood of serious injury. There are a number of UN regulations on vehicle safety that, if applied to countries' manufacturing and production standards, would potentially save many lives. These include requiring vehicle manufacturers to meet front and side impact regulations, to include electronic stability control (to prevent over-steering) and to ensure airbags and seat-belts are fitted in all vehicles. Without these basic standards, the risk of traffic injuries – both to those in the vehicle and those out of it – is considerably increased(6).

Post-crash care is crucial in outcomes of any RTIs. Delays in detecting and providing care for those involved in road traffic crash increases the severity of injuries(6).

In sub Saharan region, traffic laws on drink-driving, seat-belt wearing, speed limits, helmets and child restraints are not seriously reinforced which makes it worse when a RTI occurs(6).

Studies in low and middle-income countries have shown variable mortality and morbidity patterns. In India, *Misra et al* conducted a study in 2015 on epidemiology of road traffic injuries attending emergency department of a trauma center in New Delhi, India reported that most affected sex were male (80.0%) compared to women (16.0%) and the mean age of the victims was 32.7 years. Most of the victims (41.9%) were occupants rather than drivers. Also in their study, they reported that in India, 32% of road traffic injured victims die and of these showed that 14.4% of all deaths were due to external causes and RTIs consisted of almost one-third of all deaths due to external causes(2). Similarly, in Nepal, a study by *Karkee et al* between 2001-2013 reported that, out of a total of 95,902 crashes analyzed, there were 14,512 deaths and 100,499 injuries reported by traffic police over the 12 years period. The mortality rate increased from 4/100,000 population in 2001-2002 to

7/100,000 population in 2011-2012 and the majority of RTI were reported to occur among motorcyclists and pedestrians(5). Lastly, in Philippines, study by *Consunji et al* conducted a study on 2011 reported that among all trauma patients enrolled in their study, road traffic injuries contributed to 28.6% of all trauma related deaths following stab wounds(12).

In Africa, a study done in Addis Ababa, Ethiopia by *Getachew et al* in 2016 reported that, of 10,007 ED admissions, 779 (8%) were RTI cases. The median age was 28 years and 69% were males. The majority were pedestrians (69%) injured by an automobile (78%). Among these, 68% were discharged, 17% hospitalized, 17% referred and 1% died at the ED(12). In contrast, another study done in Addis Ababa at the ED of a specialized teaching Ethiopia by *Tiruneh* et al reported that, the incidence of RTI was much higher, 36.8% but also found that the majority of the victims were pedestrians (71.7%), followed by passengers (13%) , drivers (12.2%) and the rest were passengers. People living in urban areas accounted for 74% of all the RTIs. Most RTIs occurred in the public streets 89.3% followed by on work grounds 10% and 1% occurred around home surroundings. The most frequent locations of injury were head, neck and face 43.5%, lower extremities 25.9%, upper extremities 12.9%, pelvic 15%, chest 6% and spinal cord 2%. Moderate injuries accounted for 74.4% and severe 15%. This study compared its similarity with couple of countries. Its incidence of RTIs was 36.8% relatively similar with 35.2% in India, 27.7% in Kenya, 43.9% in Tanzania, 30.3% in Jimma University hospital and 33.8% in Addis Ababa(4).

In Kenya, *Matheka et al* conducted a study in Nairobi between January and February 2014 surveying road traffic injuries in commercial motorcycle drivers and reported that 98% of all injured victims were male and their average age was 28.4 years(13).

In Tanzania, a study done by *Casey et al*, that analyzed traumatic injuries presenting to a referral hospital ED in Moshi reported that male and individuals aged 15-44 years were most frequently affected, representing 73.4% and 57.8% respectively. The most common mechanism of injury was RTI, representing 43.9% of injuries with the common locations being head injuries (36.5%) and extremities injuries (59.5%). 59.3%, which were the majority of injured patients were admitted from the ED to hospital wards, whereas 5.6% required admission to the ICU. Death occurred in 5.4% of all the injured patients(4).

A one day survey done in district and regional public hospitals across Tanzania mainland by *Sawe et al* reported that road traffic incidents were the most common cause of injuries

accounting for 44.7% of all trauma complaints. It was mostly seen between the age group of 16-55 years (median of 30), mostly middle-aged group consistent with other studies in Tanzania and sub Saharan Africa(13).

In contrary to the above study, another study done in six public hospitals in Tanzania mainland by Boniface et al between April 2014 and September 2014 regarding factors associated with road traffic injuries reported that majority of the victims were between the age of 18-45 years (70.2%). In total, motorcyclist (as victims) led (53.4%) followed by drivers (38.3%). Among the major factors associated with mortality were using police cars for transport and delayed medical attention(14).

A 2013 systematic review by *Sobrino et al in 2013* basing on the distribution of trauma related deaths showed that many studies including the one done by Trunkey et al distributed trauma deaths in a trimodal way being immediate death that occurs at the scene to one hour after arrival to the hospital which comprises of severe and non-survivable injuries like brain injuries and massive hemorrhages. The second peak was early deaths occurring within the first 24 hours which comprises severe injuries which are potentially treatable with prompt definitive care and the third peak being late deaths that occurs weeks after injury. All these deaths depend on the pre-hospital care and in hospital management levels(15).

1.3 Problem statement

Road traffic injuries carry a high mortality rate worldwide(4). Over 90% of these deaths occur in low and middle-income countries(4). The most affected are individuals aged 15-29 years(4). Road Traffic related injuries are also very costly to countries(10). Injury cost in terms of lost gross domestic product related to road traffic morbidity and mortality is considerably higher than that related to cardiovascular diseases and cancer(4). It is predicted that, Road traffic injuries will become the sixth leading cause of death by 2020 and third highest cause of disability adjusted life years (DALY) lost by 2030(4). Death rates from RTI's are going down in HIC's but are actually increasing in LMIC's and expected to further increase.

Trauma related deaths in low and middle-income countries can be related to the absence of proper pre-hospital and emergency care, poor infrastructures, lack of trained human resources, inadequate equipment and lack of data(10). Right now, there is very little knowledge of the underlying causes of mortality.

1.4 Rationale

The results obtained in this study will give us data of the pattern of Road traffic incidents, distribution, management and in-hospital mortality of trauma patients received in our department. It will also look at risk factors for mortality among patients with RTI to determine where care can be improved including transport, ED management as well as prevention.

The results will help us know our burden, age distribution, pattern of injuries associated with high mortality rates, gaps in the management of these trauma patients which will guide us in allocation of resources especially in our limited resource environment, improve the infrastructure and equipment and know the existing gaps in our care givers which will help with the planning training and allocation of human resources.

This study, unlike previous, is focusing not on the overall burden, but on the mortality and knowing what distinguishes these cases that could lower the death rate.

Trauma has been documented to be among the leading cause of non-communicable burden of disease globally and more in the LMIC.

1.5 Research question

What is the profile of trauma related deaths among Road Traffic injured patients presenting to the Emergency Department of Muhimbili National Hospital?

1.6 Objectives

1.6.1 Broad objectives

To describe the profile of trauma related deaths among Road Traffic injured (RTI) patients presenting to the Emergency Medicine Department (EMD) of Muhimbili national hospital (MNH).

1.6.2 Specific objectives

1. To determine 90 days mortality rate among RTI patients presenting to the EMD-MNH.
2. To determine time distribution of trauma deaths among RTI patients presenting to the EMD-MNH.
3. To determine the injury patterns among RTI patients with trauma related deaths at EMD-MNH.
4. To describe the management and disposition of RTI patients with trauma related deaths at EMD-MNH.
5. To determine the factors associated with mortality among RTI patients with trauma at EMD-MNH.

CHAPTER TWO

2. METHODOLOGY

2.0 Study design

A retrospective review of patients with trauma related to a road traffic accident between years 2015-2018, using the EMD-MNH trauma registry.

2.1 Study area

The study was conducted at MNH, a tertiary referral hospital located in Dar es salaam Tanzania with a bed capacity of 1500 and receiving about 1000 to1200 in patients per week.

EMD at MNH is a full capacity emergency department receiving patients with acute illness and injury directly and from outlying hospitals. About 25% of these patients are trauma patients. The department is staffed with intern doctors rotating as a requirement of completion of their internship, general practitioners, emergency medicine residents for 3 years coarse of Master degree, emergency medicine specialists who are trained locally and abroad and visiting registered emergency medicine physicians doing consultancy from USA, Canada and South Africa.

The department receives approximately 50,000 patients per year from the city and outside the city and only 20% out of these get discharged from the EMD where 80% are either admissions or deaths at the EMD.

2.2 Target population

All patients involved in road traffic accidents presenting to acute intake areas in Tanzania during the study period.

2.3 Accessible population

All patients involved in road traffic accidents presenting at the EMD-MNH in Dar es Salaam Tanzania during the study period.

2.4 Study population

All patients involved in road traffic accidents presenting at the EMD of MNH during the time of study

2.5 Sampling design

Retrospective data extracted from the EMD-MNH trauma data base.

2.6 Subjects

Inclusion criteria

- All patients involved in road traffic accidents presenting to the ED and triaged to the resuscitation rooms during the study period.

Exclusion criteria

- Patients in cardiac arrest
- Brought in dead

Variables of interest

Predictor variables

- Age
- GCS
- ISS
- Gender
- Referral status

Outcome variables

- Death

2.7 Sample size

- The sample size estimate is based on a study from in Kenyatta National Hospital, Nairobi, Kenya in 2014 where the mortality rate for patients involved in road traffic accidents was 7.7%(16).
- With normal approximation to the binomial calculation;

$$N=4Z\alpha^2P(1-P)/W^2$$

- CL= 95%
- P= 0.077
- W=0.06

NB: Proportion is 7.7%

N= 337

Expected positive results= 26

Thus, the minimum sample size was **337**

2.8 Data collection

Data for the study were obtained from the trauma registry available in the department. All patients meeting the criteria required were recruited in the study from the EMD-MNH. A standardized case report form was used to record demographics, presenting clinical characteristics, management and outcomes and was inserted in an online date capture software (RED Cap). Patients were then followed up by research assistants at their disposition areas in the first 24 hours post admission then on day 30 and day 90. Patients who were sent home were followed by research assistants from the data registry at day 30 and 90 as required via phone calls directly to the patient or through the next of kin.

2.9 Data analysis

Data capture in online data Capture Software (RED Cap) was exported into Microsoft Excel (Microsoft Office Open XML_ISO/IEC 29500, Microsoft, One Microsoft Way, Redmond, Washington, US) and then exported to Statistical Package for Social Science (SPSS version 22.0, IBM, Ltd, Carolina, USA) for analysis.

2.10 Ethical consideration

The study was conducted after obtaining permission from the MUHAS Institutional Review Board and MNH research committee. As a retrospective study with identified data, patient's consent was not required since data was only retrieved from the trauma log.

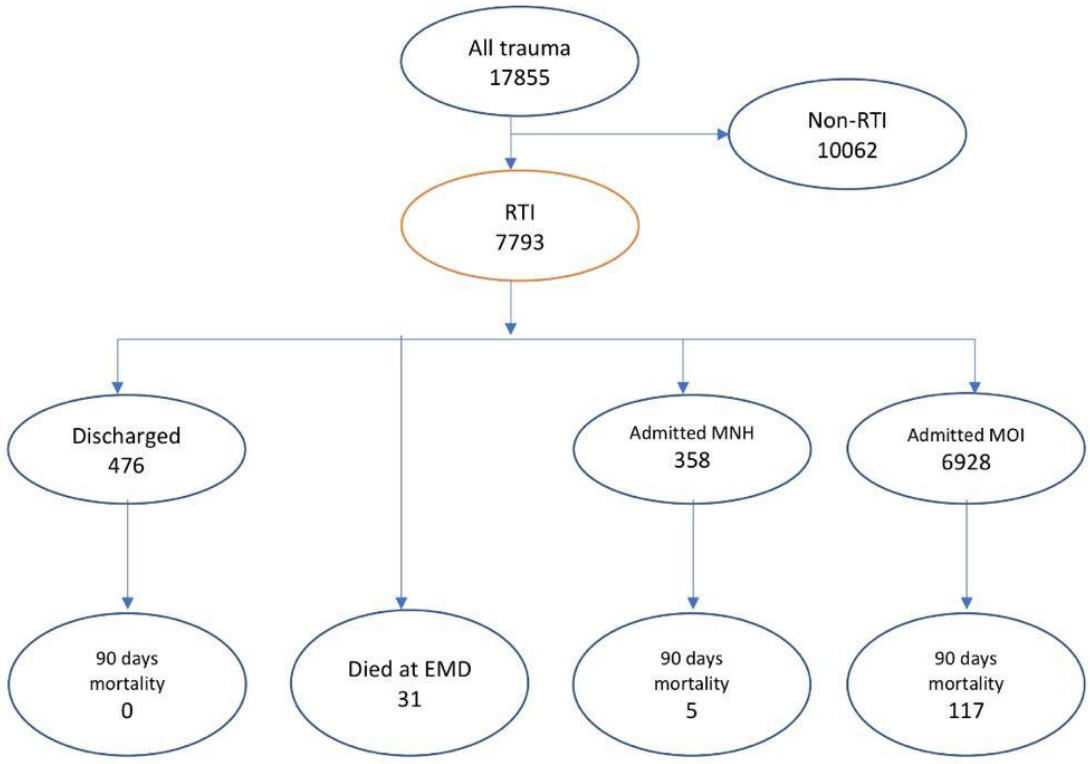
CHAPTER THREE

3.0 Study results

3.1 Flow chart of trauma patients presenting at EMD-MNH during the study period

There were 17,855 (100%) trauma patients who presented at the EMD-MNH during the study period, of these 7793 (43.7%) had RTI. Of the RTI patients, 476 (6.1%) were discharged home, 31 (0.4%) died at the EMD, 358 (4.6%) were admitted to MNH surgical wards and 6928 (88.9%), transferred to orthopaedic institute (MOI). The overall 90-day mortality rate for all RTIs was 1.96% and all of these were traceable via phone calls and ward follow ups.

Figure 1 Patient's flow chart



3.2 Demographics of study population

Among 153 patients who died, 127 (83%) were male, and the overall median age was 38 years (Interquartile range 16 to 55 years), and 121 (79.1%) were referral cases (Table 1).

Table 1 Demographic characteristics of RTI patients presenting to the EMD-MNH.

Demographic			**N=153**	
[Median (IQR)]			38 (16-55) years	
Age group (years)	**Total RTI**	**Alive**	**Died (n)**	**(n/N) %**
<5	229	224	5	3.3
5-15	493	486	7	4.6
16-55	6417	6206	111	72.5
>55	654	624	30	19.6
Sex				
Male	6167	6040	127	83.0
Female	1626	1600	26	17.0
Referral status				
Referred	2282	2161	121	79.1
Self-referral	1453	1421	32	20.9

3.3 Time distribution of trauma deaths among RTI patients presenting to the EMD-MNH during the study period.

Overall 1.97% of patients died within 90 days of RTI. Among those who died, 26.8% died within 24 hours, 53.6% died between 24 hours and 30 days and 19.6% died between 30 and 90 days (Table 2).

Table 2 Overall mortality rate and time distributions of trauma deaths among RTI patients

	Overall (N=7793)	**Died of RTI (n=153)**	**Died of RTI (Cumulative frequency)**
24-Mortality*	41 (0.53%)	41 (26.8%)	41 ((26.7%)
30-days mortality	82 (1.05%)	82 (53.6%)	123 (80.3%)
90-days mortality	30 (0.39%)	30 (19.6%)	153 (100%)
Overall mortality	1.97%		

**This includes the EMD deaths*

More than 50% of trauma related deaths occurred within 30 days post trauma regardless of the age, GCS or ISS status (Table 3).

Table 3 Time distribution of trauma death among RTI patients according to age, GCS and ISS

FACTORS	CATEGORIES (Total deaths)	24 HOURS*	30 DAYS	90 DAYS
AGE (years)				
	< 5 (N=5)	1 (20%)	2 (40%)	2 (40%)
	5-15 (N=7)	3 (43%)	3 (43%)	1 (14%)
	16-55 (N=111)	32 (29%)	59 (53%)	20 (18%)
	>55 (N=30)	5 (17%)	18 (60%)	7 (23%)
GCS AT ED				
	Severe (N=78)	27 (34%)	38 (49%)	13 (17%)
	Moderate (N=20)	2 (10%)	14 (70%)	4 (20%)
	Mild (N=55)	12 (22%)	9 (16%)	34 (62%)
ISS				
	Minor (N=33)	11 (33%)	14 (42%)	8 (24%)
	Moderate (N=1)	0 (0%)	1 (100%)	0 (0%)
	Serious (N=5)	1 (20%)	2 (40%)	2 (40%
	Severe (N=98)	25 (26%)	57 (58%)	16 (16%)
	Critical (N=17)	5 (29%)	7 (41%)	5 (29%)
	Maximal (N=0)	0 (0%)	0 (0%)	0 (0%)

**This includes the EMD deaths*

The proportion of injury severity score (ISS) was >15 for most of the road users with trauma related deaths who presented at the EMD-MNH (Table 4).

Table 4 Injury severity by road user type

Road User	Proportion with ISS >15
Motor vehicle occupant	94.4%
Motorcycle passenger	84.6%
Pedestrian vs Motor vehicle	84.4%
Motorcycle rider	81.0%
Motor vehicle driver	77.8%
Pedestrian vs Motorcycle	71.5%

3.4 Injury patterns among RTI patients with trauma related deaths at EMD-MNH during the study period

Head and neck injuries accounted for most of the injury patterns, 84.3%, of all trauma related deaths among RTI patients presenting at EMD-MNH.

The least was facial injuries which accounted up to only 1.3% (Table 5).

Table 5 Injury patterns among RTI patients with trauma related deaths at EMD-MNH

INJURY PATTERN	FREQUENCY	PERCENTAGE
Head and Neck	129	84.3%
Extremities	57	37.3%
Chest and Spine	13	8.5%
Abdomen and Pelvis	8	5.2%
External	4	2.6%
Face	2	1.3%

Overall, pedestrians were the most affected road users carrying more than 40% of the predominance of region of injuries (Table 6.)

Table 6 Predominant region of injury versus road use category at EMD-MNH

Injury region	Driver	Passenger	Pedestrian	Position Unknown	Total
Head & Neck	30 (23.2%)	32 (24.8%)	57 (44.2%)	10 (7.8%)	129 (100%)
Extremities	10 (17.6%)	16 (28.0%)	27 (47.4%)	4 (7.0%)	57 (100%)
Chest & spine	2 (15.4%)	4 (30.7%)	6 (46.2%)	1 (7.7%)	13 (100%)
Abdomen & pelvis	0 (0%)	3 (37.5%)	5 (62.5%)	0 (0%)	8 (100%)
External	2 (50%	0 (0%)	2 (50%	0 (0%)	4 (100%)
Face	1 (50%)	0 (0%)	1 (50%)	0 (0%)	2 (100%)

Among those who died, 112 (73.2%) had a diagnosis of head injury (Table 7).

Table 7 Top diagnosis of RTI related deaths

DIAGNOSIS	N	%
Head injuries	112	73.2
Extremities injuries	22	14.4
Abdomen injuries	8	5.2
Spine injuries	7	4.5
Neck injuries	2	1.3
Chest injuries	1	0.7
Pelvis injuries	1	0.7

3.5 Management of RTI patients with trauma related deaths at EMD-MNH during the study period

The most frequently documented investigation was EFAST with more than half being done to the trauma patients and out of these only 13.8% were positive similar to abnormal CT scan of the head (Table 8).

Table 8 Investigations done to RTI patients with trauma related deaths (N=153) at EMD-MNH.

INVESTIGATION	ALL (N)	ABNORMAL (n)	(n/N) %
CXR	12	10	83.3%
Pelvic X Ray	3	2	66.7%
Other CT scans*	8	3	37.5%
CT head	65	9	13.8%
EFAST	123	17	13.8%

**Includes Neck, Spine, Angiography*

Despite a high incidence of head and neck injuries, only six 6 (3.9%) patients were documented to have had neck collars applied to them during ED managements, up to 21.6% were intubated and more than half received IV fluids (Table 9).

Table 9 Treatments given to RTI patients with trauma related deaths at EMD-MNH.

MANAGEMENT N=153	n	(n/N) %
IV Fluids*	91	59.5%
Tetanus toxoid	61	39.9%
Antibiotics	44	28.8%
Suctioning	42	27.5%
ETT Intubation	33	21.6%
Splinting	22	14.4%
Oxygen therapy	22	14.4%
Blood Transfusion	12	7.8%
Chest tube	8	5.2%
Urethral catheterization	8	5.2%
Neck Collar	6	3.9%
Mannitol	1	0.65%

**Normal saline or Ringers lactate*

3.6 Disposition of RTI patients with trauma related deaths at EMD-MNH during the study period

Overall, 76.5% of all RTI patients with trauma related deaths were transferred to Muhimbili Orthopaedics Institute (MOI), 20.3% died at EMD-MNH and 3.2% were admitted in MNH wards. There were no deaths among those who were sent home or admitted in HDU or ICU (Table 10).

Table 10 Disposition of RTI patients with trauma related deaths.

Place of Disposition	Frequency	Percentage
Transfer to MOI	117	76.5%
Died at EMD	31	20.3%
MNH Ward	5	3.2%
Total	**153**	**100%**

3.7 Factors associated with mortality among RTI patients with trauma related deaths at EMD-MNH during the study period

Factors associated with mortality were age ≥55 years, GCS ≤12, head and neck injury pattern, admission to general wards and referral from other facilities (Table 11).

Table 11 Univariate analysis of factors influencing mortality among RTI patients.

FACTORS		ALIVE	DIED	P value	OR(C/I)
Age	**< 55 years**	7016 (98.3%)	123 (1.7%)	<0.0001	2.7 (1.8-4.1)
	≥ 55 years	624 (95.4%)	30 (4.6%)		
GCS	**≥ 13**	6892 (99.2)	54 (0.8%)	<0.0001	16.9 (12.0-23.7)
	≤12	748 (88.3%)	99 (11.7%)		
ISS	**≤ 15**	1448 (97.8%)	33 (2.2%)	0.41	0.9 (0.6-1.3)
	> 15	6192 (98.1%)	120 (1.9%)		
Sex	**Male**	6040 (97.9%)	127 (2.1%)	0.24	0.8 (0.5-1.2)
	Female	1600 (98.4%)	26 (1.6%)		
Referral Status	**Referred**	2161(94.7%)	121 (5.3%)	<0.0001	0.4 (0.3-0.6)
	Not referred	1421(97.8%)	32 (2.2%)		
Injury Pattern	**Head and Neck**	3427 (96.4%)	129 (3.6%)	<0.0001	0.6 (0.4-0.7)
	Others	4006 (97.9%)	84 (2.1%)		
Disposition	**MOI**	6928 (98.3%)	117 (1.7%)	<0.0001	2.6 (1.8-3.8)
	Others	823 (95.8%)	36 (4.2%)		

CHAPTER FOUR

4.0 Discussion

This study provides an overview of the profile of trauma related deaths among road traffic injured patients presenting at the Emergency medicine department of the Muhimbili national hospital in Tanzania. As in prior studies, we found that the patients were generally male, and of a younger age (median 38 years).

We found that RTI contributed 43.6% of all trauma cases seen at our ED, similar to the study done in Kilimanjaro Christian Medical Centre where RTI contributed 43.9% of all trauma cases (3) however, studies done in Ethiopia and Philippines showed that RTI contributes up to 36.8% and 29% respectively of all trauma cases in the ED (1,12).

This study shows that the mortality rate among RTI patients is 1.97%. The mortality rate seen in this study is relatively low compared to similar studies done in other LMIC's including Kenya, Nepal and Kilimanjaro where mortality rates were 7.7%, 14.4% and 5.4% respectively (3,5,16). Mortality might be lower in this case compared to the other LMIC due to the presence of a specialized full capacity orthopedic and neurosurgery center available in this study setting that contributes to reduction of early deaths as per the trimodal distribution of death. A study done in one tertiary hospital in Addis Ababa, Ethiopia on the burden of road traffic injuries in the emergency department had an ED mortality rate of 1% (4).

It is likely the mortality rate from RTIs is much higher and thus our overall low mortality should not be reassuring.

Risk factors influencing mortality among RTI patients that we analyzed were age, GCS, ISS, sex, referral status, injury pattern and disposition.

Most of the RTI studies show that people with age < 50 years are the ones who are mostly involved in RTI similar to our study. Nevertheless, patients above 55 years had a significantly higher risk of dying when involved in a motor traffic injury compared to those less than 55 years. It might be due to the fact that, firstly, there is a presence of a specialized orthopedics and neurosurgery unit in our study setting and second, patients more than 55 years might have had multiple co-morbid that contributed to their

physiological instabilities post trauma. This is similar to a study done in China (9) but contrasts to similar studies done in LMIC where the age groups less than 60 years had an increased mortality rate compared to above 60 years (12,14,16).

Also, other significant risk factors for higher mortality seen in this study were a Glasgow coma score of less or equal to 12, being referred from other facilities, having a head and neck injury as an injury pattern, and being admitted to general wards other than to a specialized orthopedics and neurosurgery Centre.
Patient severity in this study was assessed both on anatomical and physiological scores by using the Injury severity score and Glasgow coma score respectively which are risk factors for mortality. Patients with GCS less or equal to 12 had higher chances of dying compared to those with a higher GCS. However, having an ISS less than or greater than 15 had no influence on mortality. Also in a similar study done in Kenya (16).

Male predominance of mortality has been seen in this study similar to other studies and this is due to high proportion of male predomination in vehicle use in our setting, previously noted in a study on road injuries by (14). However, male sex had no risk significance in mortality in this study, similar to others (16).

Referral status was one of the risk factors that was assessed in this study and it showed that the patients that were referred from other facilities had a higher chance of dying compared to those who were not referred from other facilities and came directly. This might be due to either inappropriate stabilization at the peripheral hospital, time delayed in receiving definitive treatments that were only available at our hospital, or inappropriate transportation modalities leading to secondary injuries. In a similar study done in a similar setup (14), the mode of transportation was found to be associated with mortality.

Head and neck injuries were shown in this study to have a greater risk of mortality compared to other patterns of injury, in keeping with the findings of other studies in similar settings (16). Patients admitted to Muhimbili Orthopedics Institute (MOI) had a higher chance of surviving than those disposed to other wards. This might be due to early secondary injury prevention and definitive management to prevent early deaths.

Low mortality rate should not necessarily be reassuring and thus some interventions are likely needed in the pathway of trauma management.

This study provides the profile of trauma related deaths among RTI patients presenting to an Urban tertiary hospital in Dar es Salaam as well as highlighting the risk factors associated with increased chances of mortality among road traffic injured individuals. It will also raise awareness on the burden of RTI related deaths as well as give data that can be used to analyze both strengths and weakness in the entire channel of RTI patient's flow that can be used to improve care for RTI victims.

4.1 Study limitations

This was a retrospective study were data was obtained from a charted trauma registry. In some cases, data fields were incomplete at the time of the review.

CHAPTER FIVE

5.0 Conclusion and recommendations

5.1 Conclusion

RTI contributes to almost half of all traumas presenting at the Emergency Department. The mortality rate from RTI is low compared to other studies done in similar economic settings with most injury pattern being the head and neck. More than half of the RTI patients were transferred to the orthopaedics institute with age, referral status and GCS being the most observed fatal factors. Future studies should focus more on the brought in dead registry so as to know the real burden of RTI deaths as well as the profiles from the peripheral hospitals, the role of police task force and pre-hospital care in road traffic injuries.

5.2 Recommendations

1. Emphasis should be kept on cervical spine immobilization in trauma patients especially those to who sustained head and neck injuries until cervical injury is cleared out.
2. Integrate both police officers and fire rescue teams in the first responders team as well as providing education on how to care for the RTI patients.
3. Develop pre-hospital system and trained team that would bring RTI patients directly to a specialized trauma centre and should be sustainable.

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7 Appendix
ISS Table from www.orthotips.com

Injury Severity Score; ISS

Region	Injury Description	AIS	Square Top Three
Head & Neck	Cerebral Contusion	3	9
Face	No Injury	0	
Chest	Flail Chest	4	16
Abdomen	Minor Contusion of Liver Complex Rupture Spleen	2 5	25
Extremity	Fractured femur	3	
External	No Injury	0	
		Injury Severity Score:	50

AIS Score	Injury
1	Minor
2	Moderate
3	Serious
4	Severe
5	Critical
6	Survivable

ISS	
1-8	Minor
9-15	Moderate
16-24	Serious
25-49	Severe
50-74	Critical
75	Maximum

8. Appendix
Ethical Clearance

MUHIMBILI UNIVERSITY OF HEALTH AND ALLIED SCIENCES
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Ref. No. DA.287/298/01A/

13th June, 2018

Dr. Dereck A. Kaale
MMed. Emergency Medicine
MUHAS.

RE: APPROVAL OF ETHICAL CLEARANCE FOR A STUDY TITLED: "PROFILE OF TRAUMA RELATED DEATHS AMONG ROAD TRAFFIC ACCIDENTS PRESENTING TO THE EMERGENCY DEPARTMENT OF MUHIMBILI NATIONAL HOSPITAL"

Reference is made to the above heading.

I am pleased to inform you that, the Chairman has, on behalf of the Senate, approved ethical clearance for the above-mentioned study. Hence you may proceed with the planned study.

The ethical clearance is valid for one year only, from 12th June, 2018 to 11th June, 2019. In case you do not complete data analysis and dissertation report writing by 11th June, 2019, you will have to apply for renewal of ethical clearance prior to the expiry date.

Dr. Emmanuel Balandya
ACTING: DIRECTOR OF POSTGRADUATE STUDIES

cc: Director of Research and Publications
cc: Dean, School of Medicine

9. Appendix
Permission to collect data

MUHIMBILI NATIONAL HOSPITAL

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In reply please quote: MNH/TRC/Permission /2018/344 20th June, 2018

Head,
Emergency Medicine Department,
Muhimbili National Hospital.

RE: PERMISSION TO COLLECT DATA AT MNH

Name of Student	Dereck A. Kaale
Title	"PROFILE OF TRAUMA RELATED DEATHS AMONG ROAD TRAFFIC ACCIDENTS PRESENTING TO THE EMERGENCY DEPARTMENT OF MUHIMBILI NATIONAL HOSPITAL".
Institution	Muhimbili University of Health and Allied Sciences
Supervisors	Dr. Hendry R. Sawe
Period	20/6/2018 to 30/12/2018 (6 months)

The above named student has been permitted to collect data for the above study.
Please ensure that the researcher abide to the ethical principle and other conditions.

Sincerely,

Dr. Faraja Chiwanga
Head of Teaching, Research and Consultancy Coordination Unit

HEAD, TEACHING, RESEARCH & CONSULTANCY UNIT
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