Outcomes and its predictors of patients with traumatic brain injury among injured patients at selected public hospitals, Addis Ababa, Ethiopia, 2019.

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A THESIS TO BE SUBMITTED TO ADDIS ABABA UNIVERSITY COLLEGE OF HEALTH SCIENCES, SCHOOL OF NURSING AND MIDWIFERY, FOR PARTIAL FULFILLMENT OF MASTERS OF SCIENCE IN ADULT HEALTH NURSING.

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Outcomes and its Predictors of Patients with Traumatic Brain Injury among injured patients at Selected Public hospitals, Addis Ababa, Ethiopia, 2019.

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APPROVAL BY THE BOARD OF EXAMINATION

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STATEMENT OF DECLARATION

By my signature below, I declare and affirm that this thesis is my own work. I have followed all ethical principles of scholarship in the preparation, data collection, data analysis and completion of this thesis. All scholarly matter that is included in the thesis has been given recognition through citation. I affirm that I have cited and referenced all sources used in this document. Every effort has been made to avoid plagiarism in the preparation of this thesis.

This thesis is submitted in partial fulfillment of the requirement for a graduate degree from the Addis Ababa University at College of Health Sciences, School of Nursing and Midwifery. The thesis is deposited in the Addis Ababa University Digital Library and is made available to local, national and international scientific community. I solemnly declare that this thesis has not been submitted to any other institution anywhere for the award of any academic degree, diploma or certificate.

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ABBREVIATIONS /ACRONYMS

AaBET	Addis Ababa Burn Emergency and Trauma
ALERT	All Africa Leprosy, Tuberculosis and Rehabilitation Training Centre
CDC	Center for disease control
CT-	computer topography
ETB-	Ethiopian birr
GCS-	Glasgow coma scale
GOS-	Glasgow coma outcome scale
HT-	Head trauma
JUTH-	Jimma university teaching hospital
RTA-	Road traffic accident
TASH-	Tikur Anbessa specialized hospital
TBI-	Traumatic brain injury
USA-	United States of America

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ABSTRACT

Background: - Globally, traumatic brain injury is a substantial cause of morbidity and mortality across all age groups, with a disproportionately greater burden borne by low- and middle-income countries. **Objective: -**The aim was to assess the outcomes and predictors of traumatic brain injury among traumatic brain injury patients. **Method**: - A two years retrospective cross-sectional study design was employed among 371 participants in the two trauma hospitals found in Addis Ababa between February 25 and April 15 2019. Participants with traumatic brain injury who visited the two trauma hospitals in the city (AaBET and ALERT hospitals) from January 01, 2017 to December 31, 2018 were included. An adopted and modified semi-structured pre-tested data extraction tool was used to gather data. Purposive sampling was used to select the two trauma centers and data was collected using simple random sampling technique. Data was cleaned manually, coded and entered into EPI–data manager version 4.4 and exported to a SPSS version 21.0 for analysis. Binary and multiple logistic regressions were computed to evaluate association between dependent and independent variables. Level of significance was determined using 95% confidence interval and p-value less than 0.05.**Result: -** results of this study showed 36% unfavorable and 64% favorable outcomes. Age, time of arrival, severity of injury, papillary reactivity oxygen saturation was predictors of outcomes of traumatic brain injury. Those patients with traumatic brain injury aged between 18 and 24 were less likely to have unfavorable outcome AOR= 0.067[0.007, 0.622], Those patients with traumatic brain injury who arrived to the hospitals between 4 and 24 hours and greater than 24 hours were more likely to have unfavorable outcome AOR=2.857[1.150,7.099], and AOR=7.623[2.594,8.915] respectively. Those patients with a severe AOR=5.224[2.562, 8.915] and moderate AOR 2.851[1.298, 6.262] type of traumatic brain injury, patients who were reported to have anisorcia papillary reflex AOR=3.941[1.766, 5.793] and hypoxia AOR 3.490[1.845, 6.603] were more likely to have unfavorable outcome. **Conclusion: -** This study showed that 36% of traumatic injury patients have unfavorable outcome. Age, time of arrival, oxygen saturation, severity of injury and pupillary reactivity are associated with patient outcomes of traumatic brain injury. Improved time of arrival, and close monitoring of oxygen levels is recommended to substantiate patient outcomes.

Keywords: Traumatic brain injury, Outcomes, Predictors, Addis Ababa, Hospitals

1. CHAPTER ONE INTRODUCTION

1.1 Background

Traumatic brain injury (TBI) is a prevalent condition with a high burden to society and affecting mainly young person's.(1) Traumatic brain injury (TBI) is a non-degenerative, non-congenital insult to the brain from an external mechanical force, possibly leading to permanent or temporary impairment of cognitive, physical, and psychosocial functions, with an associated diminished or altered state of consciousness. (2)There are many different ways to categorizes patients .Each of which may impact prognosis and treatment (3).Traditionally TBI has been classified based on the severity using Glasgow Coma Scale The severity of a TBI may range from "mild" (i.e., a brief change in mental status or consciousness) to "severe" (i.e., an extended period of unconsciousness or memory loss after the injury) (4).

Globally, traumatic brain injury is a substantial cause of mortality and morbidity across all age groups, with a disproportionately greater burden borne by low- and middle-income countries. In less resourced settings, the burden is magnified by the high prevalence of risk factors and by health systems which are often unable to effectively deliver the acute and long-term care the patients require (5).

The incidence of TBI worldwide is rising, mainly owing to injuries associated with the increased use of motor vehicles, particularly in middle-income and low-income countries. Estimates of TBI incidence show substantial variation between countries(6) with data from the CDC showing incidence of traumatic brain injury in different African countries ranging from 150-500/100,000 per year(7). In Africa, one-third of all head injured patients suffer poor outcomes, and those patients with severe head injury have almost twice the risk of dying compared to those in high-income countries (8; 9). Strained health systems in the region contribute to these outcomes and improving access to pre-hospital, emergency and good intensive medical care and by prompt surgical interventions may improve these outcomes (9-11).

Traumatic head injury is a significant public health problem in Ethiopia. (12; 13). Like in other countries, in Ethiopia, the most common identified risk factors for severe head injuries were RTA, interpersonal violence and falling accidents (14; 15). Even if the government of Ethiopia has developed policies and strategies to minimize road traffic accidents, morbidity and mortality associated with severe head injury as result of RTAs are still very high(15).

1.2 Statement of the problem

The World Health Organization (WHO) global burden of injury estimate ranks injury among the top ten leading causes of death, with an estimated 5 million deaths annually of which men in Africa have the highest injury-related mortality rates in the world. Among African nations the rate of injury mortality in 2004 was the highest in Nigeria and the lowest in Egypt. South Africa and Ethiopia were second and third, respectively (5)

Traumatic brain injury is a leading cause of death and disability worldwide with enormous economic consequences (16). TBIs contribute to about 30% of all injury deaths Every day, 153 people in the United States die from injuries that include TBI (17)Most of the burden (90%) is in low and middle income countries (18).A recent review of the global impact of traumatic brain injury (TBI) identified that opportunities to adequately address this burden are compromised by limited epidemiological data on the causes and characteristics of these injuries.

Regardless of an increasing body of knowledge and prevention, head trauma (HT) is a major cause of death and disability among young adults and important public health problem in the world especially in developing countries (19-23). A recent population-based study done in urban Tanzania (24) and Ghana (25) has demonstrated that traumatic brain injuries are a major source of disability. These studies have helped to quantify the morbidity and mortality associated with injuries in developing countries and highlights the need for data examining injury epidemiology on a larger scale. A review of articles written on issues pertaining to the medical treatment of people with TBI in the past 15 years in Kenya indicates a significantly high incidence of TBIs and a high mortality rate. (26).

A meta-analysis of reports from 23 European countries revealed a hospital admission incidence of 235 per 100,000 people (6). It is estimated that 1-2% of high income populations live with a TBI disability and the incidence is high in some countries in Africa. In South Africa, the mortality rate of TBI was reported to be 81/100,000 per year; with greater than 10% of all case fatality rate. High risk groups for TBI include adolescents, young adults and the elderly, with males being affected 2-3 times more often than females (7).

A retrospective review study in Addis Ababa Ethiopia TASH found head injury accounted for almost 60% of deaths among trauma patients admitted to the surgical service from 2002 to 2006 (27). Another Study which was conducted in Ethiopia at JUTH in 2010 indicated that head injury is common public health problem of all traumas (28).

Considering TBI is a major public health concern, understanding the outcomes and its predictors is useful in making important decisions about methods of treatment for the health care professionals and in communication with the patient's family. This study aims at evaluating the outcome and predictors of outcome of traumatic brain injury at Addis Ababa public Hospital.

1.3 Significance of the study

Traumatic brain injury is a public health concern globally as well as in our country. The study will add an understanding on predictors of the outcomes of TBI. The study also will be able to identify key predictors that help in designing effective treatment strategies. In addition the study would provide data to researchers for further study at a larger scale. The result of this study will also be used by concerned bodies for planning an optimized management protocol. The recommendation of this study could benefit the public at large in providing effective treatment.

2. CHAPTER TWO LITERATURE REVIEWS

2.1 Introduction

The World Health Organization (WHO) estimates that injuries constitute 16% of the global burden of disease. This translates into around 5 million injury-related deaths at a rate of 97.9/100,000 worldwide (29; 30). Off all types of injuries those to the brain are among the most likely to result in death or disability (31). Traumatic brain injury (TBI) is a critical public health problem worldwide. TBI, according to the WHO, will surpass many diseases as the major cause of death and disability by the year 2020.It has been estimated that TBI affects over 10 million people annually leading to either mortality or hospitalization.

Traumatic brain injury (TBI) is a major cause of death and disability in the United States. TBI contributes to about 30% of all injury deaths (17). Every day even in high income countries like the United States 153 people die from injuries that include TBI. Those who survive a TBI can face effects that last a few days, or the rest of their lives. Effects of TBI can include impaired thinking or memory, movement, sensation (e.g., vision or hearing), or emotional functioning (e.g., personality changes, depression). These issues not only affect individuals but can have lasting effects on families and communities (17).

2.2 Outcomes of traumatic brain injury

A retrospective study done in Greece on 621 patients with an Outcome assessment for survivors based only on data from the medical records of patients during their hospitalization using a GOS reported 27.38% of mortality rate from TBI. The scale comprises five categories: death, vegetative state, severe disability, moderate disability, and good recovery. The study showed a 5.15 %vegetative state 7.73% Severe disability, 22.71% Moderate disability and 37.03 Good recovery .The study reported death ,vegetative state and sever disability as Unfavorable outcome and the rest two as favorable (32).

Due to rapid surge in urbanization, motorization and economical liberation, in many low and middle income countries (LMIC), non-communicable disease including injuries are

becoming a leading cause of mortality and morbidity. LMIC face a higher preponderance of risk factors for TBI yet often do not have the efficient health care capacity to deal with the associated health outcomes. The significant disabilities associated with TBI also places a considerable burden on health care system in these countries, therefore knowledge of the epidemiological profile of TBI and development of preventive measures to alleviate this burden are vital, particularly in the limited resources setting(33).

A study done in New Delhi tertiary care hospital that involved retrospective collection of data and a prospective management and follow up of 796 cases of TBI admitted to the neurosurgery department during one year study duration showed an outcome result of Good outcome noted in 80% cases and 20% cases expired. All the relevant variables recorded and analyzed were Glasgow Outcome Scale (GOS) into 3 groups namely group 1, 2 and 3. the group 1 is similar to the Glasgow coma out scale of death while the group two (Bad) goes with the GOS of vegetative state and sever disability. The third group (good) is similar with GOS of moderate disability and good recovery.(34).

A prospective study done in kamuzu central hospital, a tertiary care center in the capital of Malawi from October 2016 through May 2017 on 280 patients showed an overall mortality of 30.9% of patients who survived 80.1% made a good recovery(35) .

A prospective study that is done in Kenyatta National Hospital (KNH), a tertiary referral centre in Kenya on Eighty Seven adult patients with severe traumatic brain injury admitted between April and September 2005 showed an outcome of mortality of 54%.It also showed (21.8%) patients had persistent vegetative state, 7(8.0%) severe disability, 7(8.0%) moderate disability and 9(10.3%) had good recovery (36).

2.3 Predictors of outcomes of Traumatic brain injury

Pre-injury factors such as sex, age, coexistence of other injuries, and mode of injuries have been linked to increased mortality and worse outcome after TBI. Many clinical factors have also been shown to predict the outcome in patients with head injury. Many studies have suggested important clinical factors, including patient’s admission Glasgow Coma Scale score, motor responses, pupillary responses, presence of associated injuries, and

hypotension, hypoxia and CT scan findings like various types of intracranial hemorrhage (37; 38).

A retrospective study done in Greece society on 621 patients reported a 27.38% of mortality rate from TBI. It presented a relation to their GCS score on admission. Patients above 75-year old had worse outcome compared with the youngest group of patients (57.14% vs. 34.72% mortality rate respectively). GCS level is highly correlated with mortality rate. Patients with GCS of 3-4 had 54.96% mortality, 5-6 at 29.95% and 7-8 with mortality of 11%. The commonest cause of s TBI in this study was indeed road traffic accidents (61.99%) and injurious falls (23.99%). Other causes (i.e. workplace accidents and physical aggression) accounted for 14.02%. The study also revealed CT scan findings to the outcomes of TBI. The highest mortality rate is recorded in the case of patients with subdural hematoma (43.75%), followed by patients with brain contusion (33.87%). even though Intracerebral hematoma had the most frequent image finding (49.92% of all cases studied), mortality rate was 25.16%.

This study also found Coexisting injuries of the patients aggravated the prognosis. The mortality of patients with unequal or un-reactive pupils was 53.95%. Hypoxia ($pO2<60$ mmHg) in the first 6 hours after admission was developed in 27.38% of our patients and their mortality rate was 48.96%, while 17.23% developed shock (SBP<90 mmHg) and the mortality rate of that group was 46.73%. In general the study reveals that death emerged in 27.38% of cases while good recovery was seen in 37.03% of the patients (32).

A prospective study that is done in Kenyatta National Hospital (KNH), a tertiary referral centre in Kenya showed severe traumatic brain injury accounted for 14.3% of all ICU admissions. This study included 73 men (83.9%) and 14 women (16.1%) with a mean patient age of 34 ± 17 years. Motor vehicle accidents were the main cause (58.6%). Factors that were associated with poor outcome on univariate analysis were Glasgow coma scale of less than 5; diffuse axonal injury and intracerebral mass lesions and blood sugar greater than 10mmol / L. Fifty two patients (59.8%) were seen at the casualty within 1-4 hours of injury while 4.5% presented between 4 and 24 hours after injury. The rest arrived within a golden first hour. The high mortality in this study could be explained by high

frequency of multiple injuries and late presentation to hospital. Most patients in this study presented one to four hours after the injury with subsequent delays in starting definitive management (36).

A cohort study done in our country that included, 204 patients with head injury of which the majority were less than 30 years old (n = 104, 51.0%) and male (n = 177, 86.8%). Among the 201 patients with a recorded mechanism of injury, road traffic accidents (RTAs) caused over 40% of all head injuries (n = 82, 41.0%), with pedestrians struck by a vehicle being the most common type of RTA (n = 50, 61.0%). Twenty (10.0%) patients sustained head injuries at their workplace, either as a result of a fall (n = 9, 45%) or as a driver in an RTA (n = 4, 20%)(12).

The study also shows a significant number of patients had at least one indicator of severe injury on presentation 51 (25.0%) had a GCS < 9, 53 (26.0%) had multi-system trauma, 95 (46.6%) had at least one abnormal vital sign. The study describes injury severity by their mechanism of injury. Patients injured by an RTA were more likely to have indicators of severe injury than patients with other mechanisms, including multi-system trauma (odds ratio (OR) 3.2, 95% CI 1.7–6.2,p = 0.00), GCS < 9 (OR 3.7, 95% CI 1.8–7.4, p = 0.00), at least one abnormal vital sign (OR 2.5, 95% CI 1.4–4.6, p = 0.00) or an RTS score < 6 (OR 3.6, 95% CI 1.6–8.1, p = 0.00). Patients injured either by fall or assault had significantly higher rates of acute pathology evident on CT scan when compared to those injured in an RTA: 36.1% of falls had a subdural hematoma (p = 0.01) and 30.1% of assaulted patients had an epidural hematoma (p = 0.01)(12).

The study describes patient outcomes stratified by the severity of head injury (i.e. GCS) on presentation to the emergency center. Twenty-nine patients had a neurosurgical intervention, the majority of whom had mild head injuries (GCS 13–15 on arrival) and 28 of them were discharged home (96.5%).Overall, 149 (73.0%) patients were discharged from the hospital: 21.5% of patients were discharged with either persistent moderate or severe head injury .with GCS 9–12 and twelve with GCS < 9). Additionally, 13 (8.7%) patients were discharged home with a persistent focal neurologic finding (twelve with hemiparesis and one with aphasia)(12).

According to the study which was conducted at Jimma University Specialized Hospital ,Ethiopia for Four (4) month Prospective study, on 52 head injury patients indicated, female to male ratio was 1:9 and Interpersonal fight (n=20, 38.5%) and traffic Accidents (n=19, 36.5%) accounted for most of the injuries. Of all injuries, 15.4% (n=8) were due to falling accidents mainly in children and distribution of the severity of injury measured with the initial Glasgow Coma Score (GCS) indicates that 37 (71%) of all patients were discharged with a good recovery Glasgow Outcome Scale (GOS) 5, 7.7% with a disability and 21.2% died and All patients with initial GCS greater than 6 survived whereas almost all patients with initial GCS 6 and less were died and Patients with both non-reactive pupils at the initial examination died in 87.5% of cases (14).

This study also showed patients who sustained injury from fight or fall were more likely to have an outcome with good recovery (GOS 5) compared to patients with road traffic injury (RTI) or other causes. Only 10% of the patients who sustained injury from interpersonal fight had an initial GCS below 9 compared to 52.6% in RTI patients. In this study, 40 (77%) of all patients were managed conservatively with fluid resuscitation and antibiotics administration. Twenty-seven patients had a CT scan result which showed a fracture in 15 cases and nineteen patients had no CT scan done. Median initial GCS of the patients that had visible skull fractures on the x-rays was 13 and patients who underwent no skull x-ray had a median initial GCS of 10 (14).

2.3 Conceptual frame work

The conceptual frame work is developed based on previous literatures (32-38). According to the literatures the outcomes of TBI can be predicted based on the socio demographic status, history, clinical factors and diagnostic results of the patient.

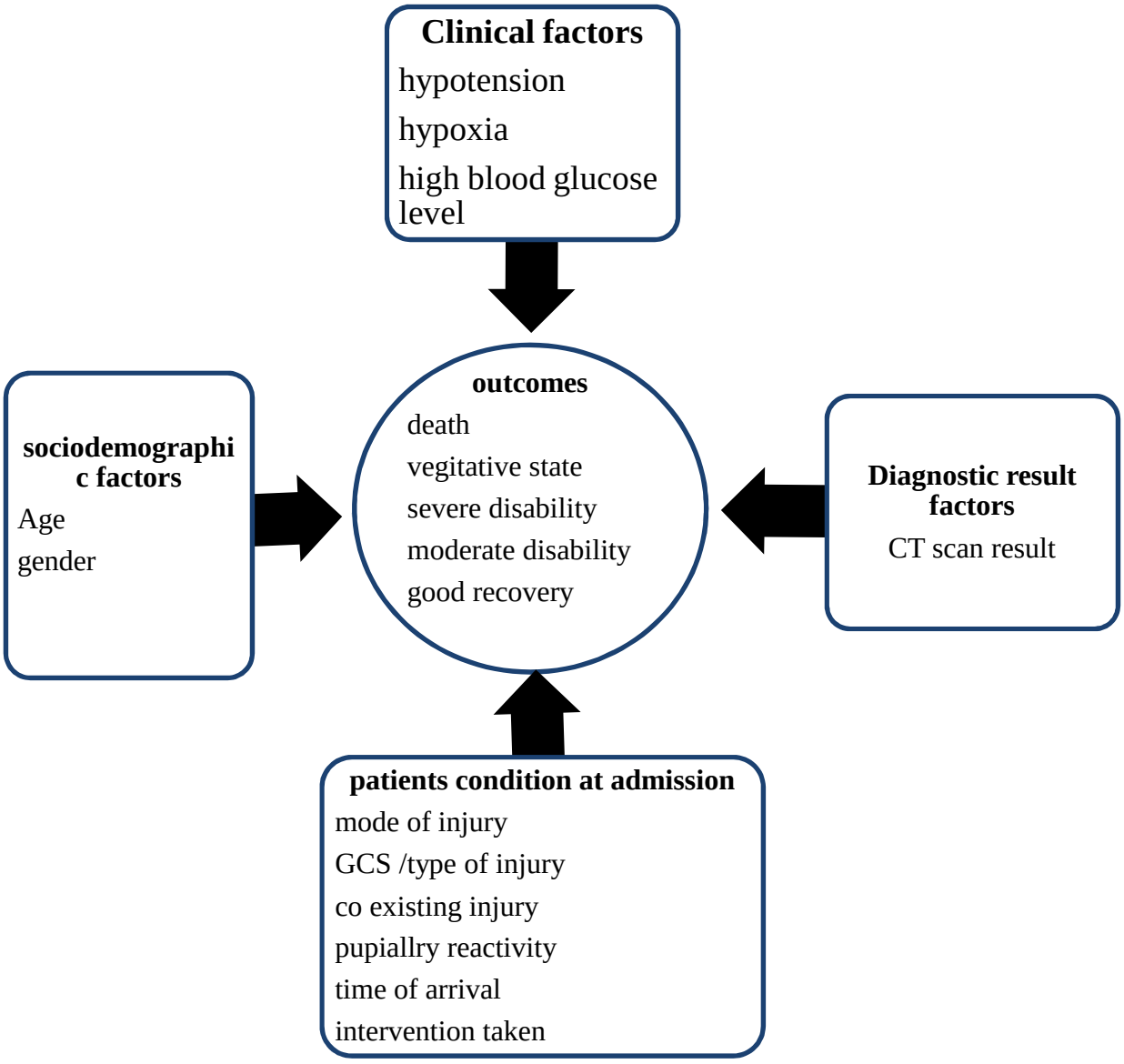

Figure 1Conceptual framework of variables predicting outcomes of traumatic brain injury at Addis Ababa public hospitals, Addis Ababa, Ethiopia, 2019.

3. CHAPTER THREE OBJECTIVES

3.1 General Objective

- To assess the outcomes and predictors of traumatic brain injury among injured patients presented in public trauma centers in Addis Ababa, Ethiopia. From January 01, 2017 to December 31, 2018.

3.2 Specific Objectives

- To assess the outcomes of Traumatic brain injury among injured patients presented in public trauma centers in Addis Ababa, Ethiopia. From January 01, 2017 to December 31, 2018.

- To identify the predictors of TBI outcome among injured patients presented in public trauma centers Addis Ababa, Ethiopia. From January 01, 2017 to December 31, 2018

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4. CHAPTER FOUR MATERIALS AND METHODS

4.1. Study area and Period

This study was conducted at Addis Ababa burn emergency and trauma (AaBET) and All Africa Leprosy, Tuberculosis and Rehabilitation Training Centre (ALERT) which are the largest trauma centers in Addis Ababa, which is the capital city of Ethiopia. The hospitals serve for about 3.3 million populations in Addis Ababa.

AaBET hospital is a newly established 250 beds and 12 ICU bed teaching and public referral hospital in Addis Ababa, Ethiopia, affiliated with St. Paul's hospital Millennium Medical College. FMOH opened AaBET on August 2015 with the mission of managing burn, emergency cases and trauma. Annually the hospital serves 5000-7000 patients (SPMMCH 2016).

ALERT is a medical facility on the edge of Addis Ababa, specializing in Hansen's disease, also known as "leprosy". ALERT trauma center opened in 2015 for the community in all emergencies great and small. The trauma center includes four departments (emergency, ICU, OR and surgical ward). In the third quarter of 2016 the center reported more than 1603 emergency visits .The trauma center is first area hospital to have this designation. The study was conducted in these two hospitals from February 25 to April 15, 2019(39).

4.2. Study Design

Institutional based retrospective cross sectional study was conducted to assess outcomes and predictors of traumatic brain injury patients presented to AaBET and ALERT hospitals from January, 01 2017 to December 31 2018.

4.3. Source Population

All patients presented with traumatic brain injury to the two trauma centers was the source population for the study.

4.4 Study population

Clients' charts was reviewed during data collection time at AaBET and ALERT hospitals from January 01, 2017to December 31, 2018

4.5 Eligibility criteria

4.5.1Inclusion criteria

All records of TBI patients visited to AaBET and ALERT hospitals from January 01, 2017 to January 31, 2018, whose age is above 18years, were included in the study.

4.5.2 Exclusion criteria

- TBI Patients chart that has inadequate data.
- TBI patient's charts which are lost from record office due to consultation, transferor any other medical reason at the time of data collection were excluded and replaced by another patient chart that was chosen randomly.

4.6 Sample size determination

Sample size was determined by a single population proportion formula by considering the following the assumptions.

P = proportion of mortality (50%)

$Z_{\alpha/2}$ = the corresponding Z score of 95% CI,

d= Margin of error (5%) and

n= required Sample size

$$n = \frac{(Z\frac{\alpha}{2})^2 \times p(1-p)}{(d)^2}$$

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

$n = 384.15 \approx 384$

Considering the whole population is less than 10,000 a correction formula is used

nf = Sample size

n = Desired sample size

N=Source population

$$nf = \frac{n}{1} + (n)/(N)$$

$$nf = \frac{384}{1} + (384)/(2748)$$

nf= 337

Adding 10 % contingency rates for an incomplete chart made the final sample size **371**.

4.7 Sampling technique and Sampling procedure

The two trauma centers were selected based on the declaration of the Federal Ministry of health as trauma centers and their high trauma patient flow. Number of TBI patients with in the two years was taken and a sample size of three hundred seventy one has been determined. The samples were proportionally allocated to the two trauma Centers according to their total population and the data was collected by using simple random sampling from the sampling frame.

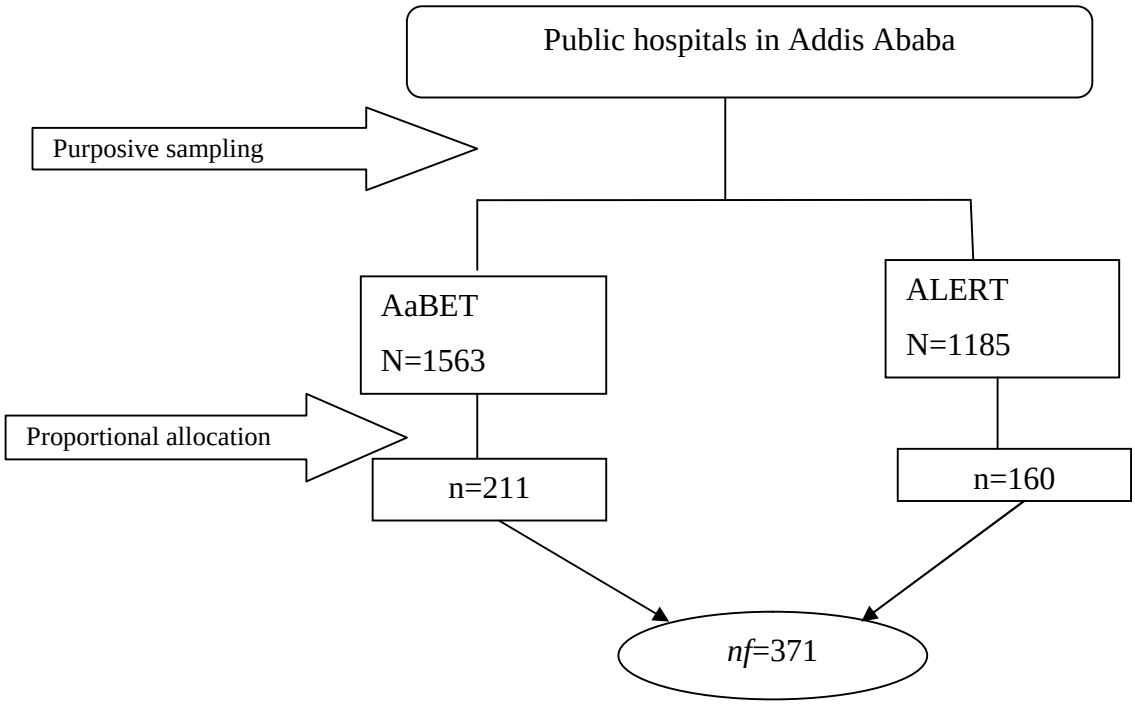

Figure 2 Proportional allocation of samples to AaBET and ALERT hospitals Addis Ababa, Ethiopia, 2019.

4.8 Variables

4.8.1Dependent variables

- Outcomes of TBI

4.8.2 Independent variable

- Age
- Sex
- Mechanism of head injury
- GCS scale/Type of TBI
- Time of arrival (time between injury and arrival)
- Interventions taken
- co-existing injuries
- hypoxia
- hypotension
- blood glucose level
- papillary reactivity
- CT scan result

4.9. Operational definitions and Definition of terms

Trauma: - A term used in a physical sense as a wound or injury – such as a severe blow, maybe leading to a fracture.

Traumatic brain injury (TBI): - alteration in brain function which is manifest as confusion, altered level of consciousness, coma and seizure.

GCS- Glasgow coma scale used for assessing the neurological status of the patient.

GOS-Glasgow coma Outcome Scale is a multi-dimensional scale which assesses various aspects of outcome

Death – patient is certified dead

Vegetative state –patient exhibits no obvious cortical function

Severe disability – (conscious but disabled) patient depends upon others for daily support due to mental or physical disability or both

Moderate disability – (disabled but independent) patient is independent as far as daily life is concerned the disabilities found include varying degrees of dysphasia hemiparesis, or ataxia as well as intellectual and memory deficits and personality changes

Good recovery –Resumption of normal activities even though there may be minor neurological or psychological deficits

Favorable outcome – GOS of IV, V is considered as favorable outcome

Unfavorable outcome -GOS of I-III is considered as un-favorable outcome

Trauma: - any serious injury to the body often results from violence or an accident.

Mild traumatic brain injury: - an injury to the head when Glasgow coma scale is between 13 and 15.

Moderate traumatic brain injury: - an injury to the head when Glasgow coma scales between 9 and 13.

Severe traumatic brain injury: - an injury to the head when Glasgow coma scale is less than or equal to 8.

4.10. Data extraction tools and procedures

The medical files of patients presented with TBI were retrospectively collected by using checklists. The checks list that was used for assessment of the outcome was adopted from Glasgow coma outcome scale (GOS).The GOS is a multi-dimensional scale which assesses various aspects of outcome. The five categories of the original GOS scale are: Grade (I) dead; Grade (II) vegetative (absence of awareness, cannot interact, unresponsive) and Grade (III) severely disabled (conscious but disabled and dependent); Grade (IV) moderately disabled (disabled but independent) and Grade (V) good recovery (can work). GOS of I-III was considered as un-favorable outcome and GOS of IV, V was considered as favorable outcome for statistical analysis (40).The scale was described in 1975. It has been widely accepted as a standard means of describing outcomes in head injury patients. It has a high degree of validity (0.80%) and reliability (95%).The extraction tool for predictors were adopted and modified from different literatures with similar title(32,36-38)

4.11. Data collectors and supervisors

The data was collected by reviewing the patient's medical cards. The data was collected by five B.Sc. nurses who were trained for a day about the data extraction tool and techniques. The data collection was supervised by two M.Sc. nurses who were also trained about the tool.

4.12. Data processing and Analysis

The collected data was manually checked for completeness and for any inconsistency then coded and entered into EPI DATA manager version 4.4 exported into SPSS version 21 for data processing and analysis. It is processed by carrying out simple descriptive statistics. Frequency with percentage distribution is used for categorical variables. Binary and multiple logistic regressions are computed to evaluate the predictors. The magnitude of the association between the different independent variables in relation to dependent variables were measured using odds ratios (OR) and 95% confidence interval. Statistical significance was declared at $p<0.05$.Finally, the result was presented in the form of text, tables, figures and charts.

4.13. Data quality assurance

Pretest was done on 5% of study participant at study setting who were excluded from final study to check the validity and reliability of data collection tools and necessary modifications was made based on the findings. Prior to data collection period, one day training was given for data collectors. Onsite supervision was done to solve any ambiguity with data collection tools and techniques. The filled check lists were cross checked at the end of each data collection day for completeness and consistency.

4.14. Ethical consideration

Ethical clearance was obtained from Addis Ababa University, College of health sciences. School of nursing and midwifery institutional review board and was given to AaBET and ALERT hospitals to get permission. Confidentiality was kept during data collection and any recorded patient information had not been exposed to third person.

4.15. Dissemination plan

The result of this research will be submitted and presented to Addis Ababa University, school of nursing and midwifery. The result of this study will also be given to AaBET and ALERT hospitals. The findings of this thesis will be disseminated to concerned bodies such as service providers and other accessible concerned stake holders. Finally, this paper will be published to peer-reviewed journals.

5. CHAPTER FIVE RESULTS

5.1. Sociodemographic characteristics

Among 2748 patients, a total of 371study participants were included in this study. Of those, about 260 (70.1%) were males. One third, 129(34.8%) of injuries occurred among ages 25-34 year old. One hundred seventy (42.3%) of the patients were from urban areas [table 1].

Table 1Sociodemographic Characteristics of patients with traumatic brain injury in ALERT and AaBET hospitals, 2019. (n=371)

Characteristics	**Category**	**Outcome**		**No (%)**
		favorable	unfavorable	
AGE	18-24	64	18	82(22.1)
	25-34	95	34	129(34.8)
	35-44	44	26	70(18.9)
	45-54	17	23	40(10.7)
	≥55	19	31	50(13.5)
GENDER	Male	170	90	260(70.1)
	Female	69	42	111(29.9)
RESIDENCY	Urban	102	55	157(42.3)
	Rural	137	77	214(57.7)

5.2. Patients condition at admission

Road traffic accident (RTA) was the leading cause of TBI accounting for 174 (46.9%), followed by assault 96 (25.9%) and fall down accident 73 (19.7%). Regarding to the arrival time after injury, 141(38%) patients were presented within the first 1-4 hours duration, 27.4% within 4 to24 hours, and 21% arrived in less than one hour. One hundred ten (29.6%) had severe type of traumatic brain injury based on score of Glasgow coma scale. Among the 255 patient with Co-existing injuries 197(77.3%) had skull injury. Amongst 371 study participants, a total of 201(54.1%) of patients had normal pupil reactivity and 239 (64.4%)of patients were treated conservatively [table 2].

Table 2 Patients condition at admission among traumatic brain injury patients at AaBET and ALERT hospitals Addis Ababa, 2019 (n=371)

Variable	Category	Outcome		No (%)
		Favorable	**unfavorable**	
Mechanism of injury	Road traffic Accident	79	95	174(46.9)
	Assault	77	19	96(25.9)
	Fall down	61	12	73(19.7)
	Other	22	6	28(7.5)
Time of arrival after injury	≤ 1 hour	64	14	78(21.0)
	1-4 hour	107	34	141(38)
	4-24 hour	48	54	102(27.4)
	> 24 hour	20	30	50(13.4)
Severity of head injury	Severe (GCS ≤ 8)	37	73	110(29.6)
	Moderate (GCS13-15)	62	38	100(26.9)
	Mild (GCS 9-13)	140	21	161(43.3)
Co-existing injury occurrence	Yes	125	130	255(68.7)
	No	144	2	116(31.3)
Type of co-existing injuries (n=255)	Skull fractures	80	117	197(77.3)
	Neck injury	33	83	116(45.5)
	Chest injury	20	47	67(26.3)
	Abdominal injury	22	28	50(19.6)
	pelvic injury	16	9	25(9.8)
	other injuries	59	73	132(51.8)
Pupillary reactivity	Normal	175	26	201(54.1)
	Both dilated	34	58	92(24.7)
	Anisocoria	26	48	74(19.9)
	Unable to assess	4	0	4(1.1)
Interventions taken	Conservative management (fluid and antibiotic administration)	201	38	239(64.4)
	Surgical	36	90	126(33.9)
	Others	2	4	6(1.6)

5.3. Clinical and diagnostic factors

Information regarding to patients` vital sign was taken from medical records. Accordingly, 175(47.1%),246(66.3%) and 211(56.9%) of patients` Blood pressure, respiratory rate and pulse rate was within the normal range on the time of arrival respectively [table 3].

Table 3Clinical and diagnostic factors of patients with traumatic brain injury, ALERT and AaBET hospitals 2019(n=371).

Clinical factors	**Category**	**Outcome**		**No (%)**
		Favorable	Unfavorable	
Blood pressure	Normal	159	16	175(47.1%)
	Increased	43	33	76(20.4%)
	Decreased	37	83	120(32.3%)
Respiratory rate	12-20	192	54	246(66.3%)
	Bradypenic	11	39	50(13.5%)
	Tachypenic	36	39	75(20.2%)
Pulse rate	60-100	179	32	211(56.9%)
	Bradycardic	16	33	49(13.2%)
	Tachycardic	44	67	111(29.9%)
O_2 saturation	Normal	190	42	232(62.5%)
	Hypoxia	49	90	139(37.5%)
BSL	<200mg/dl	72	45	117(31.5%)
	>200mg/dl	90	45	135(36.4%)
	Not investigated	77	42	119(32.1%)
Hematocrit	<30%	65	67	133(35.8%)
	>30%	102	47	149(40.2%)
	Not investigated	71	18	89(24%)
CT scan results	No CT	41	0	41(11.1%)
	Normal CT	42	0	42(11.3%)
	Hematomas	14	92	106(28.6%)
	Brain contusion	55	1	56(15.1%)
	Subarachnoid bleed	59	4	63(17%)
	Others	28	35	63(17%)

5.4. Outcomes of traumatic brain injury

Regarding to the outcome of traumatic brain injury of patients, the majority of the patients, 71(19.1%) were dead, 13(3.5%) were in a vegetative state, 40(10.7%) were severely disabled, 8(2.1%) were referred, 62(16.7%) were moderately disabled and 177(47.7) had a good recovery. For better analysis of the outcomes these GOS can easily be divided into favorable outcomes (64%) which consist of moderate disability and good recovery and Unfavorable outcomes (36%) which consist of the rest. [Figure 6]

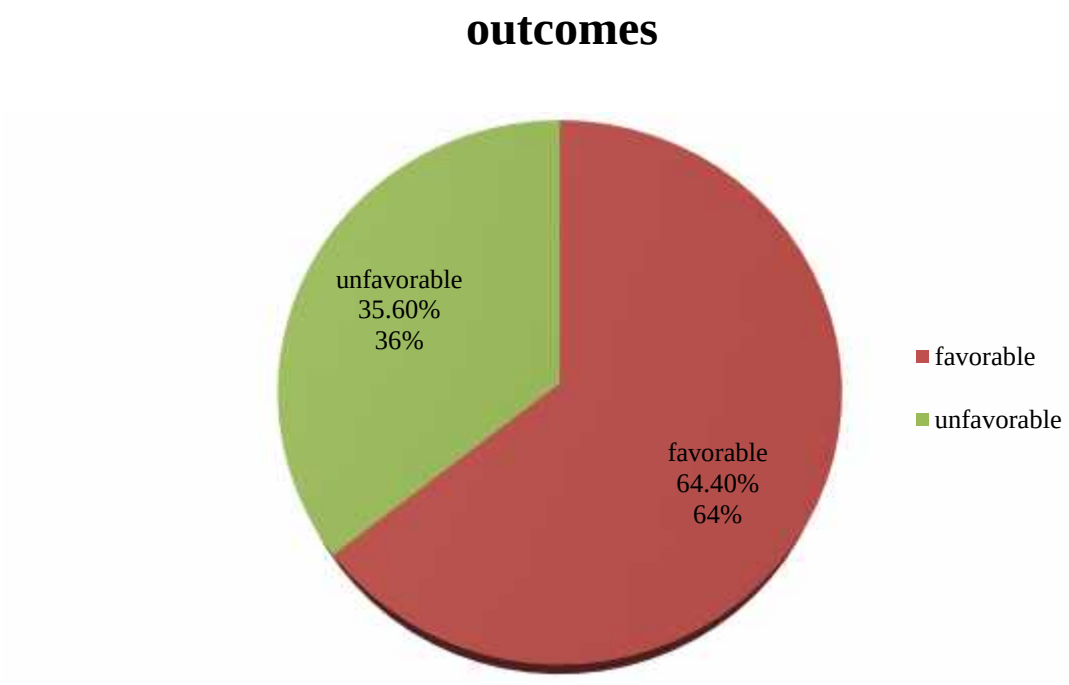

Figure 3 Outcomes of patients with traumatic brain injury, ALERT and AaBET hospitals, 2019. (n=371)

5.5. Predictors of outcomes of Traumatic Brain Injury

Table 6 shows predictive factors of outcomes of traumatic brain injury with COR and AOR with 95% CI. As shown below Ages had more favorable outcomes. Time of arrival after injury, severity of TBI pupil reactivity and oxygen saturation shows a statistically significant predictive value for unfavorable outcomes of TBI [table 4].

Table 4Bivariate and multivariate logistic regression analysis of Predictors of outcomes with traumatic brain injury, ALERT and AaBET hospitals, Addis Ababa, Ethiopia, 2019 (n=371)

Variables	Category	Outcomes		OR with 95% CI COR	p-value	OR with 95% CI AOR	p-value
		FO	UO				
Age (in years)	18-24	64	18	0.172(0.079,0.374)	0.000	0.067(0.007,0.622)	0.018
	25-34	95	34	0.219(0.110,0.438)	0.000	-	
	35-44	44	26	0.362(0.171,0.766)	0.008	-	
	45-54	17	23	0.829(0.355,1.936)	0.665	-	
	≥55	19	31	1		1	
Mechanism of injury	RTA	79	95	4.409(1.704,11.410)	0.002	-	
	Assault	77	19	0.905(0.322,2.542)	0.849	-	
	Fall down	61	12	0.721(0.322,2.155)	0.559	-	
	Others	22	6	1		1	
Time of arrival	>1 hour	64	14	1		1	
	1-4 hour	107	34	1.453(0.725,2.911)	0.293	-	
	4-24 hours	48	54	5.143(2.562,10.324)	0.000	2.857(1.150,7.099)	0.005
	>24 hours	20	30	6.857(3.053,15.39)	0.000	7.623(2.594,10.399)	0.000
Severity	Sever	37	73	13.153(7.178,20.1)	0.000	5.224(2.562,8.915)	0.000
	Moderate	62	38	4.086(2.218,7.528)	0.000	2.851(1.298,6.262	0.009
	Mild	140	21	1		1	
Pupillary reactivity	Normal	175	26	1		1	
	Dilated	34	58	11.48(6.360,20.72)	0.000	-	

	Anasorcia	26	48	12.426(6.615,21.3)	0.000	3.941(1.766,5.793)	0.001
	Unable to assess	4	0	-	0.999	-	
Blood pressure	Normal	159	16	1		-	
	Increased	43	33	7.626(3.842,15.13)	0.000	-	
	Decreased	37	83	22.29(11.711,42.4)	0.000	-	
O_2 saturation	Normal	190	42	1		1	
	Hypoxia	49	90	8.309(5.129,13.46)	0.000	3.490(1.845,6.603)	0.001
Hematocrit	<30%	65	67	4.066(2.188,7.555)	0.000	-	
	>30%	102	47	1.818(0.976,3.386)	0.060	-	
	Not investigated	71	18	1		1	
Ct scan result	No ct	41	0	0.028(0.004,0.213)	0.997	-	
	Normal ct	42	0	0.027(0.003,0.207)	0.997	-	
	Hematoma	14	92	4.200(2.124,8.305)	0.000	-	
	Brain contusion	55	1	0.041(0.009,0.182)	0.000	-	
	Subarachnoid bleed	59	4	0.314(0.145,0.581)	0.000	-	
	Others	28	35	1		1	

FO-favorable outcome, UO-unfavorable outcome,

6. CHAPTER SIX DISSCUSSION

TBI remains a leading cause of death and disability worldwide, which can affect the daily life activities and presents high risk of readmission to hospital and/or subsequent death. Thus, studies have been carried out so as to investigate variables, which could predict outcome in TBI. The study found that age, time of arrival after injury, the severity of TBI, pupillary reactivity and oxygen saturation to be predictive of TBI.

This study was aimed to assess the outcomes and predictors of traumatic brain injury in ALERT and AaBET hospitals. The study found that age, time of arrival after injury, the severity of TBI, pupillary reactivity and oxygen saturation was found to be predictors of TBI.

This study showed the outcome of traumatic brain injury of patients, a considerable amount of patients, 71(19.1%) were dead. The result was less compare with a study done in Greece which reported 27.38% death among traumatic brain injury patients. The difference may be attributed to the severity of injury that majority type of TBI in the current study is mild which has a good recovery (43.3) compare to that of the study in Greece (37.03)(32).It also showed less unfavorable outcome compare to Kenyatta National Hospital (KNH), a tertiary referral center in Kenya which showed an unfavorable outcome of 83.8%. The difference may attribute the type of severe TBI has worsened outcomes (36).

The study showed that patients whose age is younger than 25 were more likely to had a less unfavorable outcome compared with the other age group. This study is similar to a study done in Greece society which presented patients above 75-year old had worse outcome compared with the youngest group of patient (32). This may be due to multi factorial reasons that the aging brain seems more sensitive to ischemia and offers an impaired regenerative capacity. It may also be due to a higher incidence of chronic concomitant diseases in elderly patients.

The study also revealed that patients arriving 4-24 hours and >24 hours had an unfavorable outcome compare to those who came in less than 4 hours. This result is similar to a study

that is done in Kenyatta National Hospital (KNH), a tertiary referral center in Kenya which showed patients who arrived between 4 and 24 hours after injury had high mortality rate. The mortality in this study could be explained by high frequency of multiple injuries and late presentation to hospital(36).

The study finding showed the severe and moderate type of traumatic brain injury had higher unfavorable outcome compare to mild type of traumatic brain injury. The study showed similarity with a study done in Greece society which presented a high correlation between low GCS level and mortality (32). This may be due to an increasingly brain tissue damage with moderate and severe type of traumatic brain injury.

This study finding showed Patients with unequal pupil reactivity had unfavorable outcomes. It also showed patients who presented with hypoxia had an unfavorable outcome. This study shows similarity with a study done in Greece in which mortality of patients with unequal or un-reactive pupils was 53.95. Hypoxia ($pO2<60$ mmHg) presented in admission was developed in 27.38% of patients and their mortality rate was 48.96 % (32).This elevated unfavorable outcomes for both variable maybe due to increasing damage to the brain.

7. CHAPTER SEVEN CONCLUSION AND RECOMMENDATION

7.1 Conclusion

This study was done on outcomes and predictors of traumatic brain injury on ALART and AaBET trauma centers. The result of this study showed that there was 36% of unfavorable and 64% of favorable outcomes. Young age is associated with favorable outcomes in traumatic brain injury patients, while time of arrival to hospital, severity of injury, pupillary reactivity and oxygen saturation were associated with unfavorable outcome among traumatic brain injury patients.

7.2 Recommendation

Based on the study finding the following recommendations are forwarded.

1. To governmental and non- governmental organizations

The identified predictors' should be taken under consideration by health care providers, concerned bodies, and policy makers of the trauma centers to plan an optimized management protocol.

Since the majority of TBI is caused by road traffic accident precautions should be taken to reduce incidence of TBI related mortality both by pedestrian and transportation authority's by focusing on implementation of policies on road traffic.

2. To health care providers

Early response to injury by health care services providers may improve time of arrival to the hospitals hence giving the patient early treatment and decreasing worsen outcomes.

Close monitoring of changes in oxygen levels, early detection of abnormal pupil reactivity and early treatment may be necessary among emergency medical technicians and emergency care providers in the hospital to improve patient outcomes.

Emergency care can play an important role in reducing avoidable mortality. However, it needs to be planned well and supported at all levels. Reducing the burden of injuries requires an organizational approach (pre hospital care, hospital clinical care, and hospital administrative care) to prevent and treat injuries.

3. To researchers

Lastly further study with more valid instrument that can address the limitations of this study, and advanced design covering other range of samples is important to substantiate this finding for more generalizability.

8. STRENGTH AND LIMITATIONS

8.1 Limitations

This study was subjected to some limitations. Selection bias was possibly introduced due to the fact that patients with incomplete records of variables or charts which were lost for some patients were excluded. Therefore, those study subjects whose charts were not included in the study and with missing value may undermine the result. The other limitation of the current study is the external validity of the result might be limited as the study included the trauma centers.

8.2 Strength

Despite the above potential limitations, the study has the following strengths. The study was conducted in all types of traumatic brain injury, in which it identified key predictors for all possible outcomes. It also focuses on a specific type of head injury which helps to understand traumatic brain injury in detail.

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Appendix

Annex A. Information Sheet

Participant information sheet for hospital's administrators

My name is _____. I am working as data collector for the research being conducted to assess Outcomes and its Predictors of Patients with Traumatic Brain Injury by BLEN NIGUSSIE who is M.Sc. student in Addis Ababa University, Collage of Health Sciences School of Nursing and Midwifery. I kindly request you to lend me your attention to explain you about the study and study participant.

The study title: Outcomes and its Predictors of Patients with Traumatic Brain Injury among injured patients presented at Addis Ababa Selected Public hospitals, Addis Ababa, Ethiopia, 2019.

Purpose of the study: The main aim of this study is to write a thesis as a partial requirement for the fulfillment of a master's degree in Adult health nursing for the principal investigator. Moreover, the result of the study will be used as evidence and input for the Hospitals.

Procedure and duration: The data collectors will collect the necessary information from patient files using Semi structured data extraction tools to have pertinent data that is helpful for the study. The duration of data collection will be for 20 days.

Risks and benefits: Participating in this study does not have any risk or harm on study participant. Findings from this research will reveal important information for the Center, regional health bureau and government planner.

Confidentiality: The information acquired from patient file will be confidential. There will be no information that will identify in particular. The findings of the study will be general for the study community and will not reflect anything particularly of individual persons.The data extraction tools will be coded to exclude showing names and other personal information's. No reference will be made in oral or written reports that could link participants to the study.

Rights: Giving permission for this study is fully voluntary. You have the right to permit or not for this study. If you decide to permit the study, you have the right to terminate the study at any time if you consider something related to the study is wrong.

Contact address:, E-mail:blennigussie07@gmail.com, Mobile phone: +251-933-180-790

Annex B.DATA EXTRACTION TOOL

Checklist to collect data on retrospective analysis of Traumatic brain injuries from January 01/2017 to December 31/2018 G.C in AaBET and ALERT hospitals, Addis Ababa, Ethiopia.

Part I: Sociodemographic status

S.N	Variables	Responses	Skip to …
101	Age	_____	
102	Gender	1. Male 2. Female	
103	Residency	1. Urban 2. Rural	

Part II: History of the patient

201	Medical Record Number	_____	
202	Mechanism of injury	1. Road traffic Accident 2. Assault 3. Fall down 4. Other(specify)_____	
203	Time of arrival after injury	1. ≤ 1 hour 2. 1-4 hour 3. 4-24 hour 4. > 24 hour	
204	GCS score	1. 13-15 2. 9-13 3. ≤ 8	
205	Severity of head injury	1. Severe 2. moderate 3. mild	

206	Was there co-existing injury?	1. Yes 2. No	If No skip to Q #208
207	What are the co-existing injury	1. Skull fractures 2. Neck injury 3. Chest injury 4. abdominal injury 5. pelvic injury 6. other injuries(specify)_____	
208	Pupillary reactivity	1. Normal 2. Both dilated 3. Anisocoria	
209	Interventions taken	1. Conservative management (fluid and antibiotic administration) 2. Surgical 3. Others (specify)	
Part III : Clinical factors			
301	Vital sign at arrival (choose all on the chart)	1. Hypotension 2. Hypertensive 3. Tachycardia 4. bradycardia 5. Tachypenia 6. bradypenia	
302	Oxygen saturation on arrival	1. Normal 2. Hypoxia	
303	Blood sugar level	1. >200mg/dl 2. <200mg/dl 3. Not investigated	

304	Hematocrit	1. <30% 2. >30% 3. Not investigated	
Part IV : Diagnostic factors			
401	CT- scan result	1. No CT 2. Normal CT 3. Hematomas 4. Brain contusion 5. Subarachnoid bleed 6. Others	
Part V: Outcome of patients			
501	Patient outcome	1. Death 2. Vegetative state 3. Severe disability 4. Moderate disability 5. Good recovery	