Addis Ababa University

College of Health Sciences

School of Medicine

Department of Anatomy

Prevalence and Associated Factors of Traumatic Brain Injury Among Trauma Patients Admitted to the Adult Emergency Departments of Three Governmental Hospitals in Addis Ababa, Ethiopia.

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A Thesis Submitted to the Department of Anatomy, School of Medicine, College of Health Sciences, and Addis Ababa University in Partial Fulfillment of the Requirement for the Award of the Degree of Master of Science (MSc.) in Anatomy.

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Thesis Submission Form

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DECLARATIONS

This is Agumas Shibabaw from the Department of Anatomy, School of Medicine, College of Health Sciences, and Addis Ababa University. I hereby certify that the work described in this thesis is fully mine. It has never been submitted in full or in part with another degree application. I confirm that this master's thesis was completed wholly by me and was not submitted for any professional certifications, except for some states that specifically declare otherwise through references or acknowledgements.

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LISTS OF ABBREVIATIONS AND ACRONYMS

CDC	Center for Disease Control
CI	Confidence Interval
EU	European Union
GBD	Global Disease Burden
GCS	Glasgow Coma Scale
HICs	High Income Countries
HMIS	Health Management Information System
IRB	Institutional Research Board
LICs	Low Income Countries
MICs	Middle Income Countries
MRN	Medical Record Number
MTBI	Mild Traumatic Brain Injury
MVAs	Motor Vehicle Accidents
NAT	Non-Trauma Accident
OR	Odds Ratio
ODK	Open Data Kit
RTAs	Road Traffic Accidents
RTIs	Road Traffic Injuries
SPSS	Statistical Package for the Social Sciences
TASH	Tikur Anbessa Specialized Hospital
TBI	Traumatic Brain Injury
TCB	Traumatic Comma Bank
WHO	World Health Organization

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ABSTRACT

Background: Traumatic Brain Injury (TBI) is the major cause of mortality and morbidity worldwide and commonly occurs in low- and middle-income countries. The occurrence of TBI in the world around 54 million to 60 million people each year.

Objectives: To assess the prevalence and associated factors of patients with TBI admitted to the emergency departments of three governmental hospitals in Addis Ababa, Ethiopia, 2022.

Methods and Materials: The study was conducted in three governmental hospitals at Menelik, Yekatit 12, and Tikur Anbessa Specialized Hospitals in Addis Ababa, Ethiopia. The study is a hospital-based cross-sectional retrospective by design. A structured questionnaire was prepared to collect data from the medical records of patients at the emergency department. Data was entered into an Open Data Kit (ODK) exported to Statistical Package for the Social Sciences (SPSS) version 26 for analysis then the findings were presented using a bar graph, a pie chart, and tables.

Results: One hundred forty-one trauma patients were studied, of whom 85 (60.3%) were male and 85 (39.7%) females. The median (IQR) age of the patients was 43.3% (25–44) [SD = 1.007, 95% CI]. The prevalence of traumatic brain injuries was 34.6%, with RTA accounting for 40.4% of all head injuries, followed by violence at 32.6%, fall at 17.7%, and 9.2% were others. Alcohol drinkers (AOR = 1.088, 95% CI), khat chewers (AOR = 1.947, 95% CI), labour workers (AOR = 3.633, 95% CI), low-income levels (AOR = 3.686, CI), and medium-income levels (AOR = 2.060, CI) are all significantly associated with traumatic brain injury. The severity of the traumatic brain injury was 46.8% mild, 34.8% moderate, and 18.4% severe.

Conclusion: The prevalence of traumatic brain injury was 34.6%. The most common cause of traumatic brain injuries was found to be road traffic accidents. The severity of TBI was mild. Being male, alcohol drinkers, khat chewers, labour workers, those with unable to read and write, having low- and medium-income levels put them at high risk for traumatic brain injury.

Keywords: traumatic brain injury, associated factors**,** prevalence, Addis Ababa, Ethiopia

1. INTRODUCTION

1.1. Background

Traumatic Brain Injury (TBI) is an injury to the head caused by external mechanical force through high acceleration or deceleration, impact, blast waves, or penetration by a projectile, leading to temporary or permanent impairment of brain function (1). TBI continues to be an enormous public health problem, even with modern medication in the 21st century.

TBI is a major cause of mortality and morbidity worldwide and occurs in low- and middle-income countries (LICs and MICs) (2). The occurrence of TBI in the world around 54 million to 60 million people each year, and the majority of injuries are the most likely to cause long-term disability (3). According to the World Health Organization (WHO), TBI was a major cause of death and disability in 2020. The WHO estimates that more than 10 million people in the world sustain TBI each year, resulting in death or severe disability (3).

TBI-related disabilities affect approximately 57 million people worldwide (4). Approximately 5.3 million people are living with TBI-related disabilities in the USA (5), and 7.7 million people in the European Union have experienced TBI disabilities (6). About 60% of TBIs are due to road traffic injuries (RTIs), 20–30% are due to falls, 10% are due to violence, and another 10% are due to sports-related injuries in all parts of the world (7).

The distribution of TBI in children is 98% in LICs and five times higher than in high-income countries (HICs) (8). Sex variation is a risk factor for TBI, and being male makes you one point five to two point five times more vulnerable than female (9). Currently, falls have been recognised as the primary cause of TBI and have increased from 43% to 54% between 2003 and 2012, violence, sports-associated accidents, and work-associated accidents (10). The percentage of TBI due to avenue site visitors is highest in Africa and Southeast Asia at 56% each, and lowest in America at 25% (11).

TBI can be classified as either primary or secondary. Primary injury is induced by mechanical force and occurs at the moment of injury contact through either acceleration or deceleration. Secondary injury is not mechanically induced; it may be delayed from the moment of impact and may superimpose injury on a brain already affected by a mechanism of injury (12).

The severity of TBI is classified based on the Glasgow Coma Scale (GCS). The GCS is a three- to fifteen-factor scale used to evaluate a patient's level of awareness and level of neurologic function (13). It includes three sections, each of which reads: "excellent motor response, excellent verbal response, and excellent eye-opening." A score of three to eight suggests severe, a score of nine to twelve suggests moderate, and a score of thirteen to fifteen suggests mild TBI (14). Most traumatic brain injury patients were not hospitalized because most cases are not fatal and patients may not have been hospitalized due to lack of information about traumatic brain injury and how it affects health and also leads to death. This trauma may be mild at first, but it gradually worsens and affects all aspects of life, necessitating early treatment that addresses the risk factors of TBI.

1.2. Statement of the problem

TBI is a major health and socio-economic problem throughout the world (15). It is a leading cause of mortality and morbidity among young individuals in high-, middle-, and low-income countries (16). According to the National Health Interview Survey, 1.9 million people suffer a skull fracture or intracranial injury each year, which accounts for about 1% of all injuries (17). Globally, the incidence of mild TBI is about 131 cases per 100,000 people, moderate is about 15 cases per 100,000 people, and severe is approximately 14 cases per 100,000 people (18).

According to the National Trauma Data Bank, TBI is the most prevalent non-accidental trauma (NAT) suffered by children in the United States (19). The investigators found that between 2007 and 2014, among 678,503 children under the age of 15 admitted to the hospital for traumatic injuries, approximately 3% had sustained a NAT, with TBIs accounting for 50% of these diagnoses (20).

According to Global Burden Disease 2016 (GBD 2016), the incidence of road traffic injuries (RTI), falls, and violence related to TBI has been increasing sharply, with India, China, and other Asian countries having the greatest incidence (21). Compared to other world regions, Asia has a different distribution of contributing causes, with falls contributing to 77% of all TBIs and only 3% of TBIs resulting from the war (3).

In the USA, according to the CDC, the annual incidence of emergency department visits and hospital admissions for TBI is 403 per 100,000 and 85 per 100,000 respectively, and the financial burden has been estimated at over 60 billion dollars per year (22). The prevalence of TBI in the European Union is scarce, but it indicates an annual aggregate incidence of hospitalized and fatal TBI of approximately 235 per 100, 000 similar to that found in Australia (6, 23).

The incidence of TBI in sub-Saharan Africa around 2.9 million new cases of TBI, equivalent to 360 per 100,000 people. The incidence of short-term intracranial injuries due to RTI and violence in sub-Saharan Africa is 1.47 and 3.34 times higher than global rates, respectively. where in the incidence rates of long-term intracranial injuries due to war, violence, and other unintentional injuries are 5.44, 3.37, and 1.86 times higher than their respective global incidence rates (24). The incidence of TBI in sub-Saharan Africa (150–170/100,000) is much higher than the global incidence (106/100,000) (3). Ethiopia accounted for 659 (624–703) TBI cases per 100,000 population, roughly representing 10.8% of Sub-Saharan Africa and 28% of eastern Sub-Saharan Africa TBI cases (8).

TBI is the most pressing public health problem in Ethiopia. Road traffic accidents are the leading cause of fatalities and disabilities, with pedestrians accounting for 75% of victims; however, reports from the south nation nationalities of people region show that the cause of accidents is changing, with motorcycles and tricycles becoming more prevalent (25, 26). The majority of the accidents (two-thirds) involved men, and injuries accounted for 6% and 11.4% of total deaths in urban and rural areas of Ethiopia, respectively (27).

The prevalence and associated factors of the TBI burden increase significantly in low-capital areas and are the leading cause of acute and severe complications (1, 28). Around 10–15% of patients have serious TBIs, and most have mild TBIs (29). TBI is more common in young adults, particularly men (75%), which causes high costs to society because of the life years lost due to death and disability (30). Although TBI can cause long-term physical disability, it is the complex neurobehavioral sequences that produce the greatest disruption to quality of life, cognitive and behavioural changes, difficulties maintaining personal relationships, coping with school and work are reported by survivors as more disabling than any residual physical deficits (31).

1.3. Significance of the study

TBI and its complications are major public health problems in Ethiopia and Africa, as well as around the world. It currently affects the victims socially, politically, economically, and psychologically at all stages of life. The prevalence and associated factors of TBI have not yet been studied in Ethiopia; hence, it's relevant and significant to address and study the prevalence and associated factors of TBI to assess this silent epidemic trauma. This study will serve as a baseline reference for neurosurgeons, neurologists, and other health professionals and will also help policymakers allocate the necessary budget to manage TBI in Ethiopia. Additionally, it is important for readers and researchers to know the extent, severity, and depth of the problem in Ethiopia.

2. LITERATURE REVIEW

2.1. Prevalence and associated factors of TBI

A retrospective cohort study conducted in the United States showed that the prevalence of TBI was 506 per 100, 000 of the total population and reported that the highest rate of TBI occurs between the ages of 15 and 24 years and is caused by falls, which accounted for 28%, motor vehicle accidents 20%, being struck by 19%, and assaults 11%. Among falls, 20–30% of older people suffer moderate to severe injuries, including bruising, hip fractures, or brain trauma (22).

Another study conducted in the United Kingdom revealed that the prevalence of TBI in the emergency department was 453 per 100, 000 of the total population. Among them, 89.1% had mild and 10.9% had moderate to severe brain injuries, and males were at higher risk for moderate to severe TBIs than females (32).

A study done in South Australia showed that the prevalence of TBI was 322 per 100, 000 of the total population. Fifty seven percent of mechanism of brain injury was caused by RTA, 29% fall, 9% assaults, 1% gunshots, 1% drug abuse, and 3% were others. These were classified as 75% mild, 9% moderate, and 16% severe brain injuries (33). Another cohort study conducted in western Sweden showed that the prevalence of TBI was 546 per 100, 000 of the total population. Twenty seven percent of mechanism of brain injury was caused by falls, 16% RTA and 15% violence (34).

According to a population-based study conducted in New Zealand, the prevalence of TBI was 790 per 100, 000 of the total population, with falls accounting for 38% of brain injuries, RTA accounting for 20%, assaults accounting for 17%, and other causes accounting for 21%. Those were classified as 94.8% mild, and 5.2% (3.9–6.4%) were moderate to severe brain injuries (35).

In Asia, the burden of TBI in different countries was studied and showed that: among hospital-based victims in Bangalore, 24% of all injuries were a result of TBI, with a prevalence rate of 1.2%; and in Yemen, the TBI prevalence rate was at the level of 210 per 100,000 population, with domestic violence and falls as well as RTA were the leading causes of TBI. TBI is a leading cause of mortality, morbidity, and socioeconomic loss in India. It has been experiencing a much higher incidence of fall-related TBI with fractured skulls and intracranial long-term injuries in comparison to other countries, with an incidence rate of 50.3 per 100, 000 amongst Indian males in comparison with the global average of 13.3 per 100, 000 (36).

From 2013 to 2016, a cross-sectional study was conducted in Hamedan, Central Iran, and the prevalence of TBI was 450 per 100,000. Among them, 41.75% of brain injuries were due to motor vehicle accidents, 30.01% were due to falls, and 7.93% were due to assaults (37). A prospective clinical cohort study conducted at the University Teaching Hospital in Lusaka, Zambia, revealed that the prevalence of TBI was 21.1% of total population. Fall is the major cause of brain injury accounting for 56.9%, RTA accounting for 34.6%, and assault accounting for 34.6% (38).

Another retrospective cross-sectional study conducted in Nigeria showed that, the prevalence of TBI was 27.1% of the total population. Among them, 58.8% were caused by motorcycle accidents, followed by motor vehicle accidents at 22%, falls at 12%, and assaults at 7.3%. Those classified as 57.1% mild and 42.7% moderate TBIs (39).

A prospective observational study at Malawi's Kamuzu Central Hospital discovered that, the prevalence of TBI was 41%. Sixty-one-point six percent of mechanism of brain injury caused by motor vehicle accidents, assaults accounting for 28.5%, falls accounting for 5.8%, and 4.1% were others. The severity of brain injuries; 66.1% was mild, 9.3% moderate, and 24.6% severe (40). A retrospective institutional- based study was conducted at the Kilimanjaro Christian Medical Center, Tanzania showed that, the prevalence of TBI was 43.9% (95% CI, 40.9- 47.1%). Mechanism of brain injury caused by RTA accounting for 38.7%, fall by 29.5%, violence at 15.0%, and 16.8% were others (41).

A retrospective clinical study conducted in Kenya revealed a 33.3% prevalence of TBI, mechanism of brain injury caused by road traffic accidents accounting for 65%, falls accounting for 25%, and violence accounting for 15%. Between 10% and 30% were considered moderate, and 5 to 25% were severe TBIs (42).

An institution-based cross-sectional study was conducted at the University of Gondar Hospital from March to April 2016 in the emergency department in Gondar, Ethiopia. The prevalence of TBI was 40.5%. Among them, 46.7% of head injuries were caused by assaults, 26.7% by road traffic accidents, 12.4% by falls, and 14.2% by others. Those classified as 53.3% was mild, 39.1% moderate, and 7.6% severe traumatic brain injuries. Being male (AOR = 5.33; 95% CI, 2.095—13.57), daily labour worker (AOR = 2.873; 95% CI, 1.56-2.090), unintentional injury (AOR = 3.360; 95% CI, 1.08—10.46), and illiteracy (AOR = 2.7; 95% CI, 1.007—7.47) were discovered to be associated factors of TBI among 260 participants in surgical emergencies (43).

A hospital-based cross-sectional study was conducted from November 01 through December 30, 2019, at Debre Tabor Teaching and Referral Hospital, Debre Tabor, Ethiopia. The prevalence of TBI was 39.7% (95% CI, 34.9–44.9%). Among them, 41.1% (152) of head injuries were caused by assaults, 39.2% (145) by road traffic accidents, and 19.7% (73) by fall-down accidents. Those classified as 15.1% was mild, 6.5% moderate, and 4.3% severe traumatic brain injuries (44)

An institutional-based retrospective study was conducted from December 2014 to November 2016 at Dilla University Referral Hospital in Gedeo Zone, SNNPR, Ethiopia. The prevalence and TBIs was 32.1%. Among them, 39.6% of brain injuries were caused by road traffic accidents, 33% by interpersonal violence, 19.8% by fall-down accidents, and 7.5% by others. Those classified as 52.8% was mild, 15.1% moderate, and 32.1% severe traumatic brain injuries. Among 106 traumatic brain injury patients admitted to surgical wards and discovered that: age interval greater than 45 years (AOR, 5.41; 95% CI: 1.18–14.61); alcohol consumption before the trauma (AOR, 4.16; 95% CI: 1.18–14.61); delayed presentation (beyond 24 hours) after injury (AOR, 4.717; 95% CI: 1.02-21.81); and respiratory rate greater than 30 breaths per minute (AOR, 7.34; 95% CI: 1.88–28.73) were significantly associated with severe brain injury (26).

In a hospital-based retrospective study of patients with TBI admitted to TASH in the period between September 2011 and September 2013, a total of 201 TBI patients. Mechanism of brain injury caused by assault accounts for 109 (54.2%), 38 (18.9%) by traffic accidents, 36 (17.9%) by fall accidents, and 16 (7.9%) by an unknown cause ($p = 0.0001$). The severity of TBI was; 82 (40.8%) mild, 75 (37.3%) moderate, and 44 (21.9%) severe (45).

The most frequent cause associated with both fatal and non-fatal TBI is transport-related. It involves motor vehicles, bicycles, motorcycles, and pedestrian-automobile accidents and accounts for around 50% of all accidents (19, 46). The second most significant cause of TBI is falling, which accounts for 20% to 30% of all injuries, especially among the young and the elderly. In many parts of the world, assault is fast becoming one of the leading causes of brain trauma, particularly in lower socio-economic groups and war-torn countries. Other significant causes include the use of firearms (12%) and sports- or recreation-related activities. Younger people, particularly those under the age of five, are at moderate risk. This pattern reflects increased exposure for young adults to motor vehicle accidents and increasing frailty in the elderly. Males are approximately 3-4 times as likely as females to sustain a TBI. Fall has the highest risk of TBI in the 15- to 24-year-old age group, decreasing in the midlife years but rising again after 70 years (9).

2. 2. Conceptual framework

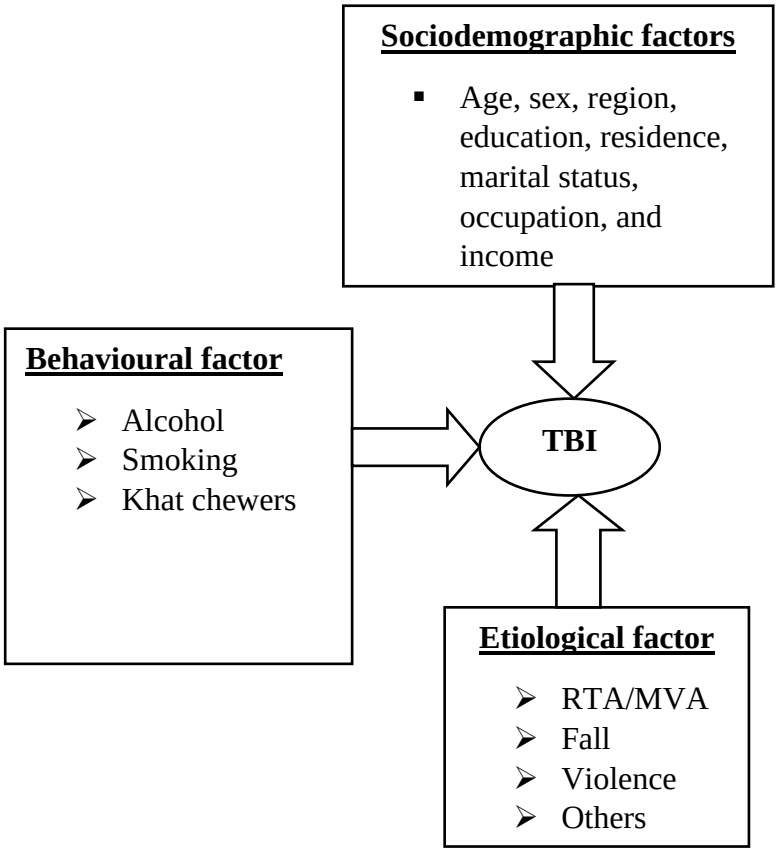

Figure 1: Conceptual framework of associated factors of traumatic brain injury.

3. OBJECTIVES

3.1. General objective

- To assess the prevalence and associated factors of TBI among trauma patients admitted to the adult emergency departments of three governmental hospitals in Addis Ababa, Ethiopia, in 2022.

3.2. Specific objectives

- To assess the prevalence of TBI among trauma patients admitted to the adult emergency departments of three government hospitals.
- To identify TBI risk factors among trauma patients admitted to the adult emergency departments of three government hospitals.
- To assess the severity of TBI among trauma patients admitted to the adult emergency departments of three government hospitals.

4. MATERIALS AND METHODS

4.1. Study area

Addis Ababa is the capital city of Ethiopia, which is located in the center of the country. There are 11 sub-cities and 116 districts in the city. There are 51 hospitals in Addis Ababa; of those, six are owned by the Addis Ababa city Administration Health Bureau, four are owned by the Federal Ministry of Health, one is owned by Addis Ababa University, three are owned by non-governmental organizations, three are owned by the Defense Force and Police, and thirty-four are owned by private organizations. The study was conducted at three selected governmental hospitals: Tikur Anbessa Specialized Hospital, Yekatit-12, and Menelik-II Hospitals of Addis Ababa, Ethiopia.

4.2. Study period

The study was conducted from February 01, 2022, to April 01, 2022.

4.3. Study Design

A hospital-based cross-sectional retrospective study design was conducted to collect the required sample size.

4.4. Source population

All trauma patients were admitted to the adult emergency department at three selected governmental hospitals in Addis Ababa city.

4.5. Study population

Trauma patients who were admitted and whose medical information has been recorded in the registry book of the adult emergency department of respective hospitals between February 01, 2017, and April 01, 2022.

4.6. Inclusion and Exclusion criteria

4.6.1. Inclusion criteria

All trauma patients admitted to the adult emergency departments who had completed MRN files.

4.6.2. Exclusion criteria

Trauma patients whose medical records were incomplete or lost.

4.7. Sample size determination

The sample size was determined by using a single proportion formula. The proportion of TBI in the adult emergency department at University of Gondar hospital was 40.5%, which was the result of previous study (43). Considering the following assumptions: Z = the standard normal distribution value at a 95% confidence interval of Za/2 = 1.96 and a margin of error (d) of 5%.

$$n = \frac{(Za/2)^2 . P . (1-P)}{d^2}$$

where n = Minimum sample size

P = Estimated prevalence of TBI

Za/2 denotes the normal variable standard.

d = Margin of error

n =370. Then add 10% as a non-respondent rate for incomplete recordings. The final sample size is **407**.

4.8. Study variables

4.8.1. Dependent variable

- Traumatic brain injury

4.8.2. Independent variables

- Road traffic accident
- Fall
- Violence
- Recreational sports injuries
- Smoking
- Khat chewers
- Alcohol drinkers
- Age
- Sex
- Residence
- Marital status

- Religion
- Region
- Education
- Occupation
- Income level

4.9. Operational definitions

Traumatic brain injury or head injury**:** An injury occurs in the head via either penetrating or blunt trauma (47).

Mild traumatic brain injury**:** Glasgow coma scale between thirteen and fifteen

Moderate traumatic brain injury: Glasgow coma scale between nine and twelve

Severe traumatic brain injury**:** Glasgow coma scale between three and eight

Recreational sports injuries**:** An injury that occurred in the head during physical exercise

4.10. Sampling procedure and technique

TASH, Yekatit-12, and Menelik-II hospitals were selected via a simple random sampling procedure from Addis Ababa governmental hospitals. A proportional number of study subjects was allocated to each study hospital. Patients were admitted to the adult emergency department, and their medical information was entered into the registry books of the study hospitals during the study period. This total sample size of medical record charts was selected by a systematic random sampling procedure, and their medical record number (MRN) was used to retrieve the medical record charts from the Health Management Information System (HMIS). The data was extracted from the medical record charts using a pretested, self-prepared checklist.

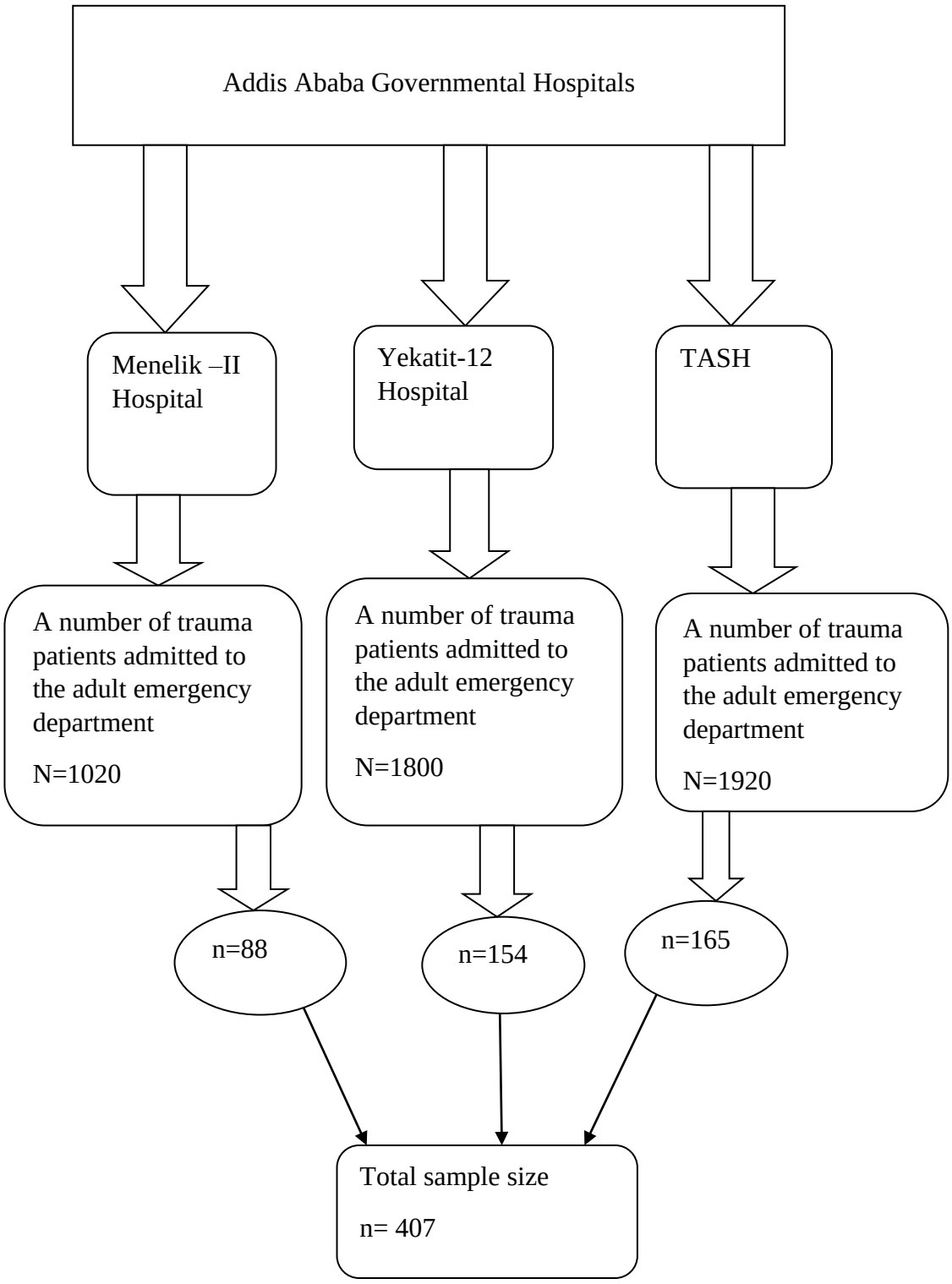

Figure 2: Sampling procedure and technique at selected governmental hospitals

4.11. Data quality management

Before data collection, two days of training were given to data collectors and supervisors on data collection techniques, data collection materials, objectives, and the relevance of the research. A structured checklist was checked by a senior professional. The data collectors were the ones not working in the selected hospitals. Five percent of the total patients' cards were performed before data collection to make necessary corrections. The completeness and consistency of the data were also checked daily by the principal investigator.

4.12. Data collection tools and procedures

The data was collected by the Open Data Kit (ODK) mobile software application. The checklists included age, education, residence, marital status, sex, income, region, occupation, road traffic accidents, falls, violence, recreational sports injuries, chewing khat, intake of alcohol, and smoking. Finally, based on the inclusion and exclusion criteria of the study, the medical record charts, which are all the variables for the study, were used. Ten BScs nurses were assigned to collect the data from medical record charts and four BScs health officers supervised the data collectors in the process of data collection. Necessary supervision has been undertaken by the principal investigator during the data collection period.

4.13. Data processing and analysis

After the data were collected, each checklist was checked for its completeness, and the data were exported to Statistical Package for the Social Sciences (SPSS) version 26 for analysis. The proportion of TBI was calculated by dividing the total number of TBI diagnosed by the total number of patients admitted to the adult emergency department. Descriptive statistics, frequency distribution, and percentage were computed for categorical data and presented by the text, bar graph, pie chart, and tables. The continuous variable was summarised using the mean, median, interquartile range, and standard deviation. Bivariate analysis using binary logistic regression was done to see the effect of each independent variable on the occurrence of TBI. The variable with $P< 0.2$ in the bivariant analysis was included in the multivariable analysis. In the multivariable analysis using multiple logistic regression, an adjusted odds ratio (AOR) with a 95% confidence interval (CI) was calculated. The variable with $P< 0.05$ was declared a significant factor affecting the occurrence of TBI.

4.14. Ethical considerations

Ethical clearance was obtained from the department of anatomy, Department Research Ethics Review Committee (DRERC), the Institutional Review Board (IRB), and Addis Ababa Public Health Research and Emergency Management Directorate. A clearance had been sent to the adult emergency departments of selected governmental hospitals to get consent for data collection. During data collection, the patient's medical chart was coded to maintain patient confidentiality. Each checklist was coded as well. The obtained results were presented anonymously, and no patient history was used to make an individual association.

5. RESULTS

5.1. Prevalence of TBI

A retrospective cross-sectional hospital-based study was conducted at selected governmental hospitals in Addis Ababa from February 01, 2017, to April 01, 2022. A total of 4,740 trauma patients were admitted to TASH, Menelik-II, and Yekatit-12 hospitals in the adult emergency department. Among them, 407 trauma patients were selected for the study through a systematic random sampling method. Of those, one hundred forty-one of the trauma patients had a traumatic brain injury and fit for analysis. The prevalence of TBI was 34.6% among the total trauma patients admitted to the adult emergency departments from the study hospitals during the study period.

5.2. Socio-demographic factors

One hundred forty-one patients had traumatic brain injury, of those patients, 85(60.3%) were males, and 56 (39.7%) females, resulting in a male-to-female ratio of 1.52:1. The risk of males suffering traumatic brain injuries was 1.52 times higher than that of females 1.52:1. The mean, median (IQR), and standard deviation (SD) of the age of trauma patients were 1.70, 43.3% (25-44), 1.007 years respectively.

Regarding educational status of the patients: 34.0% and 29.8% were unable to read and write, able to read and write respectively, 19.1% and 10.6% were completed elementary school and preparatory school respectively. The patient's marital status was mostly single (55.3%) and some were married (40.4%). The majority of the patients' occupations were labour workers (30.5%), followed drivers (26.2%), and civil servants (14.2%). Twenty-seven-point four percent of the patients were from the Oromia region, 26.2% from Addis Ababa, and 23.4% from the Amhara region. Sixty-one-point seven percent of patients were urban and 38.3% were rural.

Table 1: Socio-demographic factors of trauma patients who visited to the adult emergency departments at Yekatit-12, TASH, and Menelik-II hospitals in Addis Ababa, Ethiopia from February 01, 2017, to April 01, 2022.

Variables		Frequency	Percent
Age	15-19	20	14.2
	20-24	34	24.1
	25-44	61	43.3
	45-64	21	14.9
	Above 65	5	3.5
	Total	**141**	**100.0**
Gender	Male	85	60.3
	Female	56	39.7
	Total	**141**	**100.0**
Occupation	Civil servant	20	14.2
	Driver	37	26.2
	Labour worker	43	30.5
	Student	17	12.1
	Farmer	13	9.2
	Others	11	7.8
	Total	**141**	**100.0**
	Married	57	40.4
Marital status	Single	78	55.3
	Divorced	4	2.8
	Widowed	2	1.4
	Total	**141**	**100.0**
Education	Unable to read and write	48	34.0
	Able to read and write	42	29.8
	Elementary school	27	19.1
	Preparatory school	15	10.6

	Diploma and above	9	6.4
	Total	**141**	**100.0**
Region	Amhara	33	23.4
	Oromia	39	27.7
	Addis Ababa	37	26.2
	SNNPR	21	14.9
	Dire Dawa	6	4.3
	Others	5	3.3
	Total	**141**	**100.0**
Residence	Rural	54	38.3
	Urban	87	61.7
	Total	141	100.0
Income level	Low	75	53.2
	Medium	51	36.2
	High	15	10.6
	Total	**141**	**100.0**

Distribution of TBI patients based on gender among study particepants

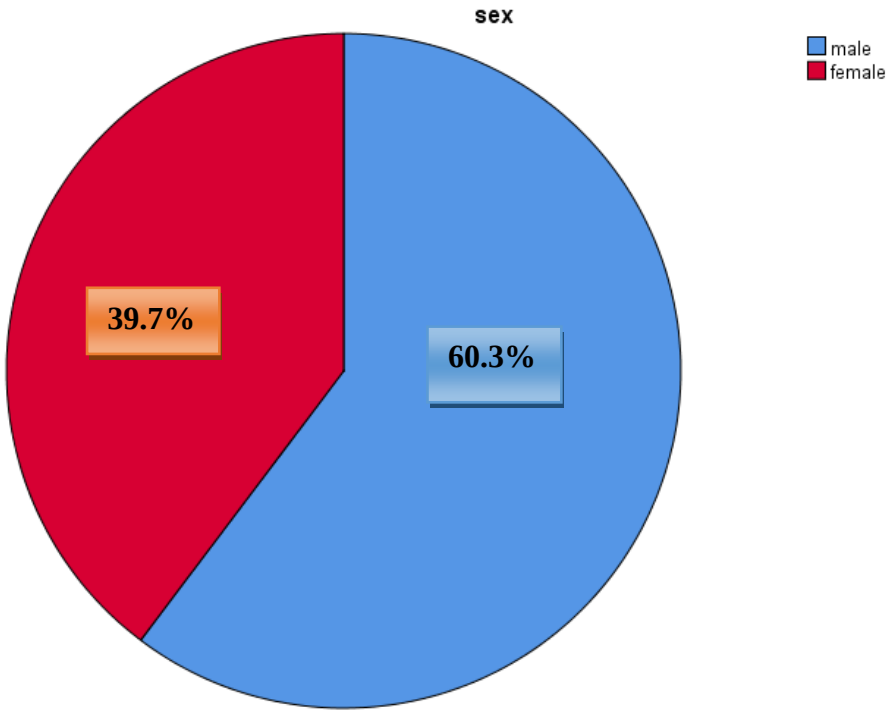

Figure 3: Distribution of TBI patients based on gender among study paricipants

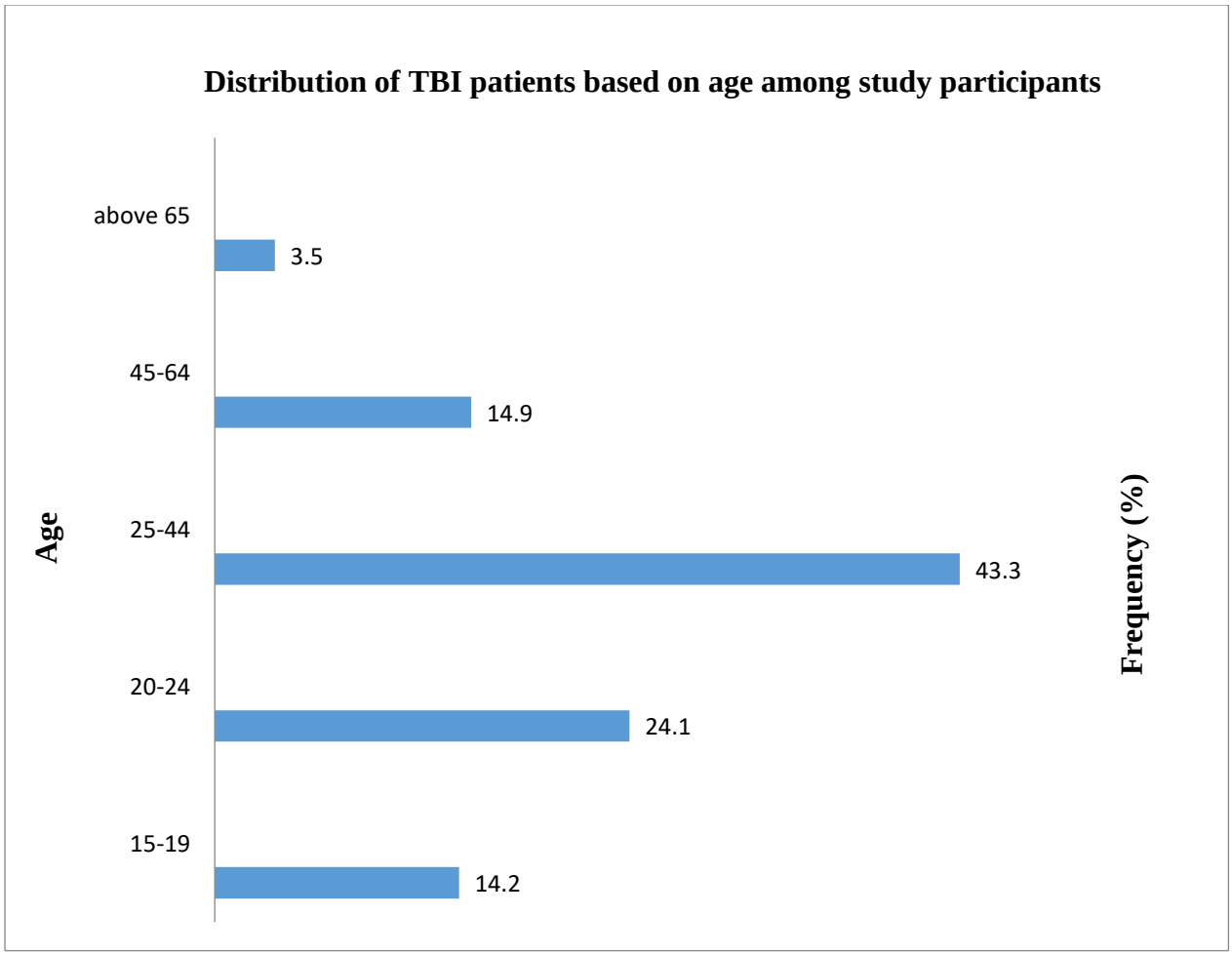

Figure 4: Distribution of TBI patients based on age among study participants

5.3. Mechanism of TBI among study participants

The mechanism of traumatic brain injury assessed among trauma patients at the adult emergency departments showed that the majority of them were related to road traffic accidents, accounting for 40.4%, followed by violence (32.6%), falls (17.7%), and others (9.2%). Of those who were associated with road traffic accidents, 43.9% were passengers, 29.8% were pedestrians, and 26.3% were cyclists.

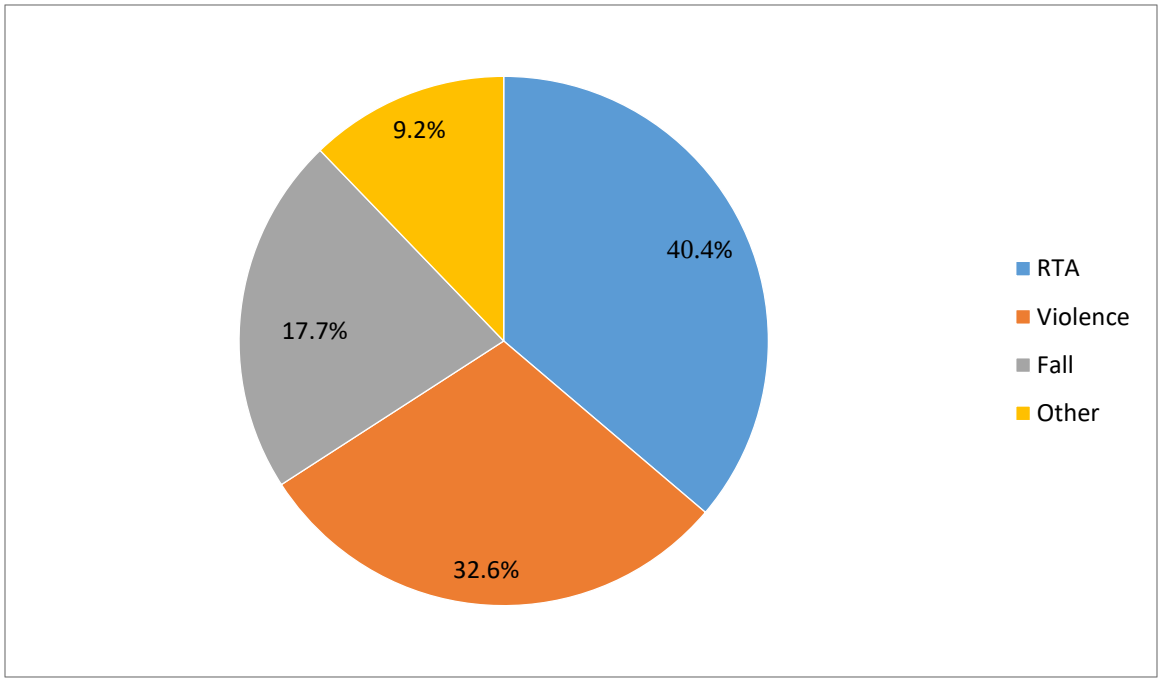

Figure 5: Mechanism of TBI among the study participants at selected governmental hospitals in Addis Ababa.

5.4. The severity of TBI among study participants

The severity of traumatic brain injury among trauma patients admitted to the adult emergency departments at governmental hospitals in Addis Ababa was 46.8% mild, 34.8% moderate, and 18.4% severe. The majority of traumatic brain injuries occurred at night, which accounted for 55.3%, where as 44.7% occurred during the day.

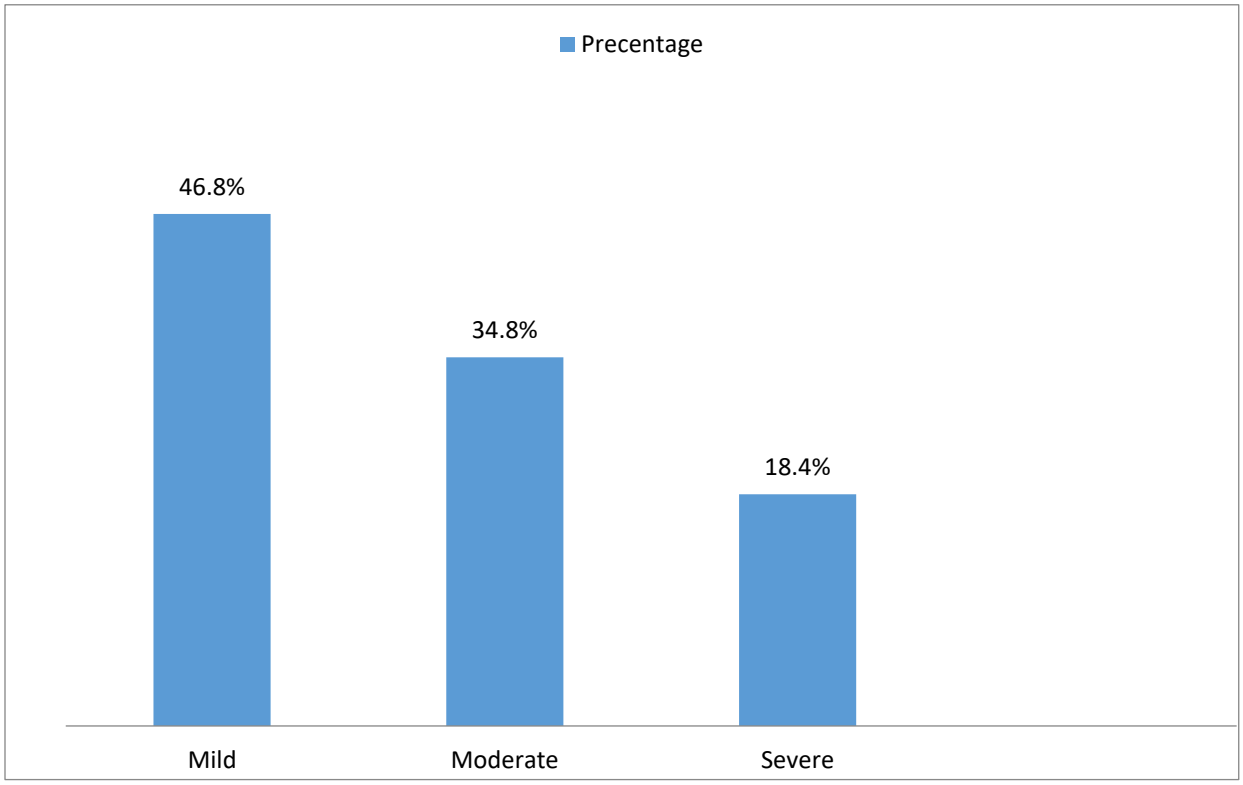

Figure 6: The severity of traumatic brain injury among the study participants at selected governmental hospitals in Addis Ababa.

Table 2: Results of bivariate and multivariate analysis for the determinants of traumatic brain injury among trauma patients admitted to the adult emergency department at governmental hospitals in Addis Ababa.

Variable		**Bivariate analysis**		**Multivariate analysis**
Independent variables	Frequency (percentage)	COR (95% C.I)	**P-value**	AOR (95% C.I)
Sex				
Female	56(39.7%)	1.00		1.00
Male	85(60.3%)	2.082 (1.352, 3.207)	0.000	2.364 (1.463, 3.819)
Education				
Diploma & above	9 (6.4%)	1.00		1.00
Unable to read/write	48 (34.0%)	3.615(1.103, 11.844)	0.001	1.215(0.196, 7.536)
Read and write	42 (29.8%)	2.023(1.130, 3.622)	0.620	0.687(0.155, 3.035)
Elementary	27 (19.1%)	1.206(0.685, 2.123)	0.516	0.834(0.260, 2.673)
Preparatory	15(10.6%)	1.759(3.105, 62.275)	0.37	0.687(0.253, 1.867)
Alcohol				
No	82 (58.2%)	1.00		1.000
Yes	59 (41.8%)	1.576(1.025, 2.421)	0.000	1.088(0.664, 1.782)
Occupation				
Civil servant	20 (14.2%)	1.00		1.00
Driver	37 (26.2%)	4.540(2.128, 9.685)	0.054	2.826 (0.983, 8.125)
Labour worker	43 (30.5%)	1.803(0.953, 3.411)	0.037	3.633 (1.083,12.188)
Student	17 (12.0%)	4.476(1.901, 10.540)	0.608	1.336(0. 442, 4.044)
Farmer	13 (9.2%)	1.114(0.559, 2.218)	0.114	3.316(0.750, 14.670)

Income level				
Low	75 (53.2%)	3.068(1.713, 5.494)	0.001	3.686(1.654, 8.212)
Medium	51 (36.2%)	2.732(1.497, 4.985)	0.044	2.060(1.018, 4.167)
High	15 (10.6%)	1.00		1.00
Khat chewer				
No	81 (57.4%)	1.00		1.00
Yes	60 (42.6%)	2.420(1.573, 3.724)	0.009	1.947(1.182, 3.205)

Among independent variables, age, educational level, occupation, level of income, sex, marital status, residence, history of smoking, alcohol drinkers, and khat chewers were analysed first by using binary logistic regression to observe their association with a traumatic brain injury. Males, alcohol users, labour workers, unable to read and write, low-income level, medium-income level, and khat chewers all had less than a P-value of 0.05 with a 95% CI, it's indicating a significant association. Variables that showed a significant association in binary logistic regression were entered into the multiple logistic regression equation models.

Being male was 2.364 times more likely than female at 95% CI (1.463, 3.819); unable to read and write patients 1.215 times more likely than diploma and above holders at 95% CI (0.196, 7.536); labour workers were 3.633 times more likely than civil servants at 95% CI (1.083, 12.188); khat chewers were 1.947 times more likely than non-khat chewers at 95% CI (1.182, 3.205); low-income levels were 3.686 times higher than higher income levels at 95% C.I(1.654, 8.212), and medium-income levels were 2.060 times more likely than the high-income level at 95% C.I (1.018, 4.167).

6. DISCUSSION

From February 01, 2017, to April 01, 2022, a five-year retrospective cross-sectional hospital-based study was conducted in adult emergency departments at three governmental hospitals in Addis Ababa. In this study, the prevalence of traumatic brain injury was 34.6%.

This study was comparable to the previous study done at Dilla University Teaching Hospital, which was 32.1% (26), but lower than a study done at the University of Gondar Hospital was 40.5% (43), and at the Debre Tabor Teaching and Referral Hospital it was 39.5% (44). These results describe that the current study is lower than the previous study due to sample size variation, methods of study design, population size, time of the study, flow of road traffic accidents, ways of data collection, person of study, inclusion and exclusion criteria, and methods of analysis.

The current study is comparable to the previous study done in Kenya, which was 33.3% (42), but higher than a study done in Zambia at 21.1% (38), Nigeria at 27.1%(39), whereas lower than a study done in Malawi 41%(40), and Tanzania 43.9%(41). These studies' differences show that due to number of populations, management of road traffic accidents, violence, cultural, political, economic, and psychological variation.

The current study was much higher than the previous study done in the United States was 506 per 100,000 (22), the United Kingdom 453 per 100,000 (32), South Australia 322 per 100,000 (33), Western Sweden 546 per 100,000 (34), New Zealand 790 per 100,000 (35), Bangalore 1.2% (36), Central Iran 450 per 100,000 (37). These results may indicate differences based on the civilization and management of the occurrence of traumatic brain injury by reducing and preventing its main causes.

Regarding the associated factors of traumatic brain injury; The major cause were road traffic accidents account for 40.4%, followed by violence at 32.6%. The majority of brain trauma patients were male, accounting for 60.3%, and the majority of marital status of the patients were single, accounting for 55.3%. The majority of brain trauma patients, 43.3%, were between the ages of 25 and 44 years. Based occupation, the majority of the patients were labour worker accounting for 30.5%; Educational status of patients, majority of unable to read and write accounting for 34.0% and able to read and write patients accounted for 29.8%. The majority of patients with brain trauma had mild injuries, which accounted for 46.8% of all injuries. Alcohol drinkers (AOR = 1.088, 95% CI: 0.664, 1.782), khat chewers (AOR = 1.947, 95% CI: 1.182, 3.205), labour workers (AOR = 3.633, 95% CI: 1.083, 12.188), unable to read and write (AOR=1.215, 95% CI: 0.196, 7.536), people with low-income levels (AOR = 3.686, 95% CI: 1.654, 8.212), and people medium income level (AOR=2.060, 95% CI: 1.018, 4.167) were highly associated to TBI.

Being a male (AOR = 5.33; 95% CI, 2.095–13.57), a daily labourer (AOR = 2.873; 95% CI, 1.56–22.090), unintentional injury (AOR = 3.360; 95% CI, 1.08–10.46), and illiteracy (AOR = 2.7; 95% CI, 1.007–7.47) were all associated with traumatic brain injury (43). Thirty-nine-point six percent of traumatic brain injuries were caused by road traffic accidents, 33% by violence, 19.8% by fall accidents, and 7.5% by others. Among those, 52.8% had mild, 15.1% moderate, and 32.1% severe traumatic brain injuries. Among 106 traumatic brain injury patients admitted to surgical wards and revealed that: age interval greater than 45 years (AOR, 5.41; 95% CI: 1.05–29.09); alcohol consumption before the trauma (AOR, 4.16; 95% CI: 1.18–14.61) (26). Fall has the highest risk of TBI in the 15- to 24-year-old age group, decreasing in the midlife years but rising again after 70 years (9). Almost all these results of associated factors of TBI were comparatively related to the previous studies which are done in a different area.

7. LIMITATION OF THE STUDY

The data was collected retrospectively from the HMIS registry of the MRN office; therefore, there were unfilled records that were not included. Depending on the prevalence and associated factors of traumatic brain injury, this data may be compiled in a variety of ways. There are known associated factors for traumatic brain injury, such as smoking and income, which were not well documented. This study was conducted only in three hospitals, so this result may not be representative of the country.

8. CONCLUSION

Overall, the prevalence of traumatic brain injury in Ethiopia is 34.6%, which is comparable to previous studies in Ethiopia and across Africa but much lower than in the United States, Asia, Australia, and Europe. The majority of traumatic brain injuries were caused by road traffic accidents, and the severity of TBI was mild. The most vulnerable age group was between the ages of 25 and 44 years. Alcohol drinkers, khat chewers, labour workers, and those with unable to read and write, low income, and medium income levels are at a higher risk of suffering traumatic brain injuries.

9. RECOMMENDATION

Based on the study's findings, the following recommendations are forwarded to those who may be concerned:

For all health organizations,

- Given safe treatment for traumatic brain injuries patients
- To evaluate and detect the severity of the brain injury
- Address and treat associated factors of traumatic brain injury
- Consult and educate the risk of smoking and khat chewing for TBI

For governments,

- Expand education programs on road traffic accidents, falls, and violence for all through mass media and other distribution methods.
- The Road Authority should focus more on traffic light management, seatbelts, and other ways to reduce RTA.
- Gender affairs authority should be given to violence education programs for society and further investigation to reduce it.

For all researchers,

- To conduct in a prospective study design.
- To add more study areas
- To conduct further than Addis Ababa

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ANNEXES: QUESTIONNAIRES

Part I: Sociodemographic factors				
No.	Questions	Categories	Code	Skip
101	Age	15-19 20-24 25-44 45-64 Above 65	0 1 2 3 4	
102	Gender	Male Female	0 1	
103	Educational status	Unable to read and write Able to read and write Primary school Preparatory school Diploma and above	0 1 2 3 4	
104	Marital status	Married Single Divorced Widowed	0 1 2 3	

105	Region	Amhara Oromia Addis Ababa Dire Dawa SNNPR Others	0 1 2 3 4 5	
106	Occupation	Civil servant Driver Labour worker Student Farmer Merchant Unemployed Housewife Others…	0 1 2 3 4 5 6 7 8	
107	Income level	Less than 3000 Between 3001-6000 Above 6000	0 1 2	
108	Where are you living?	Rural Urban	0 1	

	Part II: Behavioural factors			
201	Do you drink alcohol before an injury occurs?	Yes No	0 1	
202	Do you use khat substances?	Yes No	0 1	
203	Do you smoke a cigarette?	Yes No	0 1	
	Part III: Prevalence of TBI			
301	Do you have a traumatic brain injury?	Yes No	0 1	
	Part IV: Etiological factors of TBI			
401	Mechanism of traumatic brain injury	Road traffic accident Violence Fall Others	0 1 2 3	
402	If the cause of traumatic brain injury is a road traffic accident (RTA) from;	RTA from passenger RTA from pedestrian RTA from a cyclist RTA from others…	0 1 2 3	

403	The severity of a traumatic brain injury	Mild (GCS 13-15) Moderate (GCS 9-12) Severe (GCS 3-8)	0 1 2	
404	At what time was the injury occurring?	Day Night	0 1	