ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCE

DEPARTMENT OF ANESTHESIA

Research Thesis

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Full title of research project	Survival status and predictors of mortality among burn patients admitted to Intensive care unit at burn centers in Addis Ababa ,Ethiopia ;2022/2023,retrospective cohort study
Duration of the project	January 01 to April 25 ,2023
Study Area	Yekatit 12 Hospital Medical college burn center critical care unit and AaBET Hospital burn center critical care unit Addis Ababa ,Ethiopia
Total cost of the project	24,500 birr
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A THESIS SUBMITTED TO THE DEPARTMENT OF ANESTHESIA, ADDIS ABABA UNIVERSITY, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF SCIENCE IN ANESTHESIA.

Declaration

I, the undersigned, declare that this thesis is my original work, has not been presented in this or another university and that all the source of material used for thesis proposal have been fully acknowledged.

Name: Habtu Tsehayu

Signature _____

Submission to: MSc tutor, department of anesthesia, Addis Ababa University

Date of submission _____

This thesis work has been submitted for examination with our approval of as advisors and tutors on the MSc in Advanced clinical anesthesia course.

Approval of the advisors:

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2.	_____	_____	_____

Approval

The undersigned certify that they have read and here by recommend to Addis Ababa University to accept the thesis submitted by Habtu Tsehayu entitled, Survival status and predictors of mortality among burn patients admitted to Intensive care unit at burn centers in Addis Ababa ,Ethiopia ;2023 , in partial fulfillment of the requirements for Master's of science Degree in Anesthesia.

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Acknowledgment

I am always thanks to God for giving me this direction. I am incredibly grateful to my advisors, Mululem Sitot and Wubayehu Amare (BSc, MSc in clinical anesthesia), for their constant advice. I want to express my gratitude to Amanuel Sisay (BSc, MSc Anesthesia) for his insightful advice, unwavering support, and guidance.

Finaly,I would like to thank the administrative bodies, data clerks, and chart room staff of AaBET Hospial and Yekatit 12 Hospital medical colleage , for their support and approval to perform the study.

Abstract

Introduction : A burn critical care unit is a serious global healthcare burden. Especially in low- and middle-income countries, the mortality rate of burn patients admitted to the ICU is higher. In industrialized countries, the ICU death rate for burn patients is also significant. There is limited information about mortality and its predictors in the ICU for burn patients. Hence, this study is designed to investigate the survival status of burn patients in the ICU and its predictors.

Objective: This study estimate the incidence and predictors of mortality among burn patients admitted to intensive care units in Addis Abeba governmental hospitals, Ethiopia, from January 1, 2019, to December 30, 2022.

Methods: An institution-based, multi-center retrospective cohort study was conducted on 422 newly admitted burn patients at the intensive care units of two Addis Ababa governmental hospitals from January 2019 to December 2022. A simple random sampling technique was used to select 422 patients. The data were entered into EpiData version 4.6, and analyzed with STATA version 17. A standard Cox regression model was used. Both bivariable and multivariable regression models were fitted to identify predictors of each outcome. The 95% confidence interval of the hazard ratio (HR) was computed, and variables which had p-value < 0.05 in the multivariable model were significantly associated with the dependent variable.

Results: From the sample of 422 patients, 416 burn patients were followed retrospectively with a median follow-up time of 9 days and an IQR of 7–13 days. This study showed that the overall mortality rate was 149 (35.72%). Electrical burns(AHR:11.9(95%CI:5.73–31.4), full-thickness injuries (AHR:2.6(95%CI:1.72–4.05), inhalational injury(AHR:5.32(95%CI:1.6,17.8) were significantly associated with the mortality of burn patients admitted in the ICU.

Conclusion and recommendation:

The overall mortality of burn patients admitted in ICU high and predictors of mortality include depth injury, mechanism of injuries, mechanical ventilation age. More consideration is needed for patients who had full thickness burn injury, Inhalational injury and age < 5 years.

Key Words: Burn, Mortality, survival status, ICU, Predictors

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Acronym and Abbreviation

AaBET	Addis Ababa Burn Emergency and Trauma
ABCD	Age ,Bicarbonate,Cancer,Dialysis
AKI	Acute Kidney Injury
BCCU	Burn Critical Care Unit
BICU	Burn Intensive Care Unit
HCU	High Care Unit
HDU	High Dependency Unit
HMIS	Health Management Information System
HR	Hazard Ratio
ICU	Intensive Care Unit
IQR	Interquritile Range
LFT	Liver Function Test
MV	Mechanical Ventilation
RFT	Renal Function Test
SCORTEN	Score of toxic Epidermal Necrosis
SICT	Specialized Intensive Care Treatment
SPMMC	Saint Paul Millinium Medical Colleage
STATA	Statistics and Data
TBSA	Total Body Sourface Area
USA	United State of America

CHAPTER ONE. INTRODUCTION

1.1.Background information

Burn injuries are a trauma that is underappreciated and can happen to anyone at any moment. Even though energy transfer results in tissue damage in all burn injuries, differing sources can have various physiological and pathophysiological effects (1). Burn injuries are the most common during admission to the hospital and have high morbidity and mortality rates. Burn injury is a problem that affects the entire world and produces high impact, and long-term morbidity is frequently a major issue for burn survivors that causes misery for the person as well as their family and community. It is the fourth most frequent type of trauma worldwide after road traffic accident falls, and interpersonal violence (2).

One of the most important global public health issues is burn injuries. The World Health Organization (WHO) estimates that there are roughly 11 million burn patients globally each year from all sorts of burns. Of those burn victims, 300,000 are admitted to intensive care units each year, and 180,000 died. From those admitted to the emergency room, 4% to 22% of burn injury patients are sent to the burn intensive care unit, and from those transferred to the burn intensive care units (BICUs), an average of 27% are transferred to the surgical intensive care unit because the general state of the patient's body is involved (2–4).

A burn intensive care unit is a specialized unit that treats patients with illnesses that are life-threatening and provides critical care to patients who are very ill with burns. The best care for burn patients is provided in a specific burn critical care unit where monitoring and resuscitation focus on the pathophysiology of burns, inhalation injury, and edema formation (5). The prevalence of burn injuries remains high and ranges from 3.3% to 7.37%, with older adults making up the majority of the injured age groups, even though the epidemiology of burn patient mortality in ICUs in developed countries has decreased over the past ten years due to the availability of sophisticated medical equipment, early resuscitation, and a high number of BICUs (4).

Compared to developed nations, low-income countries have a mortality rate of over 55.2%, and the majority of the predictive factors are death related to wound infection, length of stay, depth

of burn injuries, and TBSA involvement, which are the most frequent causes of death in the BICU (6).

Studies on the frequency and care of burn patients admitted to intensive care units in Ethiopia are scarce. However, according to a study in a burn center in Yekatit 12 hospital medical college and South Gonder, the most frequent types of burns were scald burns (69.4%), flame burns (24.5%), and electrical burns (4.9%), which disproportionately affected children between the ages of 1 and 14 years old. Burn patients made up 70% of those who were injured at admission, and patients died at a rate of 16% to 18%. The main reasons for death are inadequate resuscitation, starvation in burn victims, and other comorbidities. Despite these studies were conducted, it is still unknown what predictors of burn patients admitted to the critical care unit to survive or die (7,8).

1.2. Statement of the Problems

Countries with low and middle incomes are accountable for more than 96% of fire-related burn occurrences. The majority of burn victims died, and some of them are left with a permanent disability, even though, over the past ten years, improvements and advancements in healthcare services have allowed more severely burned patients to survive (9).

Care of critically injured patients presents unique challenges to the intensive care unit, and certified burn critical care units are rare and geographically limited. Severe burn injuries often lead to a wide range of complications that go beyond the loss of skin integrity and require specialized care. Burn intensive care management is more challenging than modern surgical and medical methods from a century ago (10) . In burn ICUs, a higher proportion of patients receive organ support for a longer duration. Nearly one-third of patients with burns who were brought to general ICUs were moved to another ICU (11).

The socioeconomic status of the area affects how long burn patients survive. Even if intentional multidisciplinary interventions, including early hospitalization, appropriate fluid resuscitation, nutrition, and infection care, increase lifespan in industrialized nations, burn injuries still account for more than 50,000 hospitalizations with a 5-6% death rate. Severe electrical burns, significant burns, more than 20% TBSA, or inhalational burns aggravate the effects of burns in older adults. It is the cause of 30% of mortality in both Europe and America (12–14).

High mortality rates are still present in many African and Asian nations. The majority of burn injuries occur in middle- and low-income countries, where there are low medical resources, inadequate medical care, sub-patient care, and a disproportionate number of rural populations. The individuals at risk are male sex, productive age, and childhood, which is more venerable. The mortality in BICU ranged from 7.37% to 41.7%, related to opportunistic infections, scaled burns, and flame burns, accounting for the majority of cases (15–18)

Age, length of stay, comorbidities, kind of burn injury, and status at admission are some variables that could affect a burn patient's survival in an intensive care unit (19). By implementing HDU, developing HCU, and performing consistent modern analysis, it might be possible to improve the standard of ICU care and increase the survival rates for burn patients

(20). Making informed judgments about a patient's care may be helped by identifying patients who are more likely to survive and the type of burn injury (18).

However, past studies did not determine the predictors in a time-dependent manner.The significancy of this study establishes benchmarks and identifies patients who would benefit from corrective initiatives for quality improvement, including prospective interventional studies. Determining mortality and identifying predictors of burn patients admitted to the ICU is paramount for clinical care.

This study aims to determine the incidence and predictors of death among burn patients admitted to the BICU using sophisticated semi-parametric survival analysis statistical models.

1.3. Justification of the study

People living in low- and middle-income countries are mostly victims of burn injuries. The burden and pattern of burn injuries in Africa, particularly in the sub-Saharan region, are not well studied. A previous studies done in Ethiopia were a study on burn centers ,conducted on only pediatric burn patients with small sample size, and as a result ,they recommended futher investigation . Beside to this previous studies they were used logistic regression and descriptive approche .The hazard ratio predictive factors were not determined.They were restricted to including other age groups.

Because of more burn victims of all ages with diverse comorbidities admitted to the burn intensive care unit. This study examined all burn patients who had been admitted to an ICU with a melt center, and their time to event also examined. In addition to this, the predictive factors affecting burn patients admitted to the ICU were also determined. A Cox proportional hazard model was used to identify important factors that influence the time to death in burn patients admitted to the ICU.

To evaluate the effect, the difference in survival rates across patient groups was calculated using Cox proportional hazards regression. This strategy can account for the confounding effects of additional factors in place of the Kaplan-Meier method. This research will help healthcare providers and governmental and non-governmental organizations make the most of efforts to prevent burn patient mortality in ICUs across the country and the study area while also serving as a valuable resource for other researchers. It will also serve as a guide for future research, including developing local mortality predictions.

CHAPTER TWO. LITERATURE REVIEW

2.1. Mortality from Burn patients admitted to ICU

The critical care unit is a complex, highly work-loading, and costly treatment area that aims to follow and treat patients from the meltidicipleny unit, including burn units. The percentage of BICUs opened is different among countries; it depends on the economic status and number of patients (21). Due to an increasing number of burn-injured patients and serious burn progress each year (22). Boosting knowledge towards proper utilization of ICU beds, establishing HDU, and a comprehensive approach including relief of distress, pain, palliative care, and addressing the special needs of critically ill patients will increase their survival status (23). According to the Burn Evaluation and Mortality Study (BEAMS), every burn patient admitted to critical care has an increased risk of death(24). Other possible outcomes are being discharged alive, being discharged against medical advice, and being referred to another hospital at the end of the study.

According to a four-year retrospective cohort study carried out in two burn intensive care units in the New York Hospital in the United States, the overall death rate is 3.2%. The significant predictive factors were inhalational injury, comorbidity, renal failure, and TBSA > 30% (25), and another nine-year retrospective study conducted in the United States of America showed that the total death rate in BICU was 3.3% (13). The total death rate in the burn critical care unit was 1% during the nine-year retrospective study conducted in Canada, and the majority of patients that die in the BICU are older, come in during the winter, and have more extensive body burns (26).

In a 14-year retrospective observational study conducted in the burn critical care unit in Germany, the overall mortality rate was 7.7% (27), and another 14-year retrospective study at Hannover Medical School in northern Germany found that the mortality rate was 14.4% (28). According to a four-year retrospective study, the Netherlands-based burn critical care unit has an overall mortality rate of 3.3%. During the study, patients transferred from general hospitals and non-burn centers to the BICU had the highest mortality rate (12).

In Uruguay, the overall death rate for adult patients admitted to burn critical care units was 19.9% over 20 years (29). According to a two-year longitudinal retrospective cohort study conducted in Brazil, the overall ICU mortality rate of burn patients was 32.80% (30).

According to Yucca et al.'s eight-year study conducted in Turkey, tertiary burn critical care centers have a 7.64% mortality rate (18). Another six-year retrospective study shows that 17.6% of patients with burns at King Fahd Hospital, University of Saudi Arabia, died (31). However, the mortality rate was 4.5% in a later three-year retrospective study conducted at the BICU of King Abdul-Aziz Medical City in Riyadh (32). The total death rate was 11.8% in a retrospective cohort study done at the Sultan Ismail Hospital in Malaysia (9).

At the burn critical care unit at the Chris Hani Baragwanath Academic Hospital in Johannesburg, a four-year retrospective study found that the mortality rate was 4.4%. Referred burn patients from the non-burn unit and general care unit, compared to admitted burn intensive care unit patients, have a greater mortality rate (33). According to an M.Sc. In a study by YOUSRIA A et al., the overall mortality rate for patients in Cairo admitted to the burn critical care unit of the hospital throughout the six-month study period was 55.2 (6). The overall mortality rate of burn patients admitted to the burn critical care unit is 23.4%, according to Cameron's retrospective cohort study (34).

2.2. Factors affecting mortality among burn patients admitted to ICU

In the older age group, a retrospective study carried out in the United States, Canada, England, and Germany found that injuries with a total body surface area of less than 10% are the most common predictors of death in burn intensive care units (13,26,27). On the contrary, a different study on German burn victims found that adult and older patients had the highest mortality rates (35). According to a study, burn patients in the Netherlands are the mortality patient group most frequently between the ages of 4 and 80 (12). Other studies in Canada and spine studies revealed that the most affected age ranges are those between 44.7 and 53 years (36).

According to research from Saudi Arabia and South Africa, pediatric burn patients under the age of four are regularly impacted. In Ethiopia, according to a study conducted by the South Gondar and Yekatit 12 Hospital Medical College, pediatric burn patients admitted to the burn care unit are highly affected (7,8,31,37). Nevertheless, in another retrospective study conducted in Cameron and Ecuador, younger and more active citizens had a higher risk of developing BICU (14,34). Extreme age groups, in England, four years of retrospective research on Europe were

conducted. The study found that burn patients admitted to the BICU had a 19% mortality rate. Burn patients admitted to the general intensive care unit account for a 13% death rate (14).

Female burn patients have a higher mortality incidence in adult BICU retrospective studies conducted in the USA and Uruguay (29,38). Male burn patients admitted to intensive care units in America, Canada, and Germany are more impacted (13,26,27) . Another study conducted in Brazil, Turkey, Malaysia, and Saudi Arabia showed male burn victims admitted to intensive care units are more affected than female ones (9,18,31,39). However, a different study conducted in Egypt found no appreciable difference between male and female mortality in the Cairo burn intensive care unit (40). Length of stay: a three-year retrospective review study was undertaken in Canada, and it found that the longer gram-negative bacteria are kept in the burn critical care unit, the more resistant they become to treatment (41). Long-term patients admitted to the burn critical care unit have a greater mortality risk due to their length of stay (29).

Heat injury is one of the most frequent predictors of burn victims' mortality. Admitted to the general intensive care unit and the BICU, according to a study from the United Kingdom (14). Flame burn is the most common cause of mortality in BICU. A retrospective cross-sectional observational study from Douala General Hospital in Saudi Arabia and Turkey (19,31).

According to a three-year retrospective study conducted in Turkey, electrical burn is the most frequent predictor of adult patients admitted to the BICU (42). According to a South African study, scald burn is the most prevalent predictor of mortality in pediatric patients sent to BICU(33). 40 to 89% of the body's surface area is burned, which is the most common predictor of mortality in burn critical care units, according to a retrospective study done in Germany(35). However, 8% to 16% of the common causes of death in a different study from the United Kingdom, the TBSA, were connected to BICU(14) .

Inhalation injury is the most prevalent indication of patient fatality in the burn critical care unit, according to a study done at a tertiary hospital in Ghana (43). Malaysia, Inhalational damage is the most frequent predictor of mortality, and an elevated Cob of more than 10% on a first arterial blood gas suggests worse outcomes, according to a retrospective study conducted in a burn critical care unit (9,44).

Mechanical ventilation is the most common predictor of mortality for patients admitted to a burn critical care unit, According to a three-year retrospective analysis in Saudi Arabia and Uruguay (29,31). Malnutrition is one of the most frequent risk factors for burn patient mortality in burn intensive care units, according to an Indian study on the subject(45). According to a retrospective cohort study in Sub-Saharan Africa, an increase in mortality was associated with any form of malnutrition among burn patients when they were admitted to the intensive care unit (46). According to a retrospective study conducted in California and Texas in the United States, hypoglycemia and hyperglycemia are the most frequent predictors of death in burn critical care units (47). A ten-year retrospective study in the United States found that the main predictor of mortality for burn patients admitted to the burn critical care unit was preexisting cardiovascular disease (48). Patients with diabetes mellitus with pre-existing burn injuries are more likely to pass away from acquired infections in a burn critical care unit (49).

A retrospective analysis reveals that most independent variables used in SCORTEN and ABCD-10 are significantly associated with more significant mortality in BICU (50). Another retrospective analysis found that SCORTEN and ABCD-10 did not significantly vary in their ability to predict hospital mortality (51).

According to a study conducted at the Plastic and Reconstructive Burn Center of Mansoura University Hospitals, electrolyte and fluid disruption are the leading causes of death in burn intensive care units (52). According to ten-year retrospective research, myocardial infarction is the most frequent predictor of mortality in burn critical care units (48).

According to a retrospective study done in Belgium, sepsis is one of the most frequent predictors of mortality (53). Another 13-year study demonstrates that sepsis and a more evident extreme age group and full-thickness burn size are the most frequent predictors of mortality in burn intensive care units (54). In a five-year retrospective study in Australia, Sydney gram-positive cultures were more frequently found in the GICU, whereas gram-negative and yeast cultures were more prevalent in the BICU (55).

Infection is the most prevalent factor that predicts mortality. According to the results of a four-year retrospective study conducted at a Lebanese hospital, patients were admitted to the burn critical care unit (56). A retrospective investigation reveals that operational producers in America

are raising the BICU mortality rate (57). Aspiration is the most prevalent complication among burn patients in the intensive care unit, according to the author, Mark Ansermino et al. (58).

In conclusion, compared to industrialized nations, the death rate for burn patients admitted to intensive care units is higher in low middle- and high-income countries. Burn patient mortality is influenced by a number of factors in the context of critical care.

Conceptual framework was developed after conducting and identifing factors of mortality of burn patients BICU from previous Study.

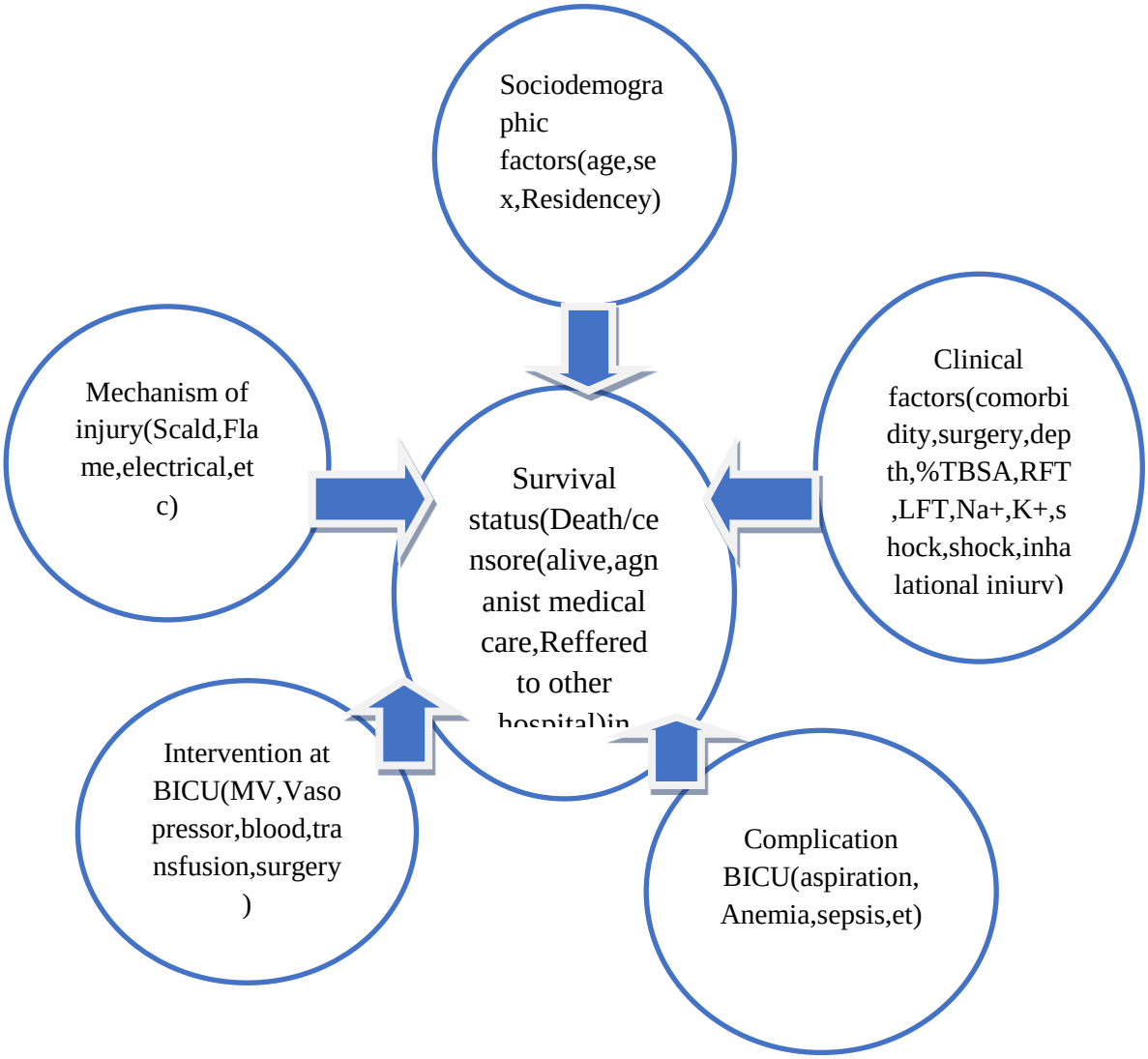


Figure 1- Conceptual framework of survival status and predictors of mortality among burn patients admitted to ICU from 2019 to 2022 Addis Ababa, Ethiopia .

CHAPTER THREE. OBJECTIVE

3.1. General objective

- ✓ To estimate the incidence and predictors of mortality among burn patients admitted to the intensive care units of selected governmental hospitals of Addis Ababa from January 1, 2019 ,to December 30, 2022.

3.2. Specific objective

- ✓ To estimate the incidence of mortality among burn patients admitted to intensive care units of selected governmental hospitals of Addis Ababa from January 1, 2019, to December 30, 2022.
- ✓ To identify the predictors of mortality among burn patients admitted to intensive care units of selected governmental hospitals of Addis Ababa from January 1, 2019, to December 30, 2022.

CHAPTER FOUR. METHODOLGY AND DESIGN

4.1. Study design

- ✓ A retrospective cohort study design was conducted from January 1, 2019, to December 30, 2022, in two purposefully selected government hospitals in Addis Ababa: Yekatit 12 Hospital Medical College and AaBET Hospital.

4.2. Study Area

The study was conducted at purposefully selected governmental hospitals with burn centers (ICU): Yekatit 12 Hospital Medical College and AaBET Hospital (an affiliation of Saint Paul Hospital Millennium Medical College) based on a higher number of burn patients admitted to burn units. Addis Ababa is the capital and largest city of Ethiopia. According to the World Population Review 2021, the population size of Addis Ababa town is estimated to be 5,005,524. It has twelve government and ten non-governmental hospitals, two burn centers including Yekatit 12 Hospital Medical College and Addis Ababa Burn, and the emergency trauma center (AaBET of Saint Paul Hospital). Saint Paulous Hospital (affiliated with AaBET Hospital) was built in 1976, and the medical college was formed in 2007. This hospital has 350 beds, an annual average of 300,000 patients, and a catchment population of more than 5 million. The AaBET Hospital intensive care unit has 20 beds: 8 for pediatrics and 12 for adults. Yekatit 12 Hospital Medical College is under the Addis Ababa City Health Bureau administration. It routinely serves Addis Ababa and other referral regional states. It has nine departments, six units, 265 beds, and seven ICUs. Two burn center units has 19 beds totally,from those 12 for adults and seven for pediatrics and seven ICU beds.

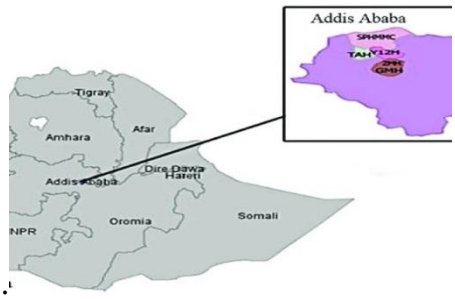


Figure 2:Map of Ethiopia,Adiss Abeba, SPMMC(AaBET hospital) and Yekatit 12 Hospital

4.3. Source population

All burn patients who were admitted to the ICUs of Yekatit 12 hospital medical college and AaBET hospital burn centers from January 1,2019,to December 30,2022.

4.3.1. Study population

All burn patients who were admitted to intensive care units at selected hospitals who met the inclusion criteria and were selected for the sample during the study period.

4.4. Sample size and sampling technique

4.4.1. Sample size determination

Previous studies conducted at BICU have not utilized the Hazard Ratio. The single population proportion formula was used to calculate the sample size.The following assumptions were considered while calculating the sample size : Proportion assuming **p** = 50%, **Za/2** = $_{Z}$.score of the 95% confidence interval = 1.96, and **W** = margin of error = 5%

$$n=\frac{(z\alpha/2)^2 p(1-p)}{w^2}$$

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

$$N=\frac{3.84*0.25}{0.0025}=384$$

The total sample size was 384. With a 10% non-respondent rate, the final sample size was **n** = 422.

4.4.2. Sampling procedure and allocation

Study participants in the study were selected using the proportional allocation algorithm, which compared the number of admissions in each BICU to the total number of burn patients admitted (Nt = 544) in the two two burn centers from January 1,2019 to December 30,2022, multiplied by the sample size (ns = 422).

- ✓ **n** =the average number of burn patients admitted to in a given ICU(**n1=**287 inYekatit 12 hospital medical colleage and **n2=** 257 in AaBET hospital ICU).
- ✓ **n** in ICU = Total sample size **(ns)** ×the average number of burn patients in a given ICU (**n**)**/Nt** (**Nt=**the total burn patient in ICU from 2019-2022).
- ✓ **ny** in Yekatit 12 hospital medical college (ICU) was= **n×n1/Nt**=422×287/544=222.
- ✓ **nA** in AaBET hospital burn ICU was =**ns×n2/Nt** =422×257/544=200.

Where **Nt**=the total number of burn patients in the two burn centers ICU,**ns=**total sample size,**ny = participants** of Yekatit 12 Hospital Medical College, and nA = **participants** of AaBET Hospital. A simple random sampling method was used to select the needed number of participants from all newly admitted burn patients admitted in the burn ICU from January 1, 2019, to December 30, 2022, from the data repository with computerised lottery method with Microsoft excel.

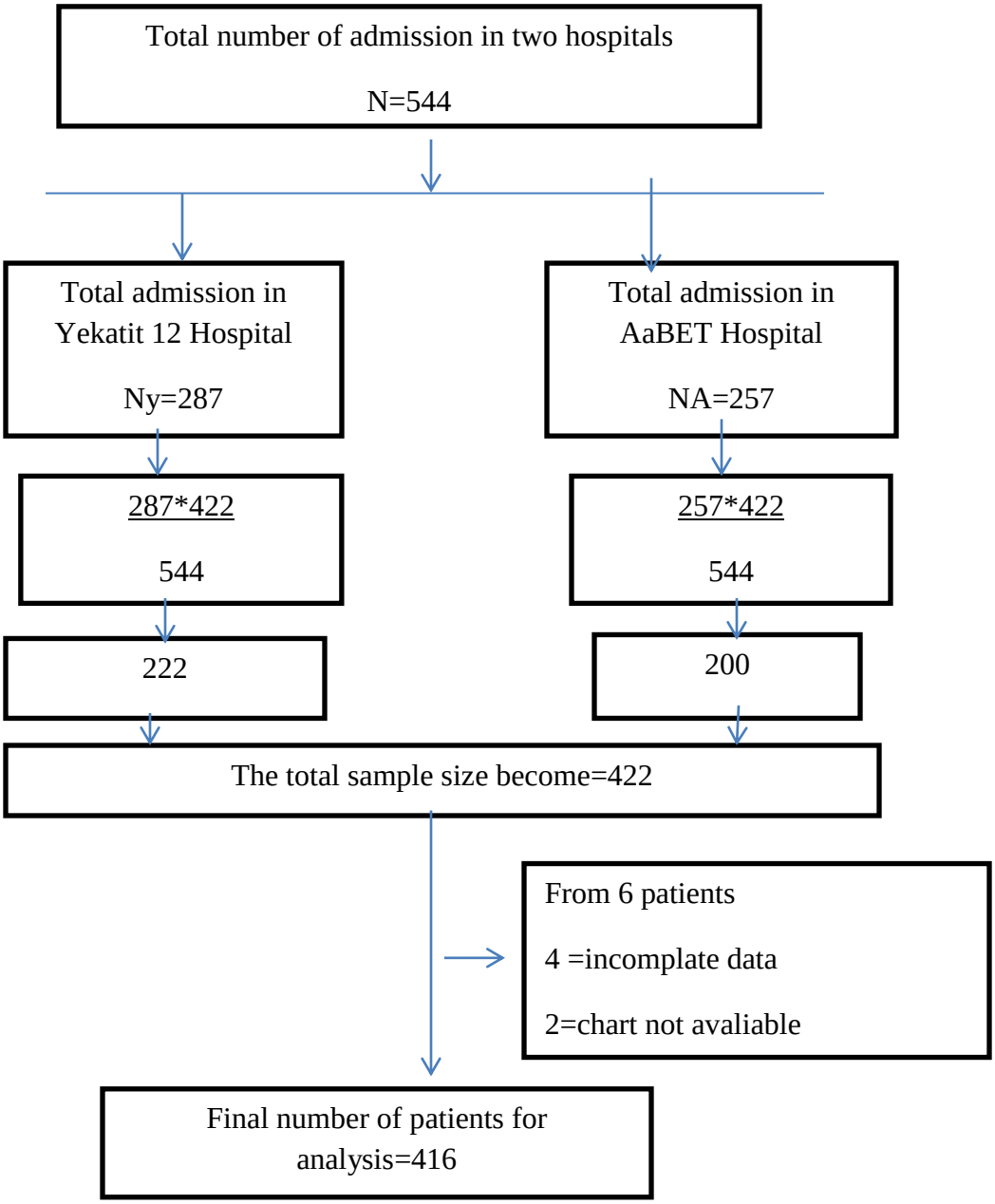


Figure 3: Sampling procedure and allocation

4.5. Inclusion and exclusion criteria

4.5.1. Inclusion criteria

All burn patients admitted to the intensive care units of a selected hospital from January 1, 2019, to December 30, 2022, were included in the study.

4.5.2. Exclusion criteria

- ✓ Patient who had missing key variables ware excluded from the study during the study period.
- ✓ Records data not available.

4.6. Variable of the Study

4.6.1. Dependent variable

- ✓ Time to death

4.6.2. Independent Variables

Socio-demographic factors: Age, Sex,Residencey

Burned anatomic body parts:Head and neck injury,extremity,trunks,genitalia,multiple body injury

Cause of Admission:Inhalational injury,shock,loss of consciousness

Mechanism of injury: Scald burn, Electrical burn, Flame burn, Chemical burn ,Contact burn,Thermal burn.

%TBSA injured:Greater than 20 %TBSA,less than 20%TBSA.

Depth of burn injury: Partialthickness ,fullthickness burn injury.

Laboratory value at admission: RFT,LFT,k+, Na+, and Blood glucose level

Previous coexisting disease: Hypertension, DM, Cardiac illness, renal illness, psychiatric disorder, Epilepsy,HIV/AIDs,Malnutrition.

Interventions did at BICU: Mechanical Ventilation, Vasopressors, Blood transfusion, Surgery , wound care

Complications at BICU: Cardiac arrest, Anemia, hypotension,hypertension,Arrhythmia, Sepsis, Aspiration,malnutrition,hypoglycemia,hyperglycemia

4.7. Data collection analysis and quality control

4.7.1. Data collection procedure

After training two anesthetic professionals, data collection was performed from the card registration room under the guidance of one MSC anesthetist at Yekatit 12 hospital medical college and SPHMMC (with AaBET) government hospital.

4.7.2 .Data quality control

Pre assement of chart was done before a day of data collection ,to guarantee the accuracy of the data, at Yekatit 12 Hospital Medical College. One day before data collection, the supervisor and data collectors received training on the study's goal and how to evaluate documents in line with the format for data . The main investigator and another supervisor oversaw the entire procedure. The supervisor and the lead investigator monitored the completed forms for daily accuracy.

4.7.3. Data processing

The data was coded and entered into Epi-data version 4.6 ,and it was transferred to STATA version 17 to analyze the data. Cross-tabulations and summary statistics were utilized to describe the study population in relation to key factors.

4.7.4. Data analysis

Missing values and outliers were checked using explorative data analysis. Multicollinearity was checked using variance inflation factors (VIF) with a tolerance of 10% to describe categorical variables. The probability of death among burn patients was described using the Kaplan-Meier curve and log-rank test were fitted for categorical variables. Before fitting the Cox regression model to the data, its data fitness and proportional hazard assumption were tested with a log-log plot (log survival probability vs. log survival probability).

A bivariate Cox regression analysis was conducted to measure the effects of each independent variable on the dependent variable. In the multivariate Cox regression analysis, variables with a

p-value less than 0.2 in the bivariable Cox regression analysis were used to find the independent predictors of mortality. The adjusted hazard ratio with 95% confidence interval was use for potential risk factors in the multivariate model . A P-value of 0.05 is considered a statistically significant association. The goodness of fit test was checked with the Cox-Snell residual.

4.7.5 . Operational definitions

Censored

Burn patients admitted to ICU but recovered and discharged to wards ,discharged against medical advice or transferred to other health institutions without knowing the outcome.

Survival status

Is the outcome of a burn patient admitted to ICU either event or censored.

Event

Death in BICU

Incomplete records

If the patients record is missing during admission, discharge date, and outcome.

Survival time

Measures the follow-up of times from well defined starting point or from the admission of burn patients admitted to ICU up to the event's occurence.

Follow-up time

From the time of admission of burn patients to ICU until an event or censorship occurs.

Length of stay

The number of days the patient stayed in the ICU from admission until death or censoring occurrence.

4.7.5 . Ethical consideration

The Institutional Review Board (IRB) of the College of Health Science at Addis Abeba University granted ethical approval. Informed consent was not sought from each client because this is secondary data; instead, it was provided to the top executive of the relevant hospital's management. Surveys were guarded, patient identities were kept private, and identities were disclosed.

4.7.6 . Dissemination of results

The research's findings will be distributed to the College of Health Science, the Department of Anesthesia, and Addis Ababa University. The study results will be delivered to the local health bureau, Yekatit 12 Hospital Medical College, and AaBET Hospitals. The outcomes will be released for peer-reviewed academic publication. The systematic review and meta-analysis will be sent to reputable journals as part of this study.

CHAPTER FIVE. RESULT

5.1. Socio-demographic characterstistics of burn patients admitted in ICU

From a sample of 422 burn patients who were randomly chosen as study participants, 416 patients were included in the final analysis. The majority of burn patients admitted to intensive care units were female; they accounted for 213 (51.2%) of the total admitted burn patients. About 225 (54.1%) burn patients arrived from rural areas. Most burn patients admitted to the ICU are between 18 and 65 years old, and they account for 227 (54.6%) of the total admitted to the ICU. 286 (68.8%) of burn patients admitted to the ICU received medical care within 6 hours. The highest percentage of mechanisms of injury were flame burns, which account for 175 (42.07%) of the total mechanisms of burn injuries.

Table 1: Socio-demographic Factors of burn patients admitted to ICU from January 2019 to December 2022,Adiss Abeba ,Ethiopia 2023**.**

Variable	**All episods,n(%)** **n=416**	**Censord,n(%)** **n=267**	**Event,n(%)** **n=149**
Residencey			
Rural	225(54.1%)	109(48.4%).	116(51.6%)**
Urban	191(45.9%)	158(82.7%)	33(17.3%).
Sex			
Male	203(48.8%)	133(65.5%)	65(34.5%)
Famele	213(51.20%)	129(60.6%)	84(39.4%)*
Age			
Less than 5 years	54(12.98%)	37(68.5%)	17(31.5%)
5 years to 18 years	63(15.14%)	14(22.2%)	49(77.8%)***
18year to 65 year	227(54.6%)	166(73.13%)	60(26.87%)
Above 65 years	72(17.31%)	51(70.8%)	23(29.2%)

NB:* significant, Famele.** Significant,Rural.*** significant between 5year and 18 years .

5.2. Clinical Charactestics of burn patients Admitted to Intensive care units

Out of the total admitted burn patients in the ICU, 184 (44.2%) had preexisting medical conditions, and the majority of the patients had epilepsy (66, or 35.7%). The extremity was the major burned anatomic body part; it accounts for 264 (63.6%). Out of the total admitted burn patients in the ICU, 267 (64.18%) were on mechanical ventilation. More than half (240, or 57.83%) of the burn patients admitted to the ICU were on Vassopresor.

Pre admission value of potassium and sodium electrolyte disturbances among burn patients admitted to the ICU; they accounted for 212 (51.08%) and 240 (56.79%), respectively. Sepsis was the major complication, and it accounts for 106 (25.6%) of the complications that occurred in burn intensive care units.

Table 2:Clinical data of burn patients admitted in ICU

Variables	**All episodes,n(%) (416)**	**Censored,n(%) (267)**	**Event,n(%) (149)**
Depth of burn			
Partial thickness	327(78.61%)	258(78.89%)	69(21.11%)
Full thickness	89(21.39%)	9(10.11%)	80(89.89%)**
%TBSA			
Less than 20%	282(67.79%)	216(76.59%)	66(23.41%)
Greater than20%	134(32.21%)	23(15.5%)	83(61.95%).
Pre-existing disease			
Yes	184(44.2%)	87(47.3%)	97(52.7%)
No	232(55.8%)	180(77.6%)	52(22.4%)
Type of pre existing			

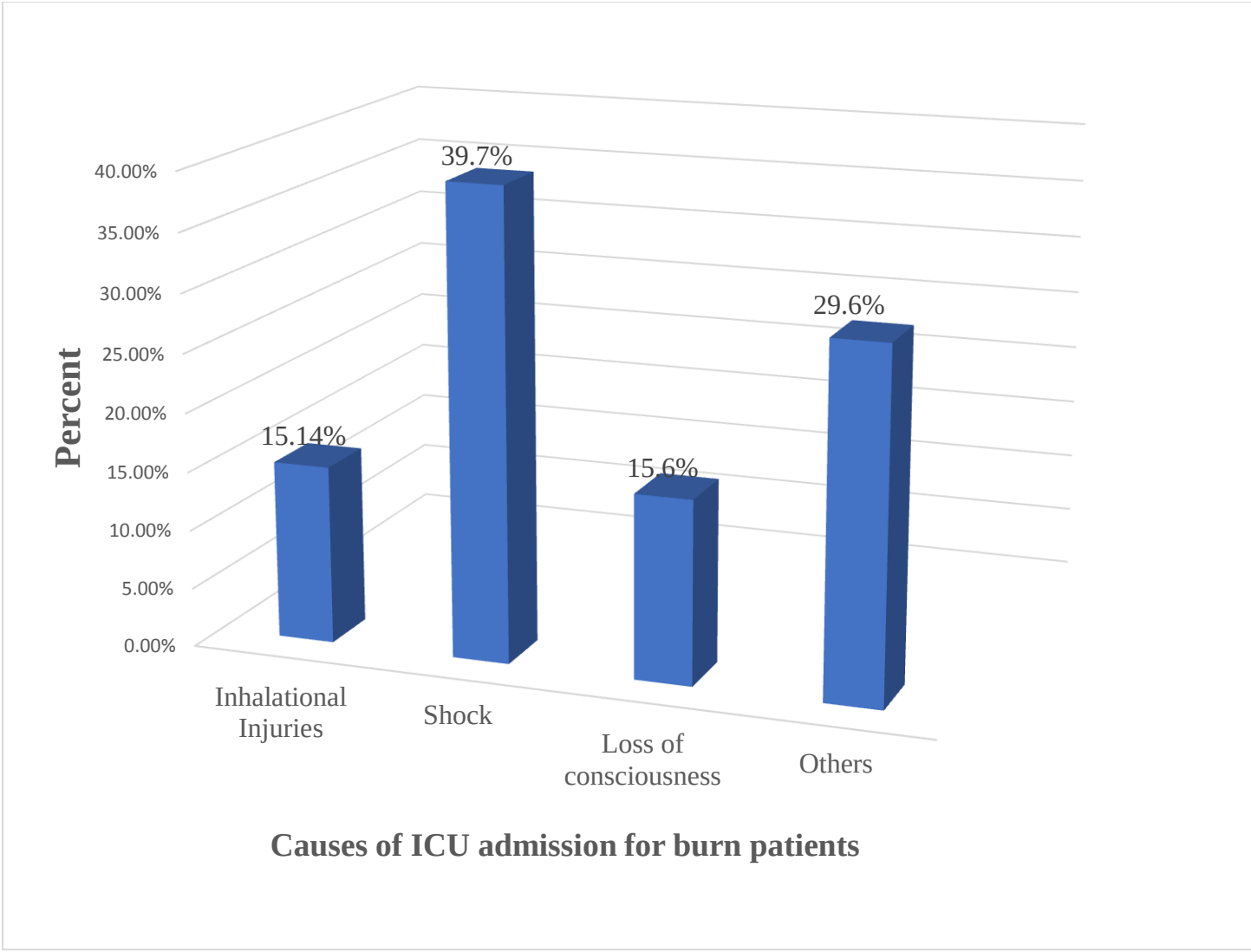
disease			
Epilepsy	66(35.7%)	21(31.8%)	45(68.2%)
RVI	27(14.1%)	5(18.5%)	22(81.5%)**
DM	24(13%)	17(70.8%)	7(29.2%)
Phycatric disorder	31(16.8%)	19(61.3%)	12(38.7%)
Others	37(20.6%)	26(70.3%)	12(29.7%)
Cause of Admision			
Inhaletional injurie	63(15.14%)	12(19.1%)	51(80.9%)**
Shock	165(39.7%)	100(60.6%)	65(39.4%)
Lossof consciousness	65(15.6%)	34(52.3%)	31(47.7%)
Others	123(29.6%)	121(98.4%)	2(1.6%)
Anatomic body part			
Head and neck	50(12.02%)	13(26%)	37(74%)*
Extermity	271(65.14%)	213(78.59%)	58(21.41%)
Trunks	86(20.67%)	35(40.69%)	51(59.31%)
Others	9(2.16%)	6(66.6%)	3(33.4%)
Wound management			
Yes	407(97.84%)	261(64.13%)	146(35.9%)
No	9(2.16%)	6(66.7%)	3(33.3%)
Blood transfusion			
Yes	288(69.23%)	196(65.05%)	92(31.95%)
No	128(30.77%)	71(55.46%)	57(44.54%)
Mechanical ventilation			
Yes	267(64.18%)	131(49.06%)	136(50.94%)
No	149(35.82%)	136(91.27%)	13(8.73%)
Vasoprossor			

Yes	240(57.83%)	117(48.75%)	123(51.25%)
No	175(42.17%)	149(85.14%)	26(14.86%)
Surgery done			
Yes	84(20.19%)	23(27.38%)	61(72.62%)
No	332(79.81%)	244(73.49%)	88(26.51%)
Abnormal glaycemic level			
Yes	281(67.55%)	152(54.09%)	129(45.91%)
No	135(32.45%)	115(85.18%)	20(14.82%)
Potassium fluctuation			
Yes	212(51.08%)	85(40.09%)	127(59.91%)
No	203(48.92%)	181(89.16%)	22(10.84%)
Sodium fluctuation			
Yes	240(57.69%)	114(47.5%)	126(52.5%)
No	176(42.31%)	153(86.93%)	23(13.97%)
RFT abnormal			
Yes	254(61.06%)	133(52.36%)	121(47.64%)
No	162(38.94%)	134(82.71%)	28(17.29%)
LFT abnormal			
Yes	275(66.11%)	143(52%)	132(48%)
No	141(33.89%)	124(87.94%)	17(12.06%)
Complication in ICU			
Yes	402(96.63%)	253(63.1%)	149(36.9%)
No	14(3.37%)	14(100%)	
Burn complication in ICU			
Aspiration	32(7.7%)	8(25%)	24(75%)*

Arrthymia	61(14.7%)	43(70.5%	18(29.5%)
Anemia	66(16%)	65(98.5%)	1(1.5%)
Malnutrition	59(14.3%)	47(79.9%)	12(20.1%)
Sepsis	106(25.6%)	39(36.8%)	67(63.2%)*
Cardiac arrest	10(2.4%)		10(100%)***
Others	80(19.3%)	63(78.8%)	17(21.2%)

NB: *head and neck burned body part,aspiration,sepsis,.**Inhalational injury,RVI,time of getting medical care,,fullthickness burn,%TBSA>20% . ***Cardic arrest.Other burned body party:Buttocks and genitalia,multiple burned area.

Of the total admitted burn patients in the ICU, the main cause of admission was shock. It accounts for 165 (39.7%), and this contributed to the highest percentage (65, 39.4%) of patients dying in the BICU.



NB:Other cause of admission : low oxygen saturation

Figure 4:Cause of admission to ICU among burn patients admitted at Adiss Abeba, Ethiopia,From Juanuary 2019 to December 2022.

The majority of burn patients admitted to the ICU were exposed to flame burns 176(42.31%). This leads to 77(44%) patients died in the BICU,and the reason were head and neck , and trunk body parts injurie during flame burn.

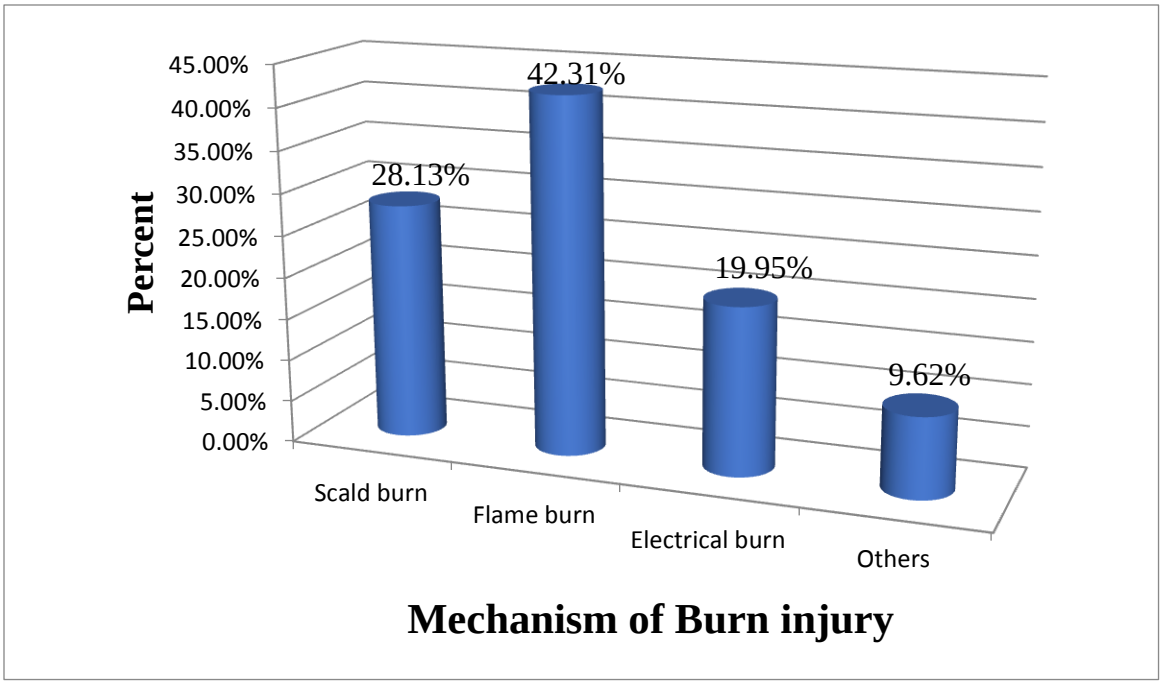


Figure 5:Mechanism of injury to ICU among burn patients admitted at Adiss Abeba, Ethiopia,From January 2019 to December 2022.

5.2. Survival Analysis

5.2.1. Survival status of burn patients admitted in ICU

In this study, patients were followed for varying lengths of time, with a median follow-up time of 9 days (IQR = 7,13) and a range of a minimum of one day to a maximum of 40 days. The incidence rate was found to be 5.5 deaths per 100 persons per day of observation (95% CI: 4.7,6.5), with a total follow-up extent of 2684 persons per day. This study show that during the follow- up period, of the total admitted burn patients in the ICU, 149 (35.82%) died and 267 (64.18%) were censored. Among censored burn patients admitted to the ICU, 257 (61.78%) were discharged home, 5 (1.2%) received medical care, and 5 (1.2%) were referred to other hospitals upon completion of the study.

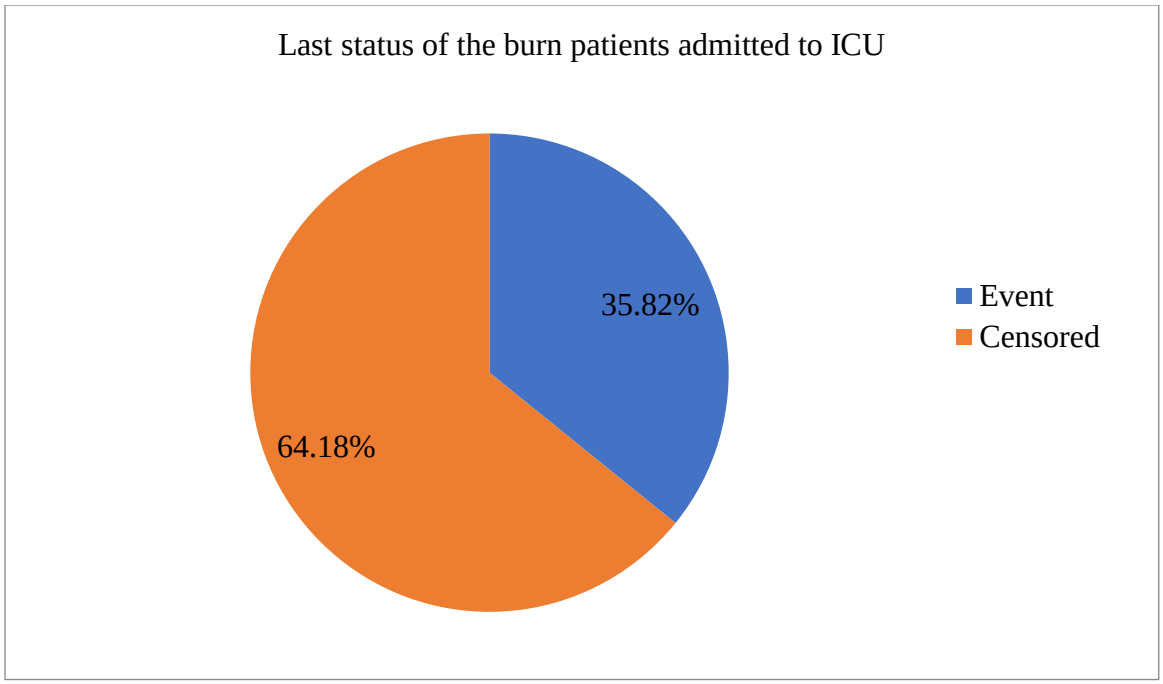


Figure 6: Pie charts of the proportion survival status of burn patients admitted in ICU from January , 2019 to December 2022.Adiss Abeba ,Ethiopia 2023.

Table3: Life Table estimation of mortality among burn patients admitted in ICU

Interval		Total	Deaths	Lost	Survival	Std. Error	[95% Conf. Int.]	
0	4	416	57	0	0.8630	0.0169	0.8261	0.8926
4	8	359	267	0	0.2212	0.0203	0.1826	0.2621
8	12	92	77	0	0.0361	0.0091	0.0211	0.0572
12	16	15	5	0	0.0240	0.0075	0.0124	0.0423
16	20	10	1	0	0.0216	0.0071	0.0107	0.0392
20	24	9	3	0	0.0144	0.0058	0.0060	0.0298
24	28	6	1	0	0.0120	0.0053	0.0046	0.0265
28	32	5	1	0	0.0096	0.0048	0.0032	0.0232
32	36	4	2	0	0.0048	0.0034	0.0010	0.0163
36	40	2	1	0	0.0024	0.0024	0.0002	0.0128
40	44	1	1	0	0.0000	.		

The cumulative probability of failure for burn patients admitted to the ICU on the first day of admission and at the end of follow-up time was 8.6% and 99.8%, respectively, with a median follow-up time of 9 days.

5.2.2 . Predictors of mortality among burn patients admitted to ICU

The failure estimate graph of burn patients admitted to the ICU is described with the Kaplan-Meier failure function as follows:

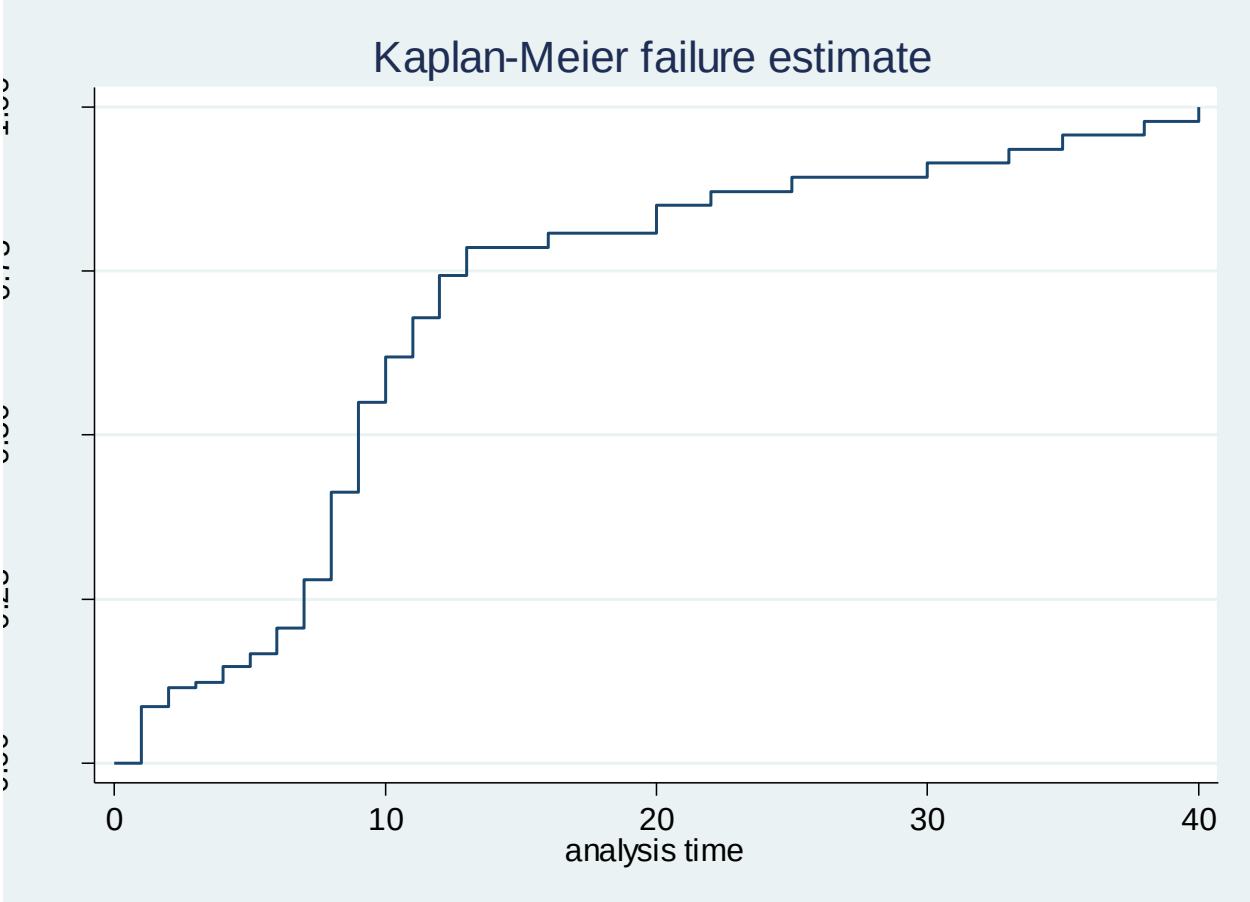


Figure 7: A Kaplan-Meire failure estimate of burn patients admitted in ICU from January 2019 to December 2022,Adiss Abeaba,Ehiopia,2023.

For each category variable, a distinct graph of the failure estimate in the KM failure function was produced. This is important to identify individual differences across the survival experience in the specified groups. The log-rank test was used to determine if there is a statistically significant difference between the survival functions of groups in the Kaplan-Meier estimate. According to the log-rank test results, there was a significant difference among categories of

residency, timing of getting medical care, age, depth of burn injury, %TBSA, mechanism of injury, pre-existing disease, and burned Anatomical body parts, blood transfusion, cause of admission, mechanical ventilation, surgery intervened, vasopressor, complication, Abnormal blood glucose level, potassium fluctuation, sodium fluctuation, LFT, and RFT abnormality. Predictors that had no statistically significant value after a log-rank test were sex and burn wound management.

Table 4: Log rank test and Medial survival time for predictors among burn patients admitted in ICU from January 2019 to December 2022 ,Adiss Abeba ,Ethiopia 2023**.**

Predictors	**Category**	**Medial survival time(95%CI)**	**Log rank test($X^{2)}$**	**P-Value**
Residencey	Rural	8(6,12)	18.80	0.0000
	Urban	16(8,16)		
Timing getting medical care	Within 6 hour	12(9,16)	79.71	0.0000
	6 to 24	6(2,9)		
	24 to 48	7(2,9)		
	>40	7(3,11)		
Age	<5 years	9(8,9)	14.34	0.0025
	5 yr to 18 yr	9(8,11)		
	18 yr to 65yr	12(8,20)		
	>65yrs	7(5,10)		
Pre –exsting disease	Yes	8(5,11)	27.02	0.0000
	NO	10(8,13)		
Anatomic body parts	Head and Neck	5(2,8)	86.57	0.0000
	Extermities	12(8,30)		
	Trunks	8(7,10)		
	Others			

Blood transfusion	Yes	10(8,16)	8.05	0.0045
	No	8(6,10)		
Complication	Yes	7(9,13)	4.25	0.0394
	No			
Depth of burn	Partial thickness	8(11,20)	77.48	0.0000
	Full thickness	6(1,9)		
%TBSA%	<20%	11(8,16)	26.02	0.0000
	>20%	8(5,10)		
MV	Yes	8(6,10)	57.19	0.0000
	NO	16(12,22)		
Vasopreser	Yes	8(5,10)	42.35	0.0000
	NO	12(10,16)		
Surgery done	Yes	8(5,10)	19.64	0.0000
	NO	12(8,20)		
Abnormal glaycemic level	Yes	8(6,11)	37.81	0.0000
	NO	13(10,22)		
Potassium fluctuation	Yes	8(4,10)	63.60	0.0000
	NO	13(10,20)		
Sodium fluctuation	Yes	8(5,11)	32.92	0.0000
	NO	16(9,25)		
Renal function test abnormal	Yes	8(6,11)	39.06	0.0000
	No	12(9,20)		
Abnormal Liver function test	Yes	8(6,11)	35.94	0.0000
	NO	16(12,39)		
Mechanism of Injury	Scald burn	9(8,11)	25.34	0.0000

	Flame burn	9(6,13)		
	Electrical burn	9(1,25)		
	Others	13(9,13)		
Cause of ICU admission	Inhalational injury	6(2,8)	87.10	0.0000
	Shock	9(7,11)		
	Loss of consciousness	8(7,12)		
	Others	22(22,30)		

NB: Others burned anatomic body parts such as Buttocks and genitalia,multiple area. Others cause of admission such as low oxygen saturation .Others mechanism of injuries such as thermal,contact,chemical burn .

Burn patients admitted to the ICU with full-thickness burn injuries have the worst survival when compared to partial-thickness burn injuries, which is supported by the log-rank test (77.48) (P-value <0.001).

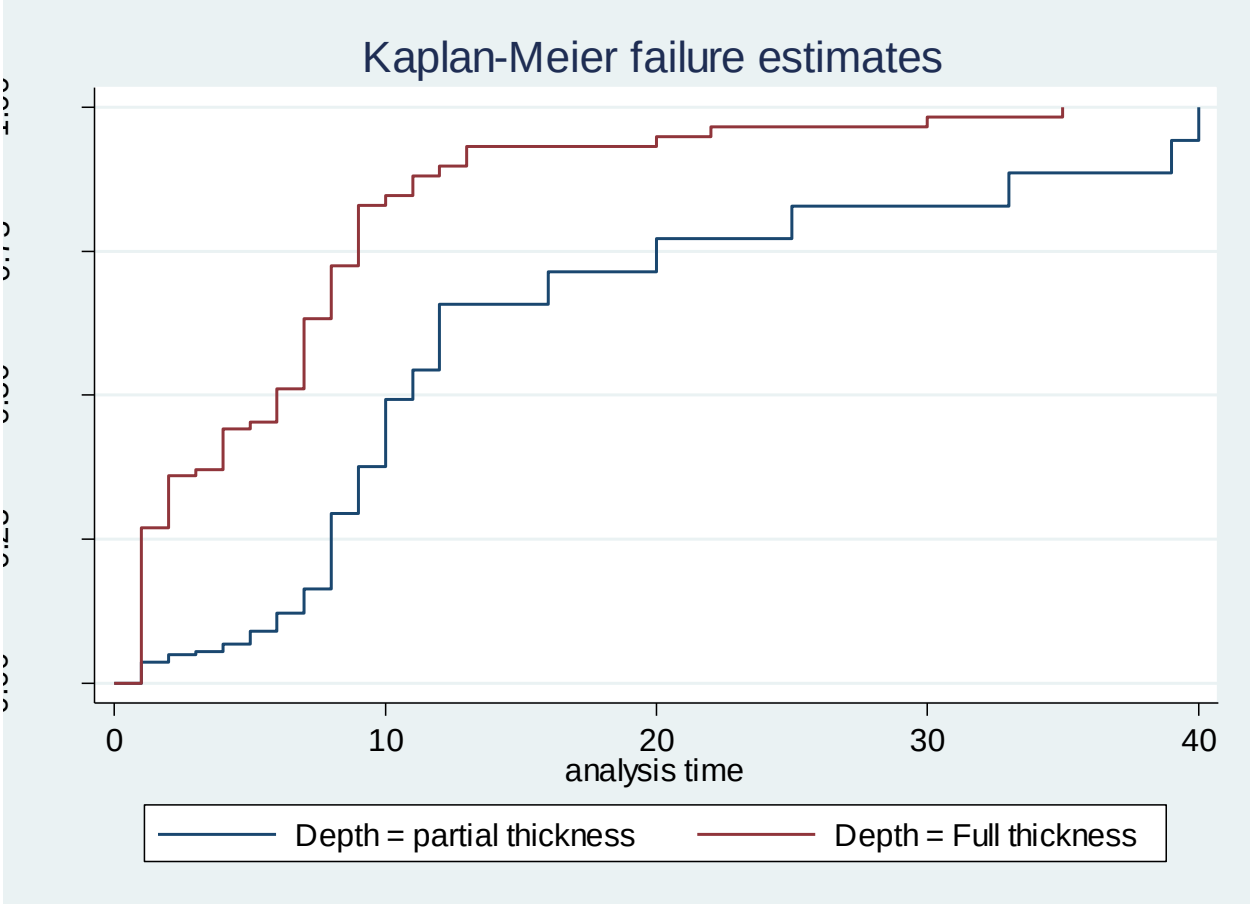


Figure 8:A KM failure curve showing the hazard of depth of burn injury among burn patients admitted in ICU at hospital Adiss Abeba ,Ethiopia,from Juanury 2019 to December 2022**.**

5.2.3. Assesing proportional hazard Assamption

All covariates and the whole model satisfied the proportional hazard assumption with test using Schoenfield residuals (chi-square = 34.25, global test value = 0.2711). After doing the univariate Cox proportional hazard analysis, it was found that all predictor variables which had a p-value of less than 0.2. Next, a multivariate model was fitted, and variables such as the mechanism of injury, depth of burn injury, age, cause of admission, burned anatomical body part, %TBSA, mechanical ventilation, abnormal glycaemic level, and vasopressor were significant predictors of death among burn patients admitted to the ICU at a 5% level of significance.

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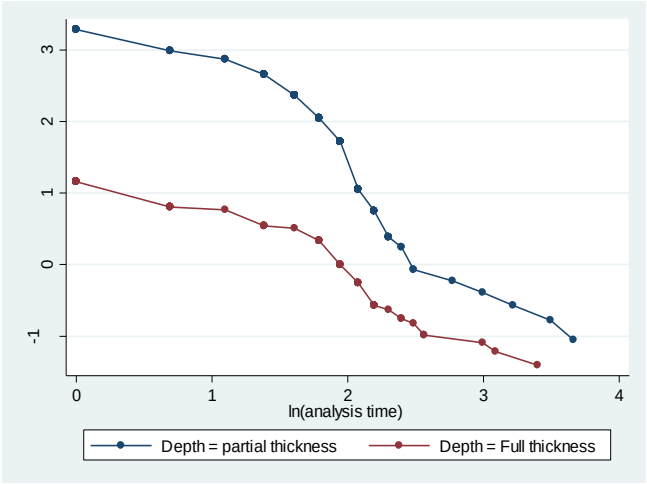

Figure 9: **Log(-log (survival probability)) log (survival time) plot by depth of burn injury**

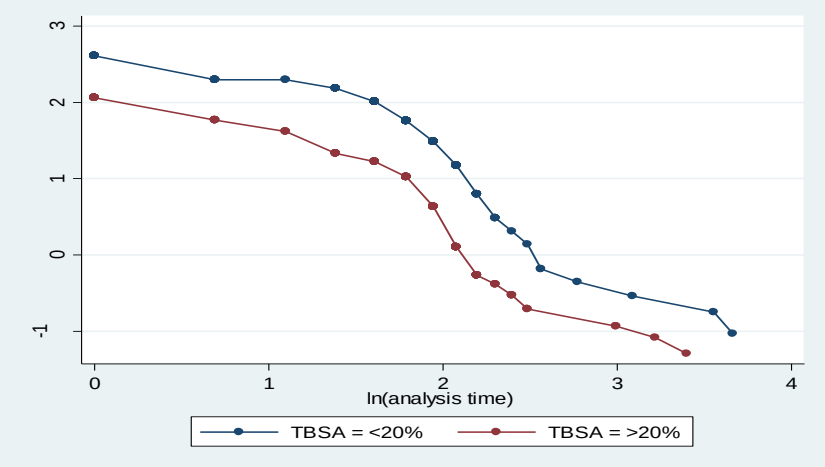

Figure 10: **Log(-log (survival probability)) log (survival time) %TBSA among burn patients admitted in ICU at Adiss Abeba ,Ethiopia,2023.**

5.4. Interpritation of Meltivariate interms of Adjusted Hazard Ratio

When all other variables were constant, patients with full-thickness burn injuries had an 89.89% higher mortality hazard than patients with partial-thickness burn injuries. (AHR= 2.6(95%CI:1.7,4.05).

Keeping other variables constant, the hazard mortality rate of burn patients who had greater than 20% TBSA burned body parts had a 61.95% higher mortality rate than patients who had less than 20% TBSA. AHR = 2.23 (95% CI: 1.6, 3.10).

Patients who had an electrical burn mechanism injury dying 11.9 times hazard of mortality compared to other mechanisms of burn injuries, keeping other variables constant. (AHR: 11.9(3.01,46.32). Keeping all other variables constant, patients who encountered inhalational injury had a 5.32-time higher mortality hazard than patients with other causes of admission.

(AHR=5.32(1.61,17.8). Controling other variables burn patients who had shock during ICU admission 4.27 times higher mortality hazard than others cause of admission (AHR:4.27(1.44,12.7).Keeping other variabels ,patients who had loss of consciousness during ICU admission 4.5 times higher mortality hazard than others cause of admission.(AHR:4.5(1.5,13.72).

Burn patients admitted to the ICU who used mechanical ventilation have a 2.3-times higher mortality hazard compared to patients who did not use mechanical ventilation, keeping other variables constant. AHR 2.3 (1.2, 4.29). Keeping other variables constant, patients who used vasopressors had a 2.02 times higher mortality hazard compared to patients who didn't use vasopressors. (AHR=2.02(1.16,3.5).

Patients with abnormal blood glucose levels have a 2.12-times higher mortality hazard than normal blood glucose level burn patients admitted to the ICU, keeping other variables constant. (AHR=2.12(1.17,3.9). When other variables constant, patients who had burned head and neck body parts had a 5.1 times higher mortality hazard compared to other burned body parts. (AHR= 5.12(2.35,11.16. Controling other variables patients who had trunks burned body parts during burn ICU admission 2.09 times mortality hazard compared to other burned body parts.(AHR:2.09(1.4,3.85).

Patients admitted to the ICU aged less than 5 years had a 2.35 times higher mortality hazard compared to other age groups, keeping other variables constant. (AHR=2.35(1.05,5.25). During ICU stay burn patients whose age greater than 65 years had 1.9 times mortality hazard campared to others age group,contoling other variables constant.(AHR:1.9(1.06,3.52).

5.5 . Cox proportional hazard model of burn patients admitted in ICU

Utilizing Cox proportional hazard regression, the relationship between the standard variable and mortality risk is examined. In bivariate analysis, clinical factors such as the mechanism of injury, depth of burn injury, %TBSA, mechanical ventilation, vasopressor treatment, surgical intervention, blood glucose level fluctuation, abnormal RFT, potassium fluctuation, abnormal LFT, and sodium fluctuation were statistically significant and had a p-value less than 0.2.

Additionally, predictors that were significant in the bivariate model included in the multivariate Cox regression model and which had a P-value of less than 0.05 were full-thickness burn injuries, %TBSA, mechanisms of injuries, causes of admission, vasopressors as treatment interventions, and abnormal blood glucose levels.

Table 5:Meltivariate Cox proportional hazard model of predictors among burn patients admitted in ICU from 2019 to 2022 at Adiss Abeba ,Ethiopia 2023.

Predictors	**Category**	**Survival**		**CHR(95%CI)**	**AHR(95%CI)**
		Event	**Censored**		
Depth	Partial thickness	69	258	1	
	Full thicknes	80	9	3.82(2.73,5.34)	2.6(1.72,4.4.05)***
Mechanism of injury	Scald burn	32	86	2.39(0.84,6.8)	1.05(0.29,3.82)
	Flame	77	98	3.7(1.33,10.04)	2.57(0.72,9.1)
	Electrical	47	36	5.9(2.1,16.6)	11.9(3.01,46.32)***
	Others	4	36	1	
Cause of Admission	Inhalation injury	48	12	26.6(9.57,73.94)	5.32(1.61,17.8)**
	Shock	66	100	11.08(4.03,30.46)	4.27(1.44,12.7)**
	Lossof consciousness	31	34	11.28(3.96,32.11)	4.5(1.5,13.72)**
	Others	4	121	1	
MV	Yes	136	131	6.25(3.5,11.1)	2.3(1.2,4.29)*
	NO	13	136	1	
Vasopressor	YES	123	117	3.54(2.31,5.41)	2.02(1.16,3.5)*
	NO	26	149	1	
Abnormal glucose level	Yes	129	152	3.83(2.4,6.2)	2.12(1.17,3.9)*
	No	20	115	1	
Burned Anatomic body parts	Head and neck	37	13	5.39(3.5,8.3)	5.12(2.35,11.16)***

	Extermity	58	213	1	
	Trunks	51	35	2.4(1.6,3.52)	2.09(1.4,3.85)**
	Others	3	6	0.95(0.29,3.11)	1.009(0.23,4.3)
Age	<5 yrs	17	37	1.04(0.6,1.8)	2.35(1.05,5.25)*
	5 yr to 18yrs	49	14	1.9(1.34,2.9)	1.2(0.7,1.98)
	19yrs to 65yrs	60	167	1	
	>65 yrs	23	49	1.2(0.73,1.9)	1.9(1.06,3.52)*
%TBSA	<20%	66	216	1	
	>20%	83	51	2.23(1.6,3.10)	1.13(0.75,2.02)*

NB: Variables after Multivariate model done which had ***** significant with P-value <0.05.******Significant with p-value<0.05.*** significant with p-value <0.001.CHR show that bivariate modeling results.Where as AHR show that meltivariabel modeling results. catagorical variables which are referenced represented by number **1.**

CHAPTER SIX. DISCUSSION

The overall incidence of mortality among burn patients admitted to the ICU at Adiss Abeba government hospital burn centers was found to be 35.82%. This study's result was consistent with the findings of studies conducted in Brazil (30).

This study's result was lower than that of a study done in Cairo, Egypt (6). The discrepancy occurred due to the study population and study design. A study conducted in Egypt included mainly patients who had TBSA >20%, and from the mechanism of injury, electrical, thermal, and inhalational flame burn injuries were included. From a population of productive age, adult male and female participants were selected within a sample size of 67 participants .

But this study result is higher than studies done in low-income countries such as Cameroon and Malaysia (9,34). The discrepancy occured due to follow-up time and sample size. This study result was higher than high income countries such as South Africa, SoudiArebia, Turkey, Uruguay, Netherland, Canada, Germeny,and USA(12,18,25–27,29,31,37).

The possible justification were,lack of essential medication, equipment, and inadequate nutritional supplementation, which have a substantial impact on the survival status of burn patients admitted to the intensive care unit, might be the cause of the discrepancy in the results (45).

In this study, burn patients aged less than five years admitted to the ICU had a higher mortality rate. This study is similar to one done at the Chris Hani Baragwanath Academic Hospital in Johannesburg (33). The patients' susceptibility to numerous infection-related problems and their lowered cellular immunity due to burns might the cause.

In this study, older age burn patients admitted in ICU have an elevated mortality rate .This is similar with study conducted USA,Canada,England(13,26,27) .The possible reasons were that there is an increase in disease risk due to medical comorbidities and immunosuppression as age increases, and these predictive factors decrease the chance of survival (48,49). In this study, patients admitted to the ICU with an increasing length of stay had an elevated mortality risk. This study is similar to one undertaken in Canada (41). The possible reason could be that as the length of stay increases, it is found that the longer gram-negative bacteria are kept in the burn

critical care unit, the more resistant they are to treatment, which facilitates opportunistic infections (29).

In this study, electrical burn injuries had a higher risk of mortality in burn patients admitted to the ICU. This study is similar to a study done in Turkey (42). The high interaction between productive age groups and daily activities in the electric city's home and occupational regions may be the cause (6).

In this study, full-thickness burn injuries and TBSA > 20% had an increased mortality risk among burn patients admitted to the ICU. This study is similar to one done in Cameron, Malaysia (9,34). The possible reasons for full-thickness burns and increased %TBSA >20% are extensive organ and membrane disruption and decreased skin elasticity, when combined with ongoing resuscitation and accompanying soft tissue edema, can lead to high compartment pressures and compromised perfusion (59).

In this study, inhalation injuries were the most prevalent indication of patient fatality in the burn critical care unit. This study is similar to studies done at tertiary hospitals in Ghana and Malaysia (9,43) . The explained reason was that inhalational damage has an elevated carbon monoxide level of more than 10% on a first arterial blood gas analysis, suggesting worse outcomes (44). The affinity of CO for hemoglobin is 200–300 times that of oxygen. This results in reduced oxygen-carrying capacity in the blood (59).

In this study, patients who lost consciousness during admission had a higher mortality hazard. This is in line with the study in Ghana(60).The reason could be breathing in hazardous combustion byproducts; conditions including carbon monoxide poisoning alter the level of consciousness (61,62). In this study, shock burn patients had a high mortality rate during admission. This study is similar to the study done in German (35). The possible reasons were body fluid loss and sepsis, according to a study done in Australia (55).

In this study, burned head and neck body parts had a higher mortality rate. This result is similar to a study done in Iran (63). The most common causes of death are respiratory complications, mainly carbon monoxide poisoning and respiratory track injuries.

In this study, patients who had burned trunks had a higher mortality rate. This is similar to a study done in South Africa (35) . The possible justification were Scald and flame burns involving large body surface areas cause difficulty breathing, extensive body fluid loss, and infection.

In this study, patients who had a percentage of %TBSA > 20% burned body parts had a higher mortality rate. This study is similar to one conducted in Malaysia(9).The reason might be massive body fluid loss occurred when the percentage of the burned surface area increased, and it was pronounced with a full-thickness burn.

In this study ,patients on mechanical ventilation had an elevated mortality rate in burn intensive care units compared to patients not on mechanical ventilation. This result is in line with studies done in Saudi Arabia and Uruguay (29,31). The possible reason was that patients on mechanical ventilation had a high risk of developing ventilator-associated pneumonia (64). Another reason might be that patients on MV for an extended period increase the chance of venous thromboembolism, decreasing the overall chance of survival (65). In this study, abnormal blood glucose levels had a lower mortality risk than normal blood glucose levels. This study is similar to one conducted in Texas in the United States (47). The reason is that burn patients who have an abnormal glycemic level are associated with greater infections, lower graft uptake, and decreased survival in the ICU(59).

In this study ,patients who used vasopressors in our study had a higher chance of dying compared to those who didn't (66). According to a systematic study conducted in Norway, the most common cause is that patients taking vasopressors have decreased renal and gastrointestinal perfusion, and most patients need mechanical ventilation and dialysis (67). The possible were according to a systematic review study in European Union countries, vasopressor use might alter the autoregulation of organ dysfunction in hypertensive patients and cause hepatosplanchial, cerebral, and renal autoregulation disruption in cases of systemic inflammation among burn patients admitted to the ICU (68).

6.1. STRENGTH AND LIMITATION

6.1.1. Strength of the study

- ✓ The study were involved multicenter study at burn centers,which are nationally renowed burn units.
- ✓ reasonable sample size.

6.1.2.Limitation of the study

- ✓ Because the study design is retrospective ,some significant predictors were not available such as (BMI,Weight).
- ✓ Physiological scores such as the Sequential Organ Failure Assessment (SOFA) and the Acute Physiological and Chronic Health Evaluation (APACHE) were not obtained.

CHAPTER SEVEN:CONCULUSION AND RECOMMENDATION

7.1: Conclusion

In this retrospective cohort study, we found that the overall mortality among burn patients admitted to the ICU at Adiss Abeba governmental hospital was high. Full thickness burn injury, electrical, %TBSA>20%, head and neck,Trunks injury, inhalational injury,shock,loss of consciousness,patients on mechanical ventilatiol , age greater than 65 years and less than 5 years, abnormal glycaemic level, and vasopressor use were significant factors for ICU mortality among burn patients.

7.2.Recommendation

- ✓ Protocols and guidelines regarding managing electrical burn patients reduce the mortality of burn patients in the ICU.
- ✓ Protocols and guidelines regarding vasopressor use are considered to decrease the mortality of burn patients admitted to the ICU.
- ✓ Protocols and guidelines regarding managing injured head and neck body parts among burn patients upon admission must be employed to decrease mortality in the ICU.
- ✓ The application of standardized mechanical ventilator settings might reduce the mortality of burn patients in the ICU.

For steckholders

- ✓ Measures and interventions at all levels of the sectoral bureaus should be improved to reduce the mortality of burn patients in the ICU.
- ✓ Increasing the number of standardized and well-equipped burn centers across the nation at the regional and district level to reduce mortality by providing early intervention.

For researchers

- ✓ This study finds valuable predictors, but it needs additional research and intervention about Mechanical ventilaton,vasopressor use among burn patients admitted in ICU.
- ✓ Large-scale studies with a prospective design are better at providing more solid evidence among burn patients admitted to the ICU.

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Annexes1. Check list

English version checklist tool

This data extraction checklist is designed to gather socio-demographic, clinical, therapeutic, and outcome-related data that is crucial for determining burn patient mortality in the ICU at Yekatit 12 Hospital Medical College and AaBET Hospital, as well as determining outcomes and predictors of burn patient mortality. Without identifying the names of any of the patients, all of this information was taken from individual patient cards. Healthcare professionals (BSc anesthetists or BSc nurses) gathered this data.**contact information** +**251928557992** and **+251953051709**

No		Possible answer
1	Residencey	1.Rural 2.Urban
2	Time of getting medical care	1. Within 6-hour
		2.6-24 hour
		3.24-48 hour
		4 >48 hour
3	Age	1.One day -5 year 2,six year-18years 3.18years-65 years 4,> 65 years old
4	Sex	1.M 2.F
5	Mechanism of injury	1.Scald ☐
		2.Flam ☐
		3.Electrical ☐
		4 .Others ☐

6	Depth of burn injury	Partial thickness ☐
		Full thickness ☐
7	% TBSA	1.<20%..... 2 >20%.....
8	Pre exsting disease	1.yes 2 no
9	Pre-existing medical condition	1.Epilepsy
		2.HIV/AIDS
		3.DM
		4.phycatric disorder
		5.others
10	Cause of admission	1.Airway compromise
		2.Arrthymia
		3.Shock
		4.Loss of consiousnes
		5.Other
11	Burn wound management	Yes NO
12	Blood transfusion	1.yes
		2.no
13	Anatomic location burned	1.Head and neck
		2.extermity
		3.trunks
		4.others
14	Mechanical ventilation	1.yes
		2.no

15	Vassopressor	1.yes 2 no
16	Surgery done	1.yes 2.no
17	Abnormal glaycemic level	1.yes 2 .no
18	Potassium fluctuation	1.yes 2.no
19	Sodium fluctuation	1.yes 2.no
20	RFT abnormal	1.yes 2.no
21	LFT	1.yes 2.no
22	Complication	1.yes 2.no
23	Length of ICU stay in days	…….day
24	Complication at ICU	1.Aspiration. 2.Arrthymia 3.anemia 4.Malnurtrition 5.Sepsis 6.Cardic arrest 7.Others
25	Last status of the patient	1.died 2.alive at end of follow up 3.dischareched against medical advice

		during follow up period 4.Reffered to other hospital ……/…./

NB:Age classification :Reffereced based on international trauma and burn classification guide line,previous study done in Malaysia. Others burned anatomic body parts such as Buttocks and genitalia,multiple area. Others cause of admission such as low oxygen saturation. Others mechanism of injuries such as thermal,contact,chemical burn.Timing of getting medical care hours classification based on study in Turkey. %TBSA : classification based on Malaysia study.

Annex II: Information Sheet

Title of the Research Project: Survival status and predictors of mortality among Burn patients admitted to intensive care unit of governmental hospitals in Addis Ababa, Ethiopia 2023: A retrospective cohort study .

Name of Principal Investigator: Habtu Tsehayu

Name of the Organization: Addis Ababa University, College of Health Science, Department of Anesthesia

Sponsor: Addis Ababa University

Purpose of the Research Project: To estimate the incidence and predictors of mortality among Burn patients admitted to intensive care units of governmental hospitals in Addis Ababa from Juanury 1,2019 to December 30,2022.

Introduction:The management of Yekatit 12 Hospital Medical College, Saint Paul Hospital Millennium Medical College, Addis Ababa Burn and Trauma (AaBET) Hospital, and the hospital's critical care unit coordination office are the intended recipients of this information sheet. The purpose of the form was to provide the above-mentioned offices with clarification of the research's objectives, methods of data collection, and approval for its conduct.

Procedure: In order to achieve the above objectives, cards of selected Burn patients who are newly admitted to the intensive care unit between Juanury 2019 and December 2022 was included.

Risk or Discomfort: It poses no risk to the person who reviewed the material to take part in this study effort.

Benefits:. One whose record or paper is used in the research does not directly gain from it. The indirect advantage of the study, however, is clear-cut for the participant and all other program participants. This is so that clients can receive appropriate care and treatment services if program planners are creating an anticipated strategy. The research effort has the most immediate advantage for healthcare planners and managers, especially those involved in the development and management of programs for chronic diseases,Trauma related disorder.

Confidentiality: The collection and extraction of the records by healthcare experts ensures the confidentiality of the customers' records. The chosen charts were then examined by the data gatherers. The data gathered for this research project was maintained with tight confidentiality, and the information analyzed on the study's clients was kept in a file without a name, i.e., the researcher used numerical codes to identify the record when reviewing it. Only the lead investigator had access to the information, which was password-protected and secured with the proper locks.

Person to contact: This research project was reviewed and approved by the Institutional Review Board of the Department of Anesthesia. College of Health Sciences. Addis Ababa University .If you want more information about the research and its undertakings, contact the committee through the advisor or principal investigator below.

1. Mulualem Sitot (MSc), Addis Ababa University, College of Health Sciences, Department of Anesthesia: Advisor Tel: **+251-921523614**

2. **Habtu Tsehayu**: Addis Ababa University, College of Health Sciences, Department of Anesthesia principal investigator Tel: +**251928557992** e-mail: **Habtutshayu2@gmail.com**

Permission: In order for the researchers to receive cooperation from the data clerks and other responsible entities, we respectfully request that you grant permission and transmit this request to the appropriate body within your organization.

Annexe III:Tables and Graphs

Table 6: All Socio-demographic Factors of burn patients admitted to ICU from 2019 to 2022,Adiss Abeba ,Ethiopia 2023**.**

Variable	**All episodes,n(%) (n=416)**	**Censored,n(%) (n=267)**	**Non survival,n(%) (n=149)**
Residencey			
Rural	225(54.1%)	109(48.4%)	116(51.6%)*
Urban	191(45.9%)	158(82.7%)	33(17.3%)
Time of getting medical care			
Within 6 hour	286(68.8%)	243(84.96%)	43(15.04%)
6 hour to 24 hour	57(13.70%)	16(28.07%)	41(71.93%)
24 hour to 48 hour	55(13.22%)	7(12.72%)	48(87.28)**
After 48 hour	18(4.33%)	1(5.6%)	17(94.4%)***
Age			
Less than 5 years	54(12.98%)	37(68.5%)	17(31.5%)
5 years to 18 year	63(15.14%)	14(22.2%)	49(77.8%)**
19year to 65 year	227(54.6%)	167(73.13%)	60(26.87%)
Above 65 years	72(17.31%)	49(70.8%)	23(29.2%)
Sex			
Male	203(48.8%)	138(65.5%)	65(34.5%)
Famele	213(51.20%)	129(60.6%)	84(39.4%)
Mechanism of injuries			
Scald burn	118(28.37%)	86(72.88%)	32(27.12%)
Flame burn	175(42.07%)	98(56%)	77(44%)

Electrical burn	83(19.95%)	46(43.38%)	47(56.62%)**
Others*	40(9.62%)	37(92.5%)	4(7.5%)

NB:* Significant predictors Famel,rural.** Significant predictors getting of medical care btewen 6 hour to 24 hour, patients age beteween 5 year and 18 years ,electrical burn. *** signidficant predictors Burn patients getting medical care within 24 hour and 48 hour and after 48 hour.

***Table 7*:**Melticolliniarity test using VIf for indipendant variable**.**

Variable	**VIF**	**1/VIF**
Potasium abnormal	1.98	0.504665
Time getting medical care	1.81	0.552651
Sodium abnormal	1.76	0.569595
RFT abnormal	1.65	0.604410
LFT abnormal	1.63	0.613058
Dysglaycemic	1.47	0.678184
Depth	1.44	0.693513
Cause of admission	1.43	0.701130
Age	1.36	0.735739
Vassopressor use	1.33	0.750885
Surgery done	1.29	0.772969
Mechanism of injury	1.27	0.790024
Residencey	1.26	0.791314
Mechanical Ventilation	1.23	0.811179
Disease	1.21	0.823607
Burned body part	1.21	0.827345
TBSA	1.20	0.831596
SEX	1.13	0.885895
Blood transfusion	1.11	0.901647
Wound care	1.07	0.937423
Complication	1.05	0.948640
Mean VIF	**1.38**	

Figure 11: log-log plot by Depth, %TBSA, mechanical ventilation and Vassopressor

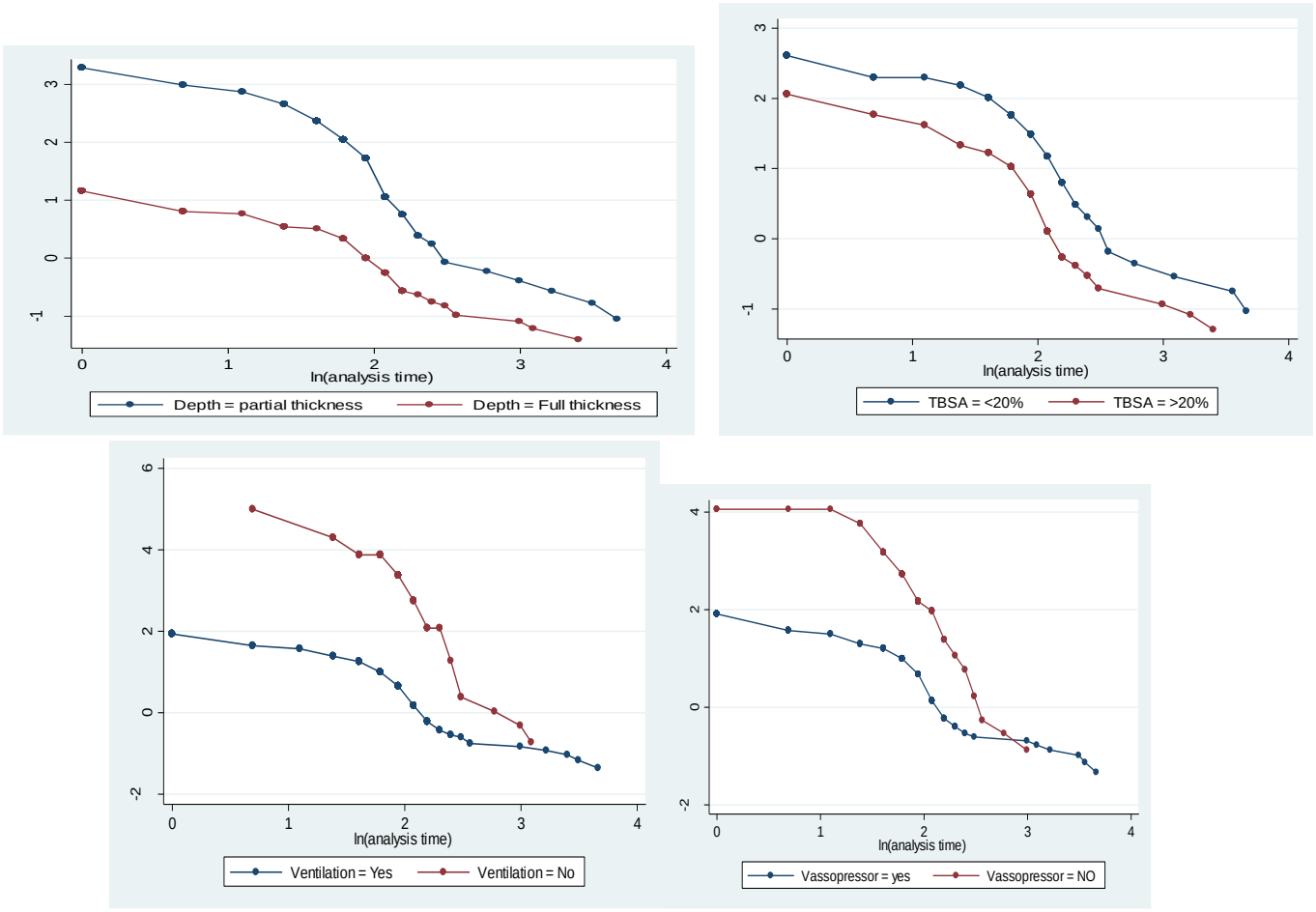
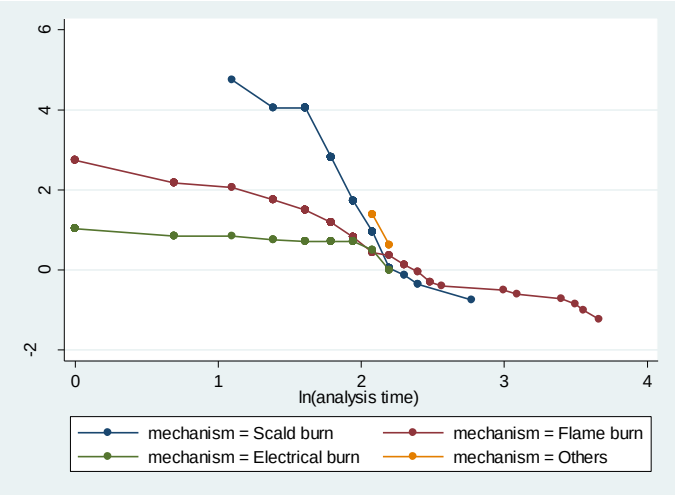
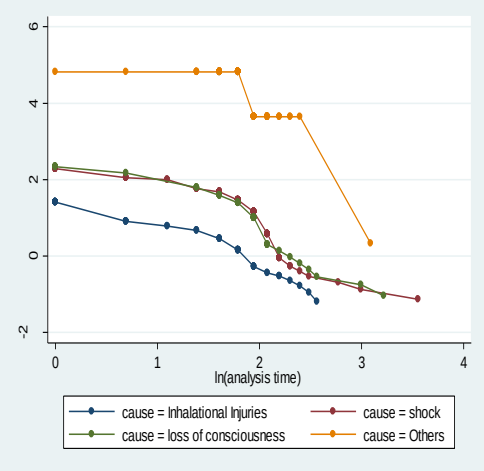
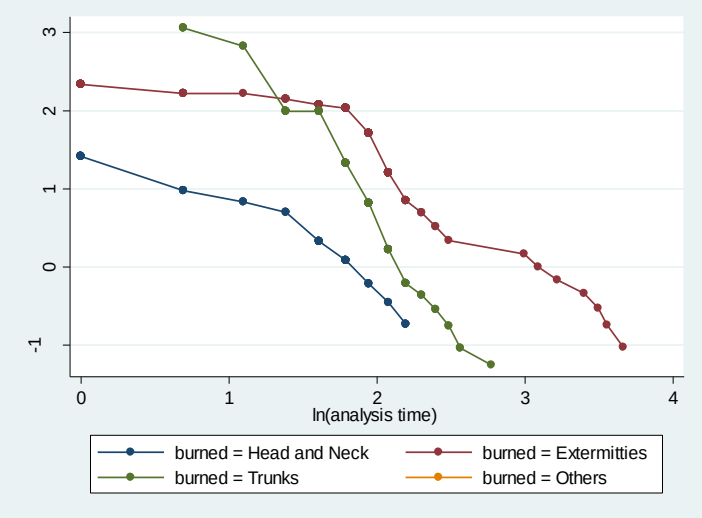
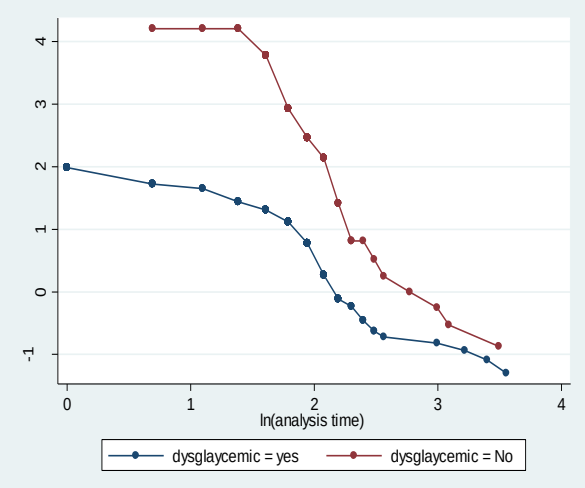


Figure 12:log log plot by Mechanism of injury,cause of Admission, and Abnormal glaycemic ,Anatomic body parts and age respectively.









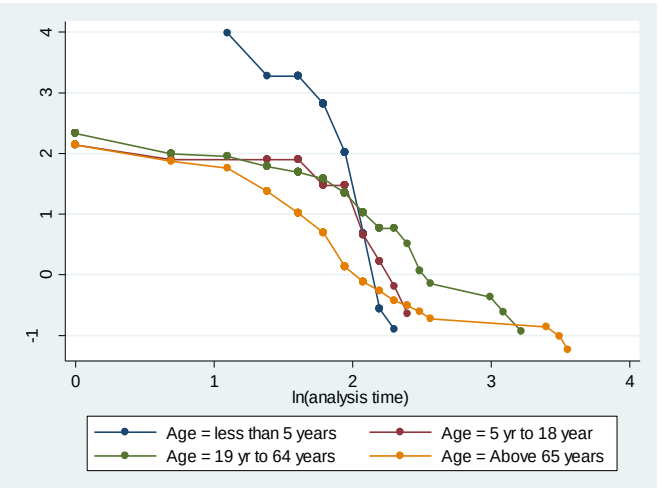
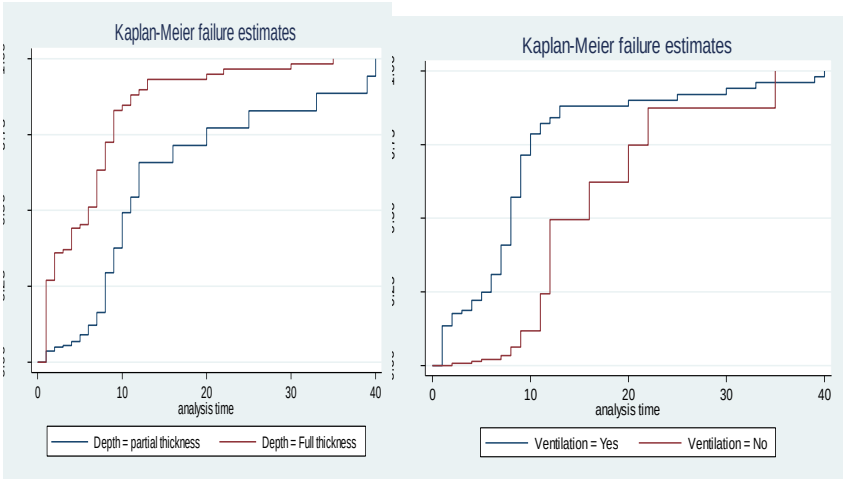


Figure 13: Kaplan Meir failure estimate by Depth, %TBSA, mechanical ventilation and vasopressor.



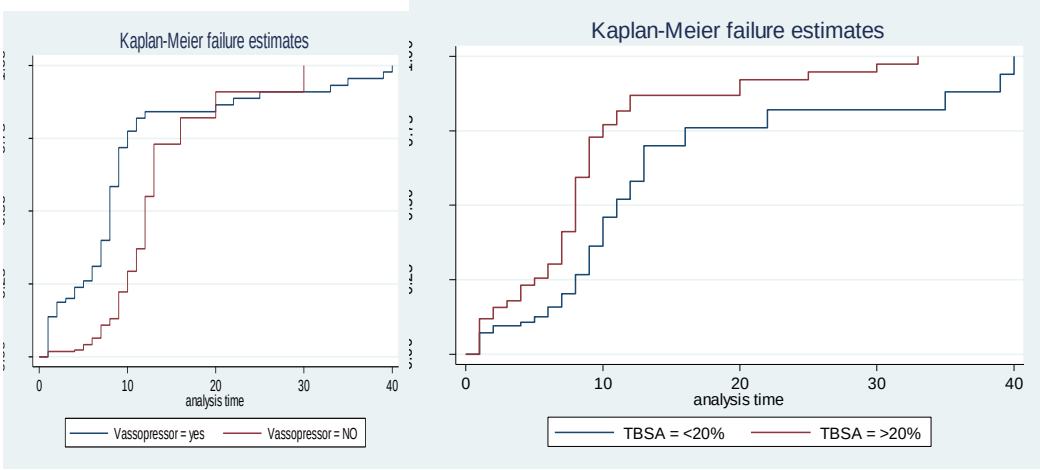
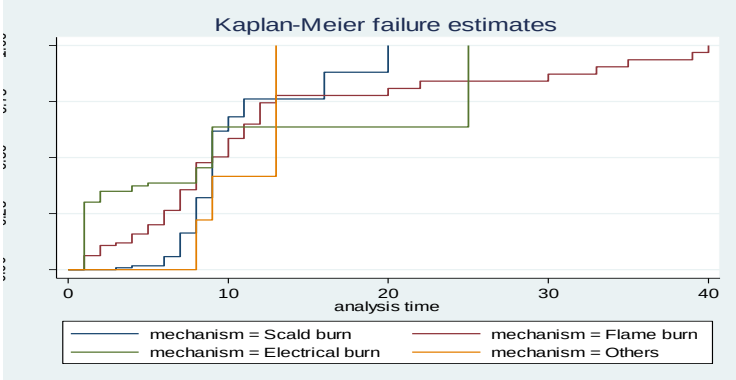
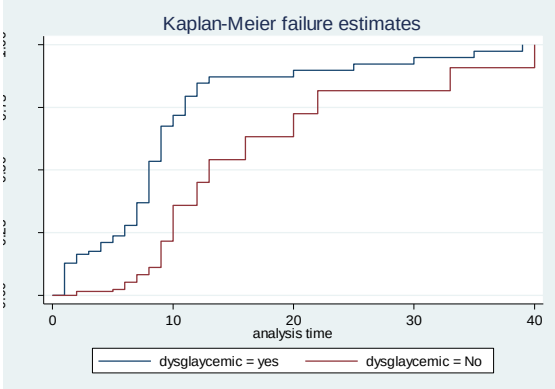
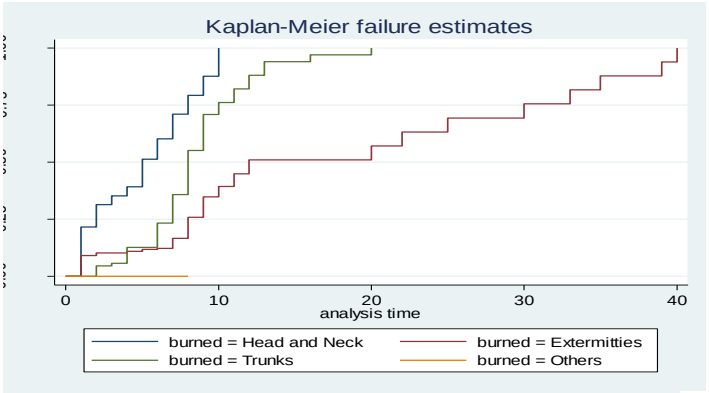
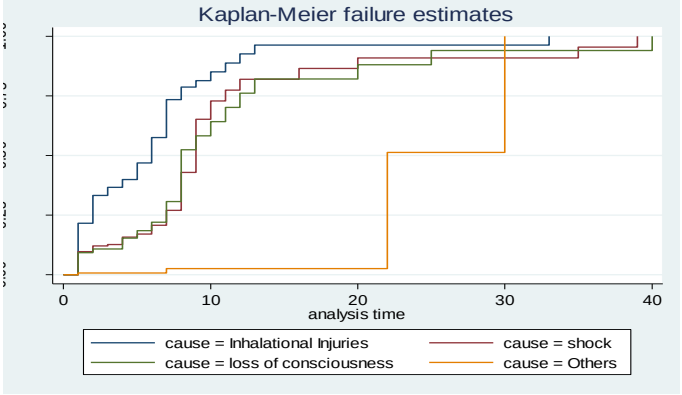


Figure 14: KM failure by abnormal glucose leve,,mechanism of injury,cause of admission,and anatomic body part.






Kaplan-Meier failure estimates
0
10
20
30
40
analysis time
burned = Head and Neck
burned = Trunks
burned = Extermitties
burned = Others


Kaplan-Meier failure estimates
0
10
20
30
40
analysis time
cause = Inhalational Injuries
cause = loss of consciousness
cause = shock
cause = Others

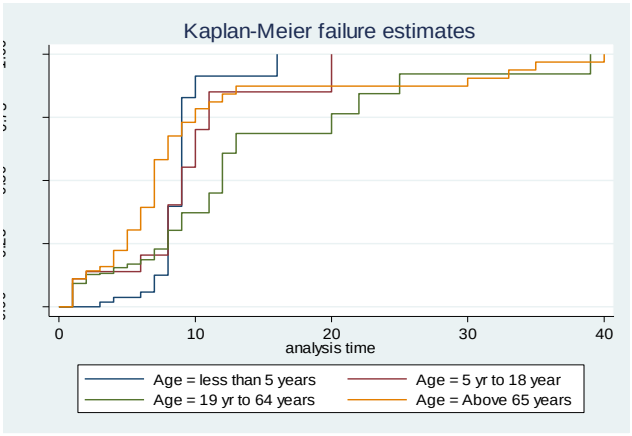

Kaplan-Meier failure estimates
0
10
20
30
40
analysis time
Age = less than 5 years
Age = 19 yr to 64 years
Age = 5 yr to 18 year
Age = Above 65 years

Table 8. Schonelfeld residual

Variables	**Rho**	**chi2**	**Df**	**Prob>chi2**
Residencey	0.04968	0.46	1	0.4979
Time	0.07509	1.23	1	0.2674
Age	- 0.03538	0.24	1	0.6226
SEX	-0.08711	1.24	1	0.2650
Mechanism	-0.13224	2.32	1	0.1276
Depth	-0.07697	1.11	1	0.2915
TBSA	0.05844	0.77	1	0.3797
Disease	-0.07326	0.91	1	0.3410
Cause of admission	0.05518	0.49	1	0.4827
Anatomic body parts	0.06264	0.73	1	0.3941
Wound management	0.11793	2.00	1	0.1574
Blood transfussion	-0.00691	0.01	1	0.9274
MV	0.18287	5.59	1	0.0181
Vasopresser	0.17552	5.41	1	0.0200
Surgery done	-0.04490	0.32	1	0.5734
Dysglaycemic	0.07989	0.90	1	0.3435
K^+	0.09673	1.55	1	0.2125
Na^+	-0.00270	0.00	1	0.9715
RFT	-0.05574	0.52	1	0.4703
LFT	-0.10368	1.95	1	0.1629
Complication	-0.07968	0.00	1	1.0000
global test		34.25	30	0.2711