ADDIS ABABA UNIVERSITY

COLLEGE OF HEALTH SCIENCES

SCHOOL OF MEDICINE

DEPARTMENT OF ANESTHESIA

# INCIDENCE AND RISK FACTORS OF MORTALITY AMONG THORACIC SURGICAL PATIENTS ADMITTED TO INTENSIVE CARE UNITS OF GOVERNMENTAL HOSPITALS IN ADDIS ABABA, ETHIOPIA: A MULTI-CENTER RETROSPECTIVE FOLLOW UP STUDY


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**A RESEARCH THESIS SUBMITTED TO THE DEPARTMENT OF ANESTHESIA, COLLEGE OF HEALTH SCIENCES, ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE MASTER OF SCIENCE IN ANESTHESIA.**

**JUNE 2023**

**ADDIS ABABA, ETHIOPIA**

# ADDIS ABABA UNIVERSITY

# COLLEGE OF HEALTH SCIENCES

# SCHOOL OF MEDICINE

# DEPARTMENT OF ANESTHESIA

## Master thesis Research submission form

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| Duration of the study | January 01 to March 30 2023 G.C |
| Study area | Tikur Anbesa specialized hospital, Addis Ababa, Ethiopia<br>Menelik II Comprehensive specialized hospital, Addis Ababa, Ethiopia<br>Saint Peter specialized hospital, Addis Ababa, Ethiopia |
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## APPROVAL SHEET

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I hereby certify that this thesis is my own and confirm it in the form of a signature below. Preparations, data collection, analysis, and finishing of this thesis have all been conducted per scholarship ethics. I confirm that all of the sources relied upon in this document have been cited and referred to. In the preparation of this thesis, all efforts were taken to prevent plagiarizing. This Research thesis is submitted in partial fulfillment of the requirement for a Master's Degree from Addis Ababa University at the College of Health Sciences, School of Medicine Department of Anesthesia. The Research thesis is deposited in the Addis Ababa University Digital Library and is made available to the local, national, and international scientific community. To the best of my recollection, that thesis was not submitted anywhere to any other institution for awarding a degree, diploma, or certificate. If the source is properly and completely acknowledged, short quotes from this thesis may be used without specific permission. Where in his or her view that the proposed use of this material is conducive to scholarship and publication, the Head of the Department or all advisors of these shall be entitled to grant a request for extended quotations from whole or partial copies of any such thesis. However, the author of the thesis must have his or her approval to do so at all other times.

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## ACKNOWLEDGMENTS

First and foremost, I want to thank my all-powerful God. Next, I would like to acknowledge Addis Ababa University, College of Health Sciences, and Department of Anesthesia for allowing me to accomplish this research thesis.

Furthermore, I would like to extend my sincere gratitude to my advisors: Mr.Leulayehu Akalu (Assistant professor in Anesthesia) and Mr. Mulualem Sitot (BSc, MSc lecturer in Anesthesia) for their unreserved timely and continuous support in advising and giving comments throughout the work of this Research thesis.

Finally, my special thank goes to my friends for giving their invaluable and continuous comments, support, and guidance starting from title selection up to the fruitful conclusion of this Research paper.

# ABBREVIATIONS AND ACRONYMS

| | |
|---|---|
| APACHE | Acute Physiology and chronic health evaluation |
| ARDS | Acute respiratory distress syndrome |
| ASA | American Society of Anesthesiology |
| CI | Confidence interval |
| COPD | Chronic obstructive pulmonary disease |
| ENT | Ear nose and throat |
| FEV1 | Forced expiratory volume in 1 second |
| G.C | Gregorian calendar |
| HDU | High dependency unit |
| ICU | Intensive care unit |
| IRB | Institutional review board |
| OR | Odds ratio |
| PI | Principal investigator |
| SPSS | Statistical package for social studies |
| TASH | Tikur Anbessa specialized hospital |
| TEA | Thoracic epidural analgesia |

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# ABSTRACT

**Background:** Thoracic surgery is a branch of medicine concerned with the diagnosis and surgical treatment of conditions caused by illness or injury to the thoracic cavity. Intensive care unit gives the intense care and life support for critically ill and injured patients. Patients in a thoracic surgery intensive care unit have severe respiratory and hemodynamic instability. The intensive care unit had a high mortality rate.

**Objectives:** To assess the incidence and risk factors of mortality among thoracic surgical patients admitted to the intensive care units of Governmental Hospitals in Addis Ababa from December 2020 to December 2022 G.C.

**Methods:** Multi-center Retrospective follow up study was employed. Two years of patients chart were reviewed from December 2020 to December 2022 in Addis Ababa Hospitals in Tikur Anbessa, Menelik II, and Saint Peter Hospital. All thoracic surgical patients admitted to the intensive care units in the study period were included. 230 patients in the intensive care unit were included. Purposive sampling and simple random sampling technique was used to select the three hospitals and collect the data respectively. The data was collected by using the mobile phone kobo tool box version 2022.3.6. Data were cleaned, checked, and exported into SPSS version 26 for analysis. Bivariate and multivariate logistic regression analysis was done. Finally, a p-value of less than 0.05 in the multivariate logistic regression model was identified.

**Result:** 230 patients' charts were reviewed in the study with giving a response rate of 100%. The mortality rate was 12.61% with a 95% confidence interval of (0.08, 0.17). Duration of ICU stay >7 days (AOR:4.921,95% CI:1.513,16.002), patients who were not managed by thoracic epidural analgesia (AOR:4.338,95% CI:1.439,13.072), low ICU platelet count (AOR:21.289,95% CI:1.347,336.549) and increased blood transfusion requirements (AOR:3.124,95% CI:1.025,9.519) were identified as a risk factor for ICU mortality.

**Conclusion:** The study confirmed that the mortality rates were high. Duration of ICU stay greater than 7 days, patients who were not managed by thoracic epidural analgesia, low ICU platelet count, and increased blood transfusion requirements were risk factors for intensive care unit mortality. Therefore health professionals should be cautious for patients who had prolonged stays in the ICU, apply and trend thoracic epidural analgesia for pain management during thoracic surgery, treat the underlying cause of low platelet count, and apply blood conservation strategies and quantify the amount of blood loss perioperatively.


**Key words: Incidence, Risk factors, Thoracic surgery, Mortality, Intensive care unit**

# CHAPTER ONE: INTRODUCTION

## 1.1 Background

Thoracic surgery is a subspecialty of medicine concerned with the diagnosis and surgical treatment of conditions caused by illness or injury to the esophagus, lungs, heart, and other structures within the chest. Thoracic surgery necessitates the skills of a variety of surgeons, including cardiothoracic, congenital heart, general thoracic and cardiovascular surgeons (1).

Thoracic surgery tends to treat conditions affecting the thorax region of the body including: the esophagus, lungs, mediastinum, trachea, and diaphragm (2). Patients in a thoracic surgery intensive care unit have severe respiratory as well as hemodynamic instability.

Elective surgical patients are admitted to the thoracic surgery intensive care unit for postoperative monitoring. The European Thoracic Surgery Association recommends a high-dependency unit and patients undergoing major elective thoracic surgery be monitored in an intensive care unit after surgery (3).

Patients at the thoracic surgery intensive care unit come in with a variety of disease and conditions, from elective surgical patients to trauma victims (3). Thoracic surgical patients frequently need to be monitored in the intensive care unit (ICU). When these patients are admitted to the ICU, there is a lack of intensive care unit beds, a rise in hospital expenses, and clinical issues such as an increased risk of nosocomial infection or disorientation (40).

Intensive care unit has a high mortality rate. As a result, intensive care unit physicians must consider the factors that affect mortality to improve their approach to and observation of thoracic patients (3). As a result, no accepted algorithms for intensive care unit admittance or follow-up exist, the Acute Physiology and Chronic Health Evaluation II score (APACHE II) is a widely used method for determining severity and prognosis (4).

## 1.2 Statement of the problem

The thoracic surgical patients' population can pose significant clinical challenges. Patients are frequently older, current or former smokers, and sicker than patients in other surgical populations. These patients frequently have underlying chronic lung disease, hypertension, diabetes, and baseline renal insufficiency. They have less physiologic reserve and a lower ability to recover from perioperative complications. They are especially vulnerable to pulmonary complications, which are extremely unpleasant. As a result, they are more likely than other patient populations to require the services of an intensive care unit (5).

During thoracic surgery there are several derangements of the physiological parameters due to the location of major solid organs like the heart, lungs, and structures that are found on the mediastinal structures, the great vessels and nerves because of these patients are at high risk of developing perioperative complication and mortality (6).

Thoracic surgical procedures result in arrhythmia and hypotension due to interference of the chest cavity and intrathoracic structures, increasing the incidence of mortality in thoracic surgical patients admitted to intensive care unit. The most common complications following thoracic surgery are pulmonary in nature, the most frequent being pneumonia and atelectasis (7).

When compared to non-cardiothoracic surgery, it is more difficult to predict postoperative pulmonary complications after elective cardiothoracic surgery. Thoracic surgery is known to be high risk, with patient factors such as poor general health status, chronic obstructive pulmonary disease, body mass index greater than 30 $kg/m^2$, low forced expiratory volume in 1 second (FEV1), and low predicted postoperative FEV1 being associated with increased risk (8).

The surgical approach is different for different types of surgical indication and the surgeon needs separation of the lung and the surgery done by general anesthesia with double lumen endotracheal tube and in need of ventilation of one lung because these patients are at high risk of hemodynamic instability like hypotension, hypoxemia, atelectasis and due to position effect alteration of ventilation and perfusion happens (9).

Morbidity and mortality in surgery are common problems that surgeons and other health professionals bear in the path of their work (10). Although the worldwide incidence of postoperative mortality is predicted to be 4%, data on surgical outcomes in developing nations are scarce. The African surgical outcomes study (ASOS) has revealed that, while patients in Africa are favored enough to have access to surgical treatment, surgical patients outcomes are relatively poor. African surgical outcome study discovered that African surgical patients were two times as likely to die after surgery as the global average, despite having an indistinguishable complication rate (11).

Mechanical ventilation, poor pre-event performance status, high admission Acute Physiologic and Chronic Health Evaluation III scores with vasopressor use, and refractory disease are all associated with poor intensive care unit outcomes (12).

The mortality rate of patients underwent thoracic surgeries admitted to intensive care units according to different studies range from 2.9%-19% and also had a wide variation in the result (3, 15-17, 22, 24, 28).

Factors that affect the mortality rate in intensive care units are increasing age, infection, massive hemorrhage, cardiovascular and pulmonary complications, prolonged intensive care unit stay, increased American society of Anesthesiology (ASA) status, use of mechanical ventilation, hypernatremia, acute renal failure, and anemia (3,13-15, 17,19,21-23,29).

The intensive care unit is the most expensive area of care in a hospital. The availability of intensive care unit beds may be limited by patients who stay for an extended period of time or by a dearth of skilled ICU staff. As a result, it is critical to identify patients who have an increased incidence and factors that raise the mortality rate (42, 43).

### 1.3 Significance of the study

Assessing the mortality rate and risk factors of mortality is a useful method for measuring the quality of decreasing and adopting steps for thoracic surgical patient hospital management. A better understanding of the incidence of mortality and risk factors can reduce intensive care unit mortality and complications while also improving the quality of care provided to thoracic surgical patients in the intensive care unit. This research will help thoracic surgeons, anesthetists, intensive care unit nurses; internists, policymakers, and program managers track operational activities in the operating room and intensive care unit in order to enhance the outcomes of thoracic surgical patients. As a result, the study aims to assess the incidence and risk factors of mortality among thoracic surgical patients admitted to the intensive care units.

The incidence and risk factors of mortality among patients admitted to intensive care units for general surgical procedures have been studied, but not for patients undergoing thoracic surgery. Determining the incidence and risk factors allows taking proactive steps to lessen its effects and burdens while also improving the likelihood that the patient will survive after being discharged from the intensive care unit. This study finding about the incidence and risk factors of mortality among thoracic surgical patients admitted to the intensive care unit can potentially serve as a background for future studies on similar subjects.

Although there have been studies conducted in other parts of the world, including Ethiopia, there have not been enough studies conducted in the area we are studying, and there is a paucity of knowledge regarding the incidence and risk factors of mortality among thoracic surgical patients admitted to intensive care units that influence their outcomes. Different researches predict the incidence and risk factors of mortality among thoracic surgical patients admitted to intensive care units consider variables such as age, gender, preexisting disease, stay on the intensive care unit, duration on mechanical ventilator, but further independent variables like type of endotracheal tube used, Inotropic and vasopressor support in the ICU, intervention and complication during ICU stay, laboratory investigation, blood transfusion requirements, duration of surgery and anesthesia added.

# CHAPTER TWO: LITERATURE REVIEW

According to the retrospective study done in New York in 2006 at Memorial Sloan Kettering Cancer Center, 2039 patients underwent lung resections. The mortality rate of pneumonectomy accounts 50% followed by lobectomy 42% and sub-lobar resections 22%. Increased age was associated with a higher ICU mortality, There was a marginally significant association between mortality and time of presentation to the ICU after surgery (p= 0.06) (13).

According to the study done in New York in 2010, 80 participating centers and 1267 patients were selected and the incidence of mortality was 5.6%, and the frequency of major undesirable perioperative events was 30.4%. Significant morbidity was associated with pneumonia, adult respiratory distress syndrome, empyema, sepsis, bronchopleural fistula, pulmonary embolism, ventilatory support beyond 48 hours, reintubation, tracheostomy, atrial or ventricular arrhythmias requiring treatment, myocardial infarct, reoperation for bleeding, and central neurologic event (14).

In a retrospective study done in Texas, 197 patients were included and the incidence of mortality in this group of patients were 7% and the mortality was not significantly affected by age, sex, or Goldman criteria. Patients who had a right pneumonectomy had a greater operative mortality rate 12% compared with patients who had a left pneumonectomy 1%, ($P<0.05$) (15).

According to an observational study done in Switzerland in 2002,193 pneumonectomies were performed for non-small cell lung carcinoma in two related institutions. The 30-day mortality rate was 9.3% and cardiovascular and respiratory complications occurred in 47% of pneumonectomy cases (16).

According to the study done in Switzerland in 2006, 1239 thoracotomies were done for an indication of lung cancer; the mortality rate was 2.9%. 1.1% in mildly impaired or normal pulmonary function tests, 5.8% in moderate chronic obstructive pulmonary disease (COPD), and 3.1% in severe COPD. The mortality rate was associated with acute lung injury 41%, heart problems 31%, bleeding 19%, or unidentifiable causes 8% (17).

According to the cohort study done in Germany in July 2004, 2563 patients were enrolled for the study within 3 years duration. Mortality was linked with renal, respiratory, and heart failure as well as age, raised APACHE II scores and concluded that patients who have prolonged intensive care unit stay have a significantly higher mortality rate (18).

In another prospective cohort study done in Germany in 2010, 6007 patients admitted to the cardiothoracic surgical intensive care unit the incidence of mortality in 30 days postoperatively was 3.5 % (19).

In an observational cohort study done in Greece in 2012 from September 2010 to January 2011 among 194 patients who were admitted to cardiac surgery intensive care unit of a general tertiary hospital in Athens the 30-day mortality was 13.3%. The result showed that patient who has preoperatively raised serum creatinine >1.4 mg/dl had three times greater probability to have greater than two days intensive care unit stay and patients with mean intraoperative blood glucose >130 mg/dl had an almost 3 times greater risk for longer intensive care unit length of stay. The study Conclude that patients with preoperative acute renal failure were associated with 6.3 times as greater risk of having an intensive care unit length of stay of greater than 2 days (20).

According to the retrospective study done in France in 2015, patients who undergoing esophagectomy for esophageal cancer among 30 centres from 2000 to 2010 the in-hospital mortality was 7.3% and risk factors of in-hospital mortality were pulmonary complications and affecting 38.1% of patients, followed by surgical site infection 15.5%, cardiovascular complications 11.2%, and anastomotic leak 10.2%. American Society of Anesthesiologists grade IV, anastomotic leak, and pulmonary, cardiovascular, and neurological problems were all factors that were independently a risk factors for 30 day postoperative mortality. About 30% of patients experienced postoperative death due to surgical complications, as opposed to 68% of patients who died from medical causes (21).

According to a study done in Spain in 2002 they reviewed retrospectively 242 patients undergoing pneumonectomy for lung cancer over 12 years and the intensive care unit mortality rate was 5.4%. Risk factors for mortality were acute respiratory failure 14%, acute renal failure 8.7%, reintubation 5.4%, pneumonia 3.3%, atelectasis 2.9%, post

pneumonectomy pulmonary edema 2.5%, mechanical ventilation more than 24 hours 1.2% and pneumothorax 0.8% (22).

A retrospective study was done in Poland in 2006 on the medical records of 121 patients in four institutions. The overall mortality was 3.3%: 1 patient (0.8%) died due to acute respiratory failure, 1 patient due to acute myocardial infarction and 2 (1.6%) after the reoperations for bronchopleural fistula. Risk factors of mortality and increased risks of complications were COPD, altered predicted FEV1, and overweight (23).

According to a retrospective cohort study done in Vienna in 2010, 2699 patients underwent cardiac surgery during the study period and 2314 patients were included in the study. The incidence of mortality was 19% and intensive care unit hypernatremia was a risk factor of mortality compared to patients without hypernatremia (8%; $p < 0.01$). Patients with hypernatremia had a longer ICU stay (17 days versus 3 days; p 0.01), and ICU-acquired hypernatremia was an independent risk factor for ICU mortality within 28 days (24).

According to the study done in Germany in 2012, a total of 4054 thoracic surgical patients were admitted to the intensive care unit and the incidence of mortality in the intensive care unit was 5.8%, and risk factors of postoperative mortality was prolonged intensive care unit stay and type of surgical procedure (25).

According to the United Kingdom prospective observational study done in 2009, patients undergoing pneumonectomy for lung cancer from January 1 to December 31, the 30-day and in-hospital mortality rates were 5.4% and 4.8%, respectively. Risk factors for pneumonectomy were respiratory causes accounted for 58.8%, major hemorrhage 23.5% and myocardial infarction 17.6% (26).

A retrospective cohort study was done in Korea in 2010 between 1994 and 2009, 425 thoracic surgical patients undergoing pneumonectomy for primary lung cancer 164 who were preoperatively evaluated with lung perfusion scanning methods. The early mortality rate was 12.8% (n=21). Causes of early mortality were surgical bleeding, ARDS, bronchopleural fistula followed by aspiration pneumonia, and empyema without bronchopleural fistula (27).

A retrospective study was done in china shanghai chest hospital in 2021 with 1140 patients who received McKeon esophagectomy. ICU readmission occurred in 3.8% of cases. Respiratory failure was identified as the primary reason for readmission, in 30 individuals 70%. Multivariate analysis identified heavy smoking, intraoperative hypoxemia, and mechanical ventilation during initial ICU, postoperative anemia, and unplanned reoperation were independent risk factors for ICU readmission (28).

According to the study done in 2021 in a prospective study of 141 centers across 41 countries following esophageal surgery for esophageal cancer, 2247 patients were followed for 90 days. In high-income nations and low and middle income nations, the incidence of mortality was 8.4% and 2.3% for low and middle income nations and high-income nations respectively. The overall complication rate was found to be significantly higher in high-income nations than low and middle income nations (65.0% vs. 54.5%, $p < 0.001$) (29).

A study done in Turkey in 2011, a total of 141 patients admitted to the thoracic surgical intensive care unit of the Denizli State Hospital, the mortality rate was (16.3%.). Advanced age was risk factors for ICU mortality. Mortality increased in the intensive care unit as the length of stay increased and the median length of intensive care unit stay was 7 days in the patients who died in the intensive care unit. The most predisposing factor for morbidity were hemorrhage 12.3%, atelectasis 7.8%, pneumonia 4.2%, and wound infection 1.4% (3).

### 1.1 Conceptual framework

Intensive care units mortality among thoracic surgical patients were affected by socio-demographic and patient's factors, surgical, Anesthetic and postoperative factors. The conceptual framework was developed from reading and reviewing and different study on thoracic surgery.

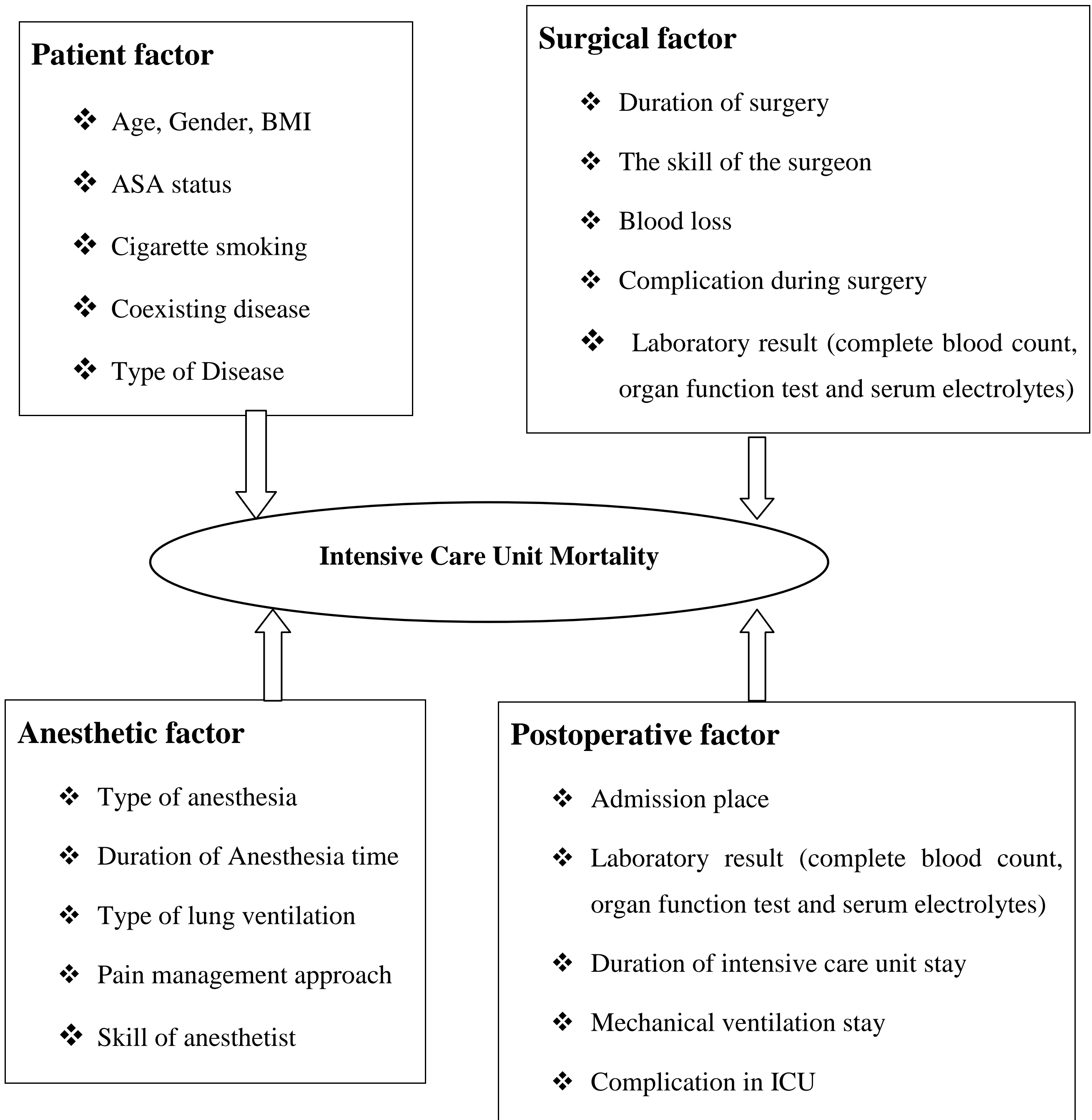


**Figure 1: Conceptual framework on intensive care unit mortality and its risk factor from a review of the literature (3, 22, 26, and 40).**

# CHAPTER THREE: OBJECTIVES

## 3.1 General objectives

- To assess the incidence and Risk factors of mortality among thoracic surgical patients admitted to intensive care units of Governmental Hospitals in Addis Ababa, Ethiopia from December 2020 to December 2022 G.C

## 3.2 Specific objectives

- To assess the Incidence of Mortality among thoracic surgical patients admitted to intensive care units of Addis Ababa Governmental Hospitals
- To identify the Risk factors of Mortality among thoracic surgical patients admitted to intensive care units of Addis Ababa Governmental Hospitals

## 3.3 Research questions

1. What is the Incidence of mortality among thoracic surgical patients admitted to intensive care units in Addis Ababa Hospitals?
2. What are the Risk factors of mortality among thoracic surgical patients admitted to intensive care units in Addis Ababa Governmental Hospitals?

# CHAPTER FOUR: METHODS AND MATERIALS

## 4.1 Study Area

The study was conducted in Addis Ababa Governmental Hospitals: Addis Ababa is the capital city of Ethiopia. There are around 13 Governmental Hospitals and greater than 40 private Hospitals; this study was conducted in three Governmental Hospitals which are a center for thoracic surgery: Tikur Anbessa Specialized Hospital, Menelik II Comprehensive Specialized Hospital, and Saint Peter Specialized Hospital.

Tikur Anbessa Specialized Hospital was established in 1972 G.C and one of the largest tertiary Hospitals in Ethiopia. Different surgical procedures are done like general surgeries, urologic surgeries, orthopedic surgeries, thoracic surgeries, pediatrics surgeries, gynecological surgeries, ENT surgeries, and is a place for Referral Hospital across the country and delivers both outpatient and inpatient treatment service and the Hospital have different intensive care units like neonatal ICU, pediatrics ICU, general ICU. It has also over 700 beds, 15 operation theatres, and serves as a teaching Hospital.

The second Hospital is Menelik II Comprehensive Specialized Hospital was established in 1909 G.C. It is the first and oldest Hospital and gives services like outpatient and inpatient services, obstetrics follow up and treatment. The Hospital has around 10 operation rooms, and delivers emergency operation room, ENT and thoracic surgeries, general surgeries, pediatrics surgery room, ophthalmic surgeries, and the Hospital has general ICU which has four beds and four mechanical ventilators.

The third Hospital is the Saint Peter Specialized Hospital established in 1961 G.C and located in Gullele sub city around Entoto and was a center for tuberculosis. The Hospital gives services in different areas like outpatient and inpatient treatment services, toxicology centers, medical and surgical wards, obstetrics follow up and management centers and the Hospital has 8 operation rooms and 15 ICU beds and mechanical ventilators and gives services like management for general surgery, orthopedic surgery, gynecological surgery, pediatrics surgery, neurosurgery, obstetrics surgery, and thoracic surgeries.

## 4.2 Study Design and Period

A Multi-center Retrospective follow up study was employed in Addis Ababa Governmental Hospitals from December 2020 to December 2022 and the data extraction period was carried out from January 1 to March 30 2023 G.C.

## 4.3 Source and study population

### 4.3.1 Source population

All thoracic surgical patients admitted to Tikur Anbessa Specialized Hospital, Menelik II Comprehensive Specialized Hospital, and Saint Peter Specialized Hospital.

### 4.3.2 Study population

All thoracic surgical patients admitted to ICUs of selected Hospitals who fulfilled the inclusion criteria and selected for the sample during the study period.

## 4.4 Variables

### 4.4.1 Dependent variables

- Mortality (Yes, No)

### 4.4.2 Independent variables

- Age
- Sex
- Body mass index
- Type of surgery
- Presence of coexisting disease
- History of smoking
- ASA status
- Duration of surgery
- Length of ICU stay
- Pain management approach
- Duration on a mechanical ventilator
- Type of endotracheal tube used
- Occurrence of complication
- Inotropic and vasopressor support
- Amount of blood loss

- Laboratory result (complete blood count, organ function test and serum electrolytes)

### 4.5 Inclusion and exclusion criteria

#### 4.5.1 Inclusion criteria

All thoracic surgical patients who were admitted to the intensive care units of selected Hospitals from December 2020 to December 2022 were included.

#### 4.5.2 Exclusion criteria

- A patient chart that misses vital variables
- Emergency patients came for thoracic surgeries

### 4.6 Sample size determination

The sample size for the incidence and risk factors of mortality among thoracic surgical patients admitted to the intensive care units was calculated using single population proportion formula using the retrospective study done in Turkey (3).

The sample was the following:

**Table 1: sample size determination**

| **Assumptions** | Variable | P value | Sample size |
|---|---|---|---|
| 95% confidence interval<br><br>5% margin of error | | | |
| | Incidence of mortality among thoracic surgical patients | 16.3% | 209 |
| Risk factors of mortality | Acute respiratory failure | 14% | 185 |
| | Hemorrhage | 12.3% | 166 |
| | Length of ICU stay | 4.96% | 72 |

So, from the above table we used the largest sample size with a 95% confidence interval, 5% margin of error, and 10% incomplete or contingency data as parameters to determine the sample size.

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

Where n=sample size

Z=statistics corresponding to the confidence level

P=expected prevalence

d=precision (corresponding to the effect size)

Then by substituting the single proportion formula the sample size was

$$n = \frac{1.96^2(0.163)(1-0.163)}{0.05^2}$$

$$n = \frac{3.842 \times 0.163 \times 0.837}{0.0025}$$

n=209.67 by adding 10% incomplete data the final sample size was n=230

Therefore the sample size required for this study was two hundred thirty thoracic surgical patients.

**4.7 Sampling technique**

Purposive sampling techniques was used to select the three Hospitals which are a center for thoracic surgery, and situational analysis was done based on the Recorded logbook of thoracic surgical patients who underwent thoracic surgery in the intensive care units of the study Hospitals from December 2020 to December 2022. Accordingly 132 elective thoracic surgical patients in TASH, 116 in Menelik II Comprehensive Specialized Hospital, and 97 in Saint Peter Specialized Hospital per two years were admitted to the intensive care units. Finally, the sample size for each study Hospital was allocated proportionally based on their average two years report. So, proportionally from TASH 88, Menelik II Comprehensive Specialized Hospital 77, and Saint Peter Specialized Hospital 65 patient were chosen for the Study during the study period. A simple random sampling technique was used to select participants from each Hospital.

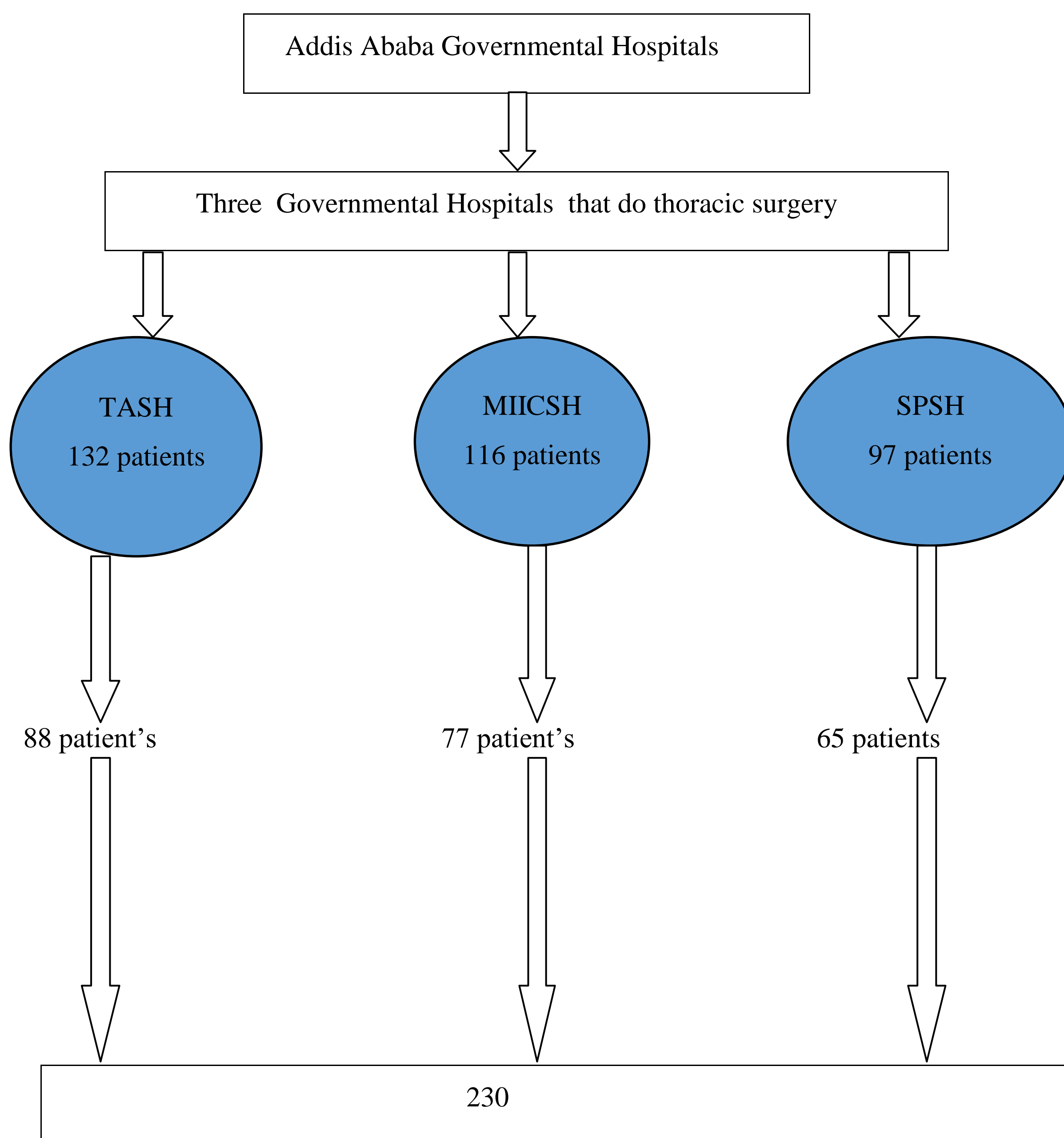


**Figure 2: Proportional allocation of study participants for each selected Addis Ababa Governmental Hospitals, Addis Ababa, Ethiopia, from December 2020-December 2022 G.C**

### 4.8 Operational definitions

**Intensive care unit (ICU)**: Gives the intense care and life support for critically ill and injured patients

**Thoracic surgical ICU**: A special department of a hospital or health care facility in which thoracic surgical patients are admitted for postoperative follow-up or better control of the disease entity and health condition

**Length of intensive care unit stay:** The numbers of days stay in the intensive care unit between admission and discharge from an inpatient care facility

**ASA classification:** Grading system to determine the health of a person before a surgical procedure that requires anesthesia

**Mechanical ventilation:** The technique through which gas is moved toward and from the lungs through an external device connected to the patient

**Vital variables**: Are variables that have a major impact on the conclusion that can be drawn from the data

**Hypoxia:** Hypoxia is a state in which oxygen is not available in sufficient amounts at the tissue level to maintain adequate homeostasis, Oxygen saturation level of lower than 90%

**Anemia:** Defined as hemoglobin levels less than 12 gm/dl in women and less than 13 gm/dl in men

**Hypotension:** Lowering of systolic blood pressure to less than 90 mm Hg or lowering of mean arterial pressure to less than 65 mm Hg

**Hypertension:** Is the pressure in the blood vessels with the systolic blood pressure is ≥140 mmHg and/or the diastolic blood pressure is ≥90 mmHg

**ICU mortality:** End of life that occurs in the intensive care unit after admission to ICU or before discharge to ward

### 4.9 Data collection techniques

A data collection checklist was prepared in English after reviewing literatures and Data was collected by three trained MSc anesthesia students from Tikur Anbessa Specialized Hospital, Menelik II Comprehensive Specialized Hospital, and Saint Peter Specialized Hospital by using a mobile phone kobo tool box version 2022.3.6. preoperative, intraoperative, intervention and complication in intensive care unit were recorded from the patients' medical records.

### 4.10 Data quality assurance and control measures

To assure the quality of data and tools, 5% of the sample size was pretested from Yekatit Hospital and the pretest was not included during the data collection time. Data collectors received brief orientations on the assessment tools as well as training on the study's goals and relevance. All information was gathered during data collection and entered accurately into the format that was planned. The supervisor was controlling the data collector and checked for completeness daily after data collection. For data collection, data collectors were trained for one day on the data collection tool and procedure and also familiarized with the objective and the method of the research.

### 4.11 Data Process and Analysis

The data was cleaned, checked, and from Kobo toolbox exported to SPSS version 26 for analysis. The mean, median, standard deviations, interquartile range, and frequency table were used to display descriptive statistics. Bivariate and Multivariate logistic regression analysis was done to find out the association between dependent and independent variables. To determine risk factors of intensive care unit mortality, variables with a P value of less than 0.2 in bivariate analysis were fitted into the multivariate logistic regression analysis. Finally, a p-value of less than 0.05 in the Multi-variable logistic regression model was used to identify variables significantly associated with the incidence of mortality in the thoracic surgical intensive care unit. To assess the goodness of fit, the Hosmer and Lemeshow test was utilized with the value of 0.739.

### 4.12 Ethical Consideration

Ethical clearance was obtained from the research review board of Addis Ababa University College of Health Sciences and Addis Ababa City Administration Health Bureau, protocol number Anes/20/2022/2023. In addition, an official letter of cooperation was provided to the selected Government Hospitals. The objective was briefly clarified and explained to each Hospital responsible person. Confidentiality was maintained at all levels of the study by not writing the respondent's name and chart numbers on the questionnaire and the information got from medical records was not shared with other persons and was used only for the study.

### 4.13 Dissemination of results

The result will be presented and submitted to Addis Ababa University College of health sciences, Department of Anesthesia and disseminated to Addis Ababa Governmental Hospitals working on thoracic surgery and Addis Ababa City Administration Health Bureau. The result will be published in journals that are peer reviewed scientific journals.

# CHAPTER FIVE: RESULT

## 5.1 Basic socio-demographic patients' Characteristics and preoperative factors

In this study, 230 patients' charts was reviewed and analyzed with giving a response rate of 100%. The median age of the patient was 40 years± 29 interquartile range. The majority of the patients were female 133 (57.8%) and above half of the patients, 141 (61.3%) had a normal BMI with a range of (18.5-24.9).171 (74.3%) of the patients had ASA status II. Under the type of surgery, patients underwent esophageal surgery was 62 (27%) followed by decortication 35 (15.2%) and pneumonectomy 35 (15.2%). Out of 230 patients, 216 (93.9%) patients had no coexisting disease. 150 (65.2%) Patients had normal WBC count, normal hemoglobin level 169 (73.5%), normal hematocrit level was 157 (68.3%), normal platelet level 197 (85.7%), normal serum sodium level 183 (79.6%), normal serum potassium level 190 (82.6%), normal serum chloride level 190 (82.6%) normal AST level 217 (94.3%) and normal serum creatinine level 134 (58.3%) (**Table 2**).

**Table 2: Basic Socio-Demographic characteristics and preoperative factors after thoracic surgery in intensive care units in Addis Ababa Governmental Hospitals, Addis Ababa, (n=230).**

| Factor | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Age | <65 years | 210 | 91.3 |
| | >65 years | 20 | 8.7 |
| Gender | Male | 97 | 42.2 |
| | Female | 133 | 57.8 |
| Body mass index | <18.5 | 78 | 33.9 |
| | 18.5-24.9 | 141 | 61.3 |
| | 25-29.9 | 11 | 4.8 |
| | >30 | 0 | 0 |
| ASA status | ASA I | 46 | 20 |
| | ASA II | 171 | 74.3 |
| | ASA III | 13 | 5.7 |
| Type of surgery | Bullectomy | 4 | 1.7 |
| | Cystectomy | 26 | 11.3 |
| | Decortication | 35 | 15.2 |
| | Esophageal surgery | 62 | 27 |
| | Gastrectomy | 3 | 1.3 |
| | Gastrostomy | 2 | 0.9 |
| | Heller myotomy | 2 | 0.9 |
| | Lobectomy | 21 | 9.1 |

| | | | |
|---|---|---|---|
| | Others* | 29 | 12.6 |
| | Pneumonectomy | 35 | 15.2 |
| | Thoracotomy | 9 | 3.9 |
| | Thoracotomy and diaphragmatic hernia repair | 2 | 0.9 |
| Presence of coexisting disease | None | 216 | 93.9 |
| | Chronic smoker | 3 | 1.3 |
| | Tuberculosis | 2 | 0.9 |
| | Hypertension | 5 | 2.2 |
| | Chronic smoker and COPD | 1 | 0.4 |
| | Hypertension and DM | 1 | 0.4 |
| | Cardiac disease | 1 | 0.4 |
| | Infectious disease | 1 | 0.4 |
| White blood cell count | <4500 | 38 | 16.5 |
| | 4500-10500 | 150 | 65.2 |
| | >10500 | 42 | 18.3 |
| Hemoglobin | <12 gm/dl | 48 | 20.9 |
| | 12-16 gm/dl | 169 | 73.5 |
| | >16 gm/dl | 13 | 5.7 |
| Hematocrit | <37% | 58 | 25.2 |
| | 37-48% | 157 | 68.3 |
| | >49% | 15 | 6.5 |
| Platelet | <150000 | 7 | 3 |
| | 150000-450000 | 197 | 85.7 |
| | >450000 | 26 | 11.3 |
| Serum sodium | <135 mmol/l | 31 | 13.5 |
| | 135-145 mmol/l | 183 | 79.6 |
| | >145 mmol/l | 16 | 7 |
| Serum potassium | <3.5 mmol/l | 34 | 14.8 |
| | 3.5-5.5 mmol/l | 190 | 82.6 |
| | >5.5 mmol/l | 6 | 2.6 |
| Serum chloride | <95 mmol/l | 25 | 10.9 |
| | 95-109 mmol/l | 190 | 82.6 |
| | >109 mmol/l | 15 | 6.5 |
| AST | 0-45 IU/L | 217 | 94.3 |
| | 45-135 IU/L | 12 | 5.2 |
| | >135 IU/L | 1 | 0.4 |
| Serum creatinine | <0.5 mg/dl | 90 | 39.1 |
| | 0.5-1.2 mg/dl | 134 | 58.3 |
| | >1.2 mg/dl | 6 | |

*Bronchoplueral fistula repair, mediastinal mass excision, thoracoplasty, esophageal dilatation, mass excision and reconstruction, lung mass excision, sternotomy and mass excision, bilateral sympathectomy, open window, omentectomy and esophagostomy, open window thoracostomy, pericardectomy, thoracotomy and tumor excision, tracheoesophageal injury repair, chest wall mass excision, sternal mass excision, tracheal mass excision, bronchogenic cyst excision.

## 5.2 Intraoperative patient characteristics

Based on the report of intraoperative patient characteristics greater number of the respondents' vital signs were, patients who had normal systolic blood pressure 110 (47.8%) and normal diastolic blood pressure 152 (66.1%), normal pulse rate 190 (82.6%), normal oxygen saturation 200 (87%). Those patients undergone thoracic surgery who used double lumen tube 178 (77.4%).Patients who transfused blood during the intraoperative period 96 (41.7%),103 (44.8%) patients had duration of surgery 121-240 minutes and 97 (42.2%) patients had duration of anesthesia 241-360 minutes. 126 (54.8%) patients developed complications during surgery. Vasopressor support during the surgical procedure 67 (29.1%) and 185 (80.4%) patients were extubated after the surgical procedure. Thoracic surgery done by senior surgeon was 132 (57.39%), by MSc Anesthetist and MSc Anesthesia student 69 (30.0%), 65 (28.3 %) respectively (**Table 3**).

**Table 3: Intraoperative patient characteristics among thoracic surgical patients in intensive care units in Addis Ababa Governmental Hospitals, Addis Ababa, (n=230).**

| Systolic blood pressure | Category | Frequency(n) | Percentage (%) |
|---|---|---|---|
| | <90 | 11 | 4.8 |
| | 90-120 | 110 | 47.8 |
| | 121-139 | 82 | 35.7 |
| | >140 | 27 | 11.7 |
| Diastolic blood pressure | <60 | 26 | 11.3 |
| | 60-80 | 152 | 66.1 |
| | 80-89 | 37 | 16.1 |
| | >90 | 15 | 6.5 |
| Pulse rate | <60 | 4 | 1.7 |
| | 60-100 | 190 | 82.6 |
| | >100 | 36 | 15.7 |
| Saturation (SPO2) | <90 | 7 | 3 |
| | 90-94 | 23 | 10 |
| | >95 | 200 | 87 |
| Type of tube used | Double lumen tube | 178 | 77.4 |
| | Single lumen tube | 52 | 22.6 |
| Blood transfusion | Yes | 96 | 41.7 |
| | No | 134 | 58.3 |
| Duration of surgery | 60-120 minutes | 28 | 12.3 |
| | 121-240 minutes | 103 | 44.8 |
| | 241-360 minutes | 84 | 36.5 |
| | 361-480 minutes | 13 | 5.7 |
| | >480 minutes | 2 | 0.9 |
| Duration of anesthesia | 60-120 minutes | 13 | 5.7 |
| | 121-240 minutes | 90 | 39.1 |
| | 241-360 minutes | 97 | 42.2 |

|  | 361-480 minutes | 27 | 11.7 |
|---|---|---|---|
|  | >480 minutes | 3 | 1.3 |
| Complications in the operation room | Yes | 126 | 54.8 |
|  | No | 104 | 45.2 |
| Did the patient need vasopressor support | Yes | 67 | 29.1 |
|  | No | 163 | 70.9 |
| Did the patient extubated | Yes | 185 | 80.4 |
|  | No | 45 | 19.6 |
| Skill of the Surgeon | Senior surgeon | 132 | 57.39 |
|  | Fellow surgeon | 98 | 42.61 |
| Skill of the Anesthetist | MSc anesthesia student | 65 | 30.0 |
|  | MSc anesthetist | 69 | 28.3 |
|  | Anesthesiology resident | 54 | 23.5 |
|  | Senior anesthesiologist | 42 | 18.3 |

113 (49.1%) patients were managed by thoracic epidural analgesia followed by thoracic paravertebral blocks and opioids 36 (15.7%) of patients who underwent thoracic surgery.

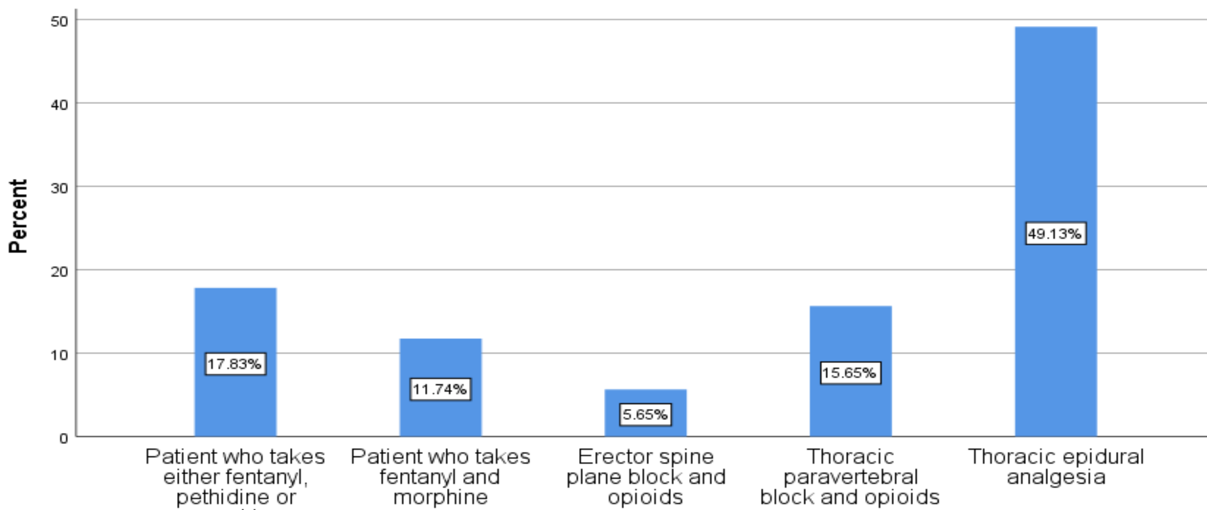


**Figure 3: pain management methods during the intraoperative period after thoracic surgical patients in Addis Ababa governmental hospitals, Addis Ababa, Ethiopia, (n=230).**

During the surgical procedure 121 (52.6%) patients had surgical blood loss of 500-1000ml and 53 (23%) patients had surgical blood loss of less than 500 ml of blood.

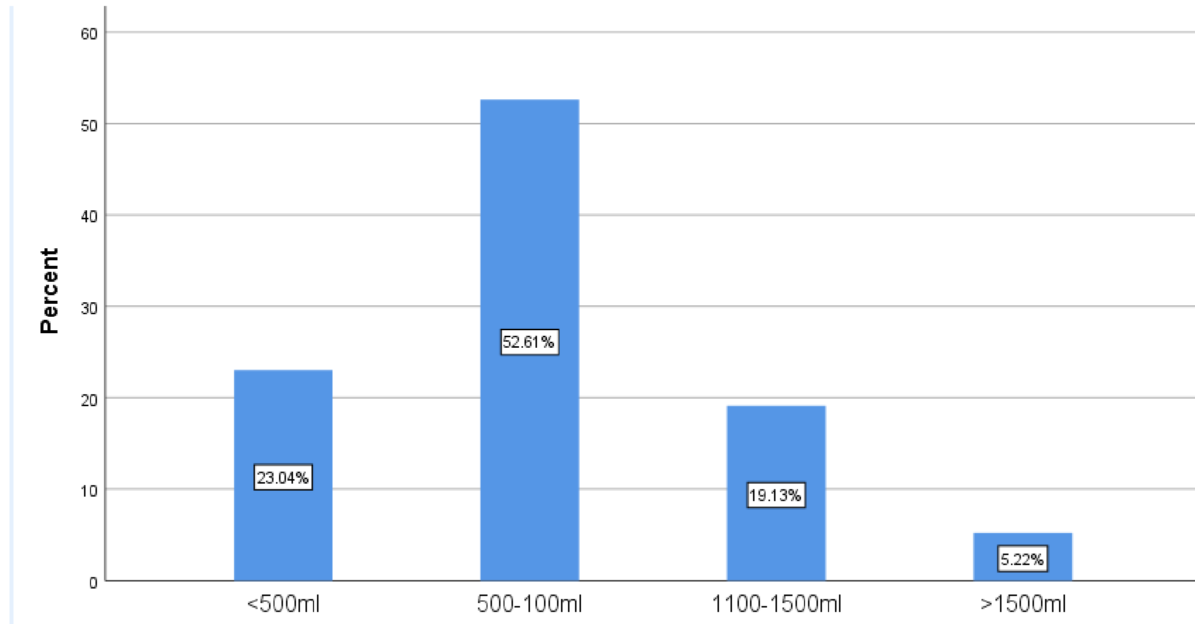


**Figure 4: Intraoperative surgical blood loss among thoracic surgical patients in Addis Ababa Governmental Hospitals, Addis Ababa, Ethiopia, (n=230).**

### 5.3 Intensive care unit patients characteristics

Other findings were those patients who need intervention in ICU (mechanical ventilation were 44 (19.1%), vasopressor support 67 (21.1%), fluid requirements 229 (99.6%), feeding 220 (95.7%), GIT prophylaxis 228(99.1%) and blood transfusion was 59 (25.7%)).Those patients who develop complications in ICU (cardiac arrest 3 (1.3%), arrhythmia 3 (1.3%), aspiration 1(0.4%), anemia 31 (13.5%), hypotension 26 (11.3%), infection 1 (0.4%), hypoxia 3 (1.3%), hypertension 1 (0.4%)).

Laboratory result, most patients had normal WBC count 152 (66.1%) followed by high WBC count 46 (20%), 117 (50.9%) patients had normal HGB level followed by low hemoglobin level 108 (47%), majority of the patients had low hematocrit level 93 (40.4%), most of the patients had normal platelet count 194 (84.3%) followed by low platelet level 20 (8.7%), greater than half of the patients had normal serum sodium level of 185 (80.4%), normal serum potassium level of 194 (85.2%), patients who had normal serum chloride level was 20 (8.7%), normal AST level was 203 (88.3%) and above half of the patients had normal serum creatinine level 148 (64.3%) followed by low serum creatinine level of 71 (30.9%) (**Table 4**).

**Table 4: Intensive care unit patient characteristics after thoracic surgery in Addis Ababa Governmental Hospitals, Addis Ababa, (n=230).**

| Factor | Category | Frequency (n) | Percentage (%) |
|---|---|---|---|
| Did the patient need mechanical ventilation | Yes | 44 | 19.1 |
| | No | 186 | 80.9 |
| Vasopressor support | Yes | 67 | 29.1 |
| | No | 163 | 70.9 |
| Fluid administered | Yes | 229 | 99.6 |
| | No | 1 | 0.4 |
| Feeding | Yes | 220 | 95.7 |
| | No | 10 | 4.3 |
| GIT prophylaxis given | Yes | 228 | 99.1 |
| | No | 2 | 0.9 |
| Blood transfusion | Yes | 59 | 25.7 |
| | No | 171 | 74.3 |
| Cardiac arrest | Yes | 3 | 1.3 |
| | No | 227 | 98.7 |
| Arrhythmia | Yes | 3 | 1.3 |
| | No | 227 | 98.7 |
| Aspiration | Yes | 1 | 0.4 |
| | No | 229 | 99.6 |

| Anemia | Yes | 31 | 13.5 |
|---|---|---|---|
| | No | 199 | 86.5 |
| Hypotension | Yes | 26 | 11.3 |
| | No | 204 | 88.7 |
| Infection | Yes | 1 | 0.4 |
| | No | 229 | 99.6 |
| Hypoxia | Yes | 3 | 1.3 |
| | No | 227 | 98.7 |
| Hypertension | Yes | 1 | 0.4 |
| | No | 229 | 99.6 |
| White blood cell | <4500 | 32 | 13.9 |
| | 4500-10500 | 152 | 66.1 |
| | >10500 | 46 | 20 |
| Hemoglobin | <12 gm/dl | 108 | 47 |
| | 12-16 gm/dl | 117 | 50.9 |
| | >16 gm/dl | 5 | 2.2 |
| Hematocrit | <37% | 136 | 59.1 |
| | 37-48% | 93 | 40.4 |
| | >49% | 1 | 0.4 |
| Platelet | <150000 | 20 | 8.7 |
| | 150000-450000 | 194 | 84.3 |
| | >450000 | 16 | 7 |
| Serum potassium | <3.5 mmol/l | 33 | 14.3 |
| | 3.5 -5.5 mmol/l | 196 | 85.2 |
| | >5.5 mmol/l | 1 | 0.4 |
| Serum sodium | <135 mmol/l | 25 | 10.9 |
| | 135-145 mmol/l | 185 | 80.4 |
| | >145 mmol/l | 20 | 8.7 |
| Serum chloride | <95 mmol/l | 24 | 10.4 |
| | 95-109 mmol/l | 186 | 80.9 |
| | >109 mmol/l | 20 | 8.7 |
| AST level | 0-45 IU/L | 203 | 88.3 |
| | 45-135 IU/L | 24 | 10.4 |
| | >135 IU/L | 3 | 1.3 |
| Serum creatinine level | <0.5 mg/dl | 71 | 30.9 |
| | 0.5-1.2 mg/dl | 148 | 64.3 |
| | >1.2 mg/dl | 11 | 4.8 |

130 (56.5%) patients had duration of intensive care units less than 3 days and followed by 67 (29.1%) of patients had duration of ICU stay between 4-6 days.

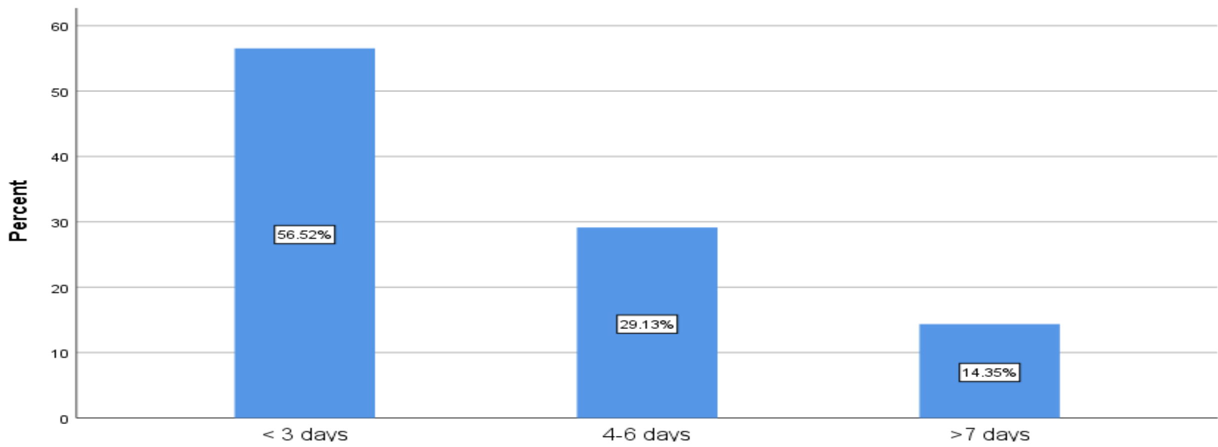


**Figure 5: patients' duration on ICU after thoracic surgery in Addis Ababa Governmental Hospitals, Addis Ababa, Ethiopia 2023 G.C (n=230).**

### 5.4 Incidence of mortality

Among 230 patients admitted to intensive care units after thoracic surgery, 29 (12.61%) patients were died with 95% confidence interval of (0.08,0.17).

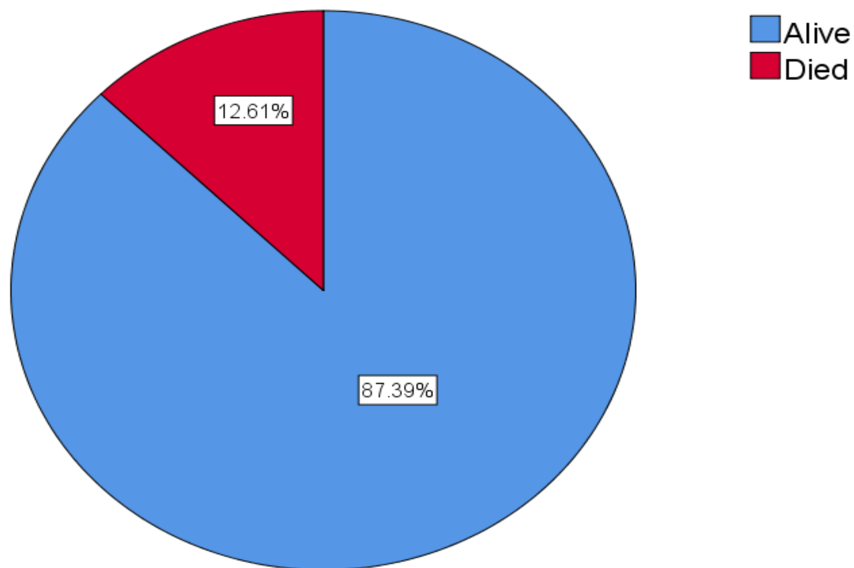


**Figure 6: Incidence of mortality among thoracic surgical patients admitted to an intensive care units in Addis Ababa Governmental Hospitals, Addis Ababa, Ethiopia, 2023 G.C(n=230).**

### 5.5 Risk factors of ICUs mortality among thoracic surgical patients

We analyzed the variables in both Bivariate and Multivariate methods to control potential confounding factors and to determine risk factors of mortality. Ten independent variables were included in the bivariate analysis. During bivariate analysis: Duration on ICU stay, preoperative hematocrit, preoperative platelet count, pain management approach by using thoracic epidural analgesia, ICU hemoglobin, ICU platelet, ICU AST, vasopressor, and inotropic support by using adrenaline, blood transfusion requirements and ICU potassium were included with p value less than 0.2 **(Table 5).**

Four variables were selected from the multivariate model and all of the variables were significant by using P-value <0.05. Patients with a duration of ICU stay greater than 7 days were 4.9 times higher risk of mortality than those patients who had a duration of ICU stay less than 3 days p (0.008), (AOR: 4.921, 95% CI: 1.513, 16.002), patients who were not managed by thoracic epidural analgesia were also 4.3 times higher risk of mortality than those patients who were managed by thoracic epidural analgesia p (0.009), (AOR: 4.331, 95% CI: 1.439, 13.072).

On the other hand, patients who had low ICU platelet were 21.2 times higher risk of mortality than those patients who had a platelet count of >450000 p (0.030), (AOR:21.289, 95% CI:1.347,336,549). The study also showed that patients who had blood transfusion requirements also experienced a 3.1 times higher risk of mortality than patients had no blood transfusion requirements p (0.045), (AOR:3.124, 95% CI 1.205,9.519).

**Table 5: Risk factors of mortality analyzed in both Bivariate and Multivariate logistic regression in Addis Ababa Governmental Hospitals, Addis Ababa, 2023 G.C.**

| Factor | Category | Died | Alive | COR(95% CI) | P value | AOR(95% CI | P value |
|---|---|---|---|---|---|---|---|
| Duration on ICU | <3 days | 10 | 120 | 1.00 | | 1.00 | |
| | 4-6 days | 8 | 59 | 1.627(0.610,4.338) | 0.331 | 0.919(0.281,3.005) | 0.889 |
| | >7 days | 11 | 22 | 6.000(2.276,15.820) | 0.000* | 4.921(1.513,16.002) | 0.008** |
| Preop HCT | <37% | 12 | 46 | 1.00 | | 1.00 | |
| | 37-48% | 16 | 141 | 0.435(0.192,0.987) | 0.046* | 0.703(0.242,2.042) | 0.517 |
| | >49% | 1 | 14 | 0.274(0.033,2.295) | 0.232 | 0.484(0.046,5.1170 | 0.546 |
| Preop PLT | <150000 | 9 | 11 | 1.00 | | 1.00 | |
| | 150000-450000 | 19 | 175 | 0.176(0.037,0.838) | 0.029* | 0.169(0.021,1.353) | 0.094 |
| | >450000 | 1 | 15 | 0.174(0.025,1.187) | 0.074* | 0.365(0.034,3.963) | 0.407 |
| TEA | Yes | 6 | 104 | 1.00 | | | |
| | No | 23 | 97 | 4.110(1.605,10.523) | 0.003* | 4.338(1.439,13.072) | 0.009** |
| ICU HGB | <12 gm/dl | 18 | 90 | 0.300(0.047,1.926) | 0.204 | 0.581(0.034,9.893) | 0.707 |
| | 12-16 gm/dl | 9 | 108 | 0.125(0.018,0.848) | 0.033* | 0.389(0.020,7.399) | 0.530 |
| | >17 gm/dl | 2 | 3 | 1.00 | | | |
| ICU PLT | <150000 | 3 | 4 | 12.273(1.350,111.609) | 0.026* | 21.289(1.347,336.549) | 0.030** |
| | 150000-450000 | 23 | 174 | 1.629(0.204,13.021) | 0.646 | 4.702(0.400,55.226) | 0.218 |
| | >450000 | 3 | 23 | 1.00 | | | |
| ICU AST | 0-45 IU/L | 25 | 178 | 1.00 | | | |
| | 45-135 IU/L | 2 | 22 | 0.647(0.143,2.921) | 0.572 | 0.467(0.079,2.750) | 0.400 |
| | >135 IU/L | 2 | 1 | 14.240(1.245,162.835) | 0.033* | 4.200(0.032,545.998) | 0.563 |
| Vasopressor support | Yes | 8 | 25 | 2.682(1.073,6.701) | 0.035* | 1.787(0.467,6.482) | 0.397 |
| | No | 21 | 176 | 1.00 | | | |
| Blood transfusion | Yes | 14 | 45 | 3.236(1.453,7.203) | 0.004* | 3.124(1.025,9.519) | 0.045** |
| | No | 15 | 156 | 1.00 | | | |
| ICU potassium | <3.5 mmol/l | 9 | 24 | 3.319(1.356,8.120) | 0.009* | 2.099(0.647,6.807) | 0.217 |
| | >3.5 mmol/l | 20 | 177 | 1.00 | | | |

Key
*.variables significant in the bivariate logistic regression analysis (p<0.2)
**.variables significant in the multivariate logistic regression analysis (p<0.05)
1.00 is an indicator/reference

COR=crude odd ratio

AOR=adjusted odd ratio

# CHAPTER SIX: DISCUSSION

The purpose of this study was to find out the incidence of intensive care unit mortality to confirm whether there are risk factors between demographic and patient factors, intra-operative and intensive care unit patient characteristics as relevant explanatory power of intensive care unit mortality incidence. We assessed the incidence of intensive care unit mortality in 230 patients who had undergone thoracic surgery. In this study, the mortality rate of thoracic surgical patients in the intensive care unit was 12.61%.

Our result is in line with a study done in Korea, which reported that in patients undergoing pneumonectomy mortality was 12.8% (31). Another retrospective cohort study done in Turkey on 141 patients undergoing thoracic surgery reported a high incidence (16.3%) of ICU mortality (3). The possible reason for the difference between these mortality rates might be the Turkey study was done including emergency thoracic surgical patients and they did not manage patients by thoracic epidural analgesia. A prospective study done in United Kingdom from 6101 consecutive patients who underwent surgery from 2003 to 2007, the mortality rate was 10% (44).

A study done in Greece in 2012 among 194 patients, the overall mortality rate was 13.3% (46). Another study done in Switzerland, which reported that, the mortality rate was 9.3% (16). According to the study done in United Kingdom, which found that the mortality rate was 8.4% (29).There is another study conducted in Vienna among patients who underwent cardiothoracic surgery who had reported the largest incidence (19%) of mortality (24). This study was somewhat higher than our results this might be due to the participants being cardiac patients and this surgical procedure is complicated and the patient had electrolyte disturbance.

In contrast to our findings some study predicts the mortality of thoracic surgical patients in intensive care units: According to the study done in Texas found that the mortality rate was 7% (15), A study done in Spain indicated that the mortality rate was 5.4% (22), A study done in Nigeria, which reported that the overall mortality rate was 5.4% (37). A study done in Switzerland, which reported that, the mortality rate was 2.9% (17). The possible explanation for this variation in mortality rate was that the above literature was done in developed countries, they used advanced surgical and anesthesia techniques as well as most of the

surgical procedures performed were pulmonary surgeries also their methods of assessment were different from ours and they managed the patient in full setup and had adequate intensive care unit follow up and difference in the quality of ICU treatment, sample size, accessibility of medical equipment, and stratification of qualified personnel.

From our findings, there was a risk factors of thoracic surgical patient admitted to the intensive care units mortality having a prolonged duration on ICU. Patients with prolonged duration of ICU stay had 4.9 times greater risk of mortality than patients who had shorter ICU stay. A study done in Turkey agreed with our findings, reported that prolonged intensive care unit stay had a marked effect on intensive care unit mortality $p < 0.05$ (3).

Another study done at Wolaita Sodo University found that length of ICU stays more than 14 days had 4.1 times with a 95% confidence interval of (1.074, 15.761) at risk of intensive care unit mortality than patients who had less than 7 days of intensive care unit stay (41). A study done in Ethiopia in 2021 by Abate et al stated that intensive care unit length of stay greater than 2 weeks had 8.7 times 95% confidence interval of (3.6,20.1) at risk of mortality than those patients who had ICU stay less than 1 weeks (40). The reason for this is that for patients who stay prolonged in the ICU the risk of complications during their stay was increased and they are vulnerable to hospital-acquired infection.

Another study that supports our findings was a study done in New York found that patients had a 28.5% hospital mortality which was a greater than those in the ICU less than 14 days (5.3%, $p < 0.05$) (33). The discrepancies that occurred in the study done in New York were the study population was cardiac patients and the duration of intensive care unit stay was considered prolonged they last greater than 14 days. In a prospective study done in London of 6101 patients 1139 (18.75) patients had a prolonged ICU stay, these patients had a higher ICU mortality rate (10%) compared with patients who had shorter ICU stay (0.6%): $p<0.001$) (37).

This study found that patients who were not managed by thoracic epidural analgesia had 4.3 times higher risk of mortality as compared to patients who were managed by thoracic epidural analgesia. These findings were in line with an observational study done in Switzerland, which reported that patients who were managed by continuous epidural analgesia were associated

with a reduced risk of respiratory complication and intensive care unit mortality (OR: 0.2, 95% CI: 0.1 to 0.6 (16). Another study that supports our evidence is a prospective study done in Switzerland, which reported that patients who were managed by thoracic epidural analgesia were associated with lower risk of mortality (OR:0.4,95% CI:0.2 to 0.8) compared to patients who were not managed by thoracic epidural analgesia (17). The explanation for this was Uncontrolled pain can make a critically ill patient in a state of persistent catecholamine release, which can lead to additional stress on the cardiovascular and respiratory system. Critically ill patients are typically in catabolism, and uncontrolled pain leads to even higher levels of metabolic energy consumption, which may worsen an already risky metabolic state and makes the patient increase the chance of morbidity and mortality (30).

A study done in Washington found that patients who gained thoracic epidural analgesia during the procedure had a morbidity and mortality rate of 3% and 2% respectively and conclude that technique of epidural anesthesia with light general anesthesia provided satisfactory anesthesia with low mortality and morbidity in a high-risk group of patients undergoing surgery (46).

A study done in Canada among 259 037 patients, 56 556 (22%) received epidural anesthesia found that epidural anesthesia was associated with a small reduction in 30-day mortality (1.7% vs. 2.0%; RR 0.89, 95% CI 0.81–0.98, p=0·02 (47).

The study showed that patients who need blood transfusion requirements were at high risk of intensive care unit mortality this was supported by the study done in Texas found that transfusion requirements greater than three units increased the operative mortality rate from 4% to 17% $p<0.05$ (15).Another retrospective study reported that the mortality of transfused patients was twice that was the non transfused (15% versus 7%) (34). Our findings were evidenced by a study done in Australia impact of blood product transfusion on short and long term survival after cardiothoracic surgery found that the overall 30-day mortality was 1.7%, but in patients who received transfusions (3.6%) was significantly higher than the non-transfused group (0.3%, $p < 0.001$) (35).

A study done in United kingdom, which reported that there was a very strong relationship between transfusion and hospital death in the single variable logistic regression (OR 29.4

(95% CI 9.2–94.2), $p < 0.001$ (36). The explanation is Infection, ischemic postoperative morbidity, hospital stay, increased early and late mortality, risk of hospital costs, chance of acute lung injury and hemolytic reactions, chance of renal failure, as well as respiratory, cardiac and neurological complications are all significantly increased in patients who receive blood transfusions after thoracic surgery (47).

The study also showed that patients who had low intensive care unit platelet count were at 21.2 times higher risk of mortality than patients who had normal platelet count in the intensive care unit, these findings were supported by an observational prospective study done in Germany found that Intensive care unit mortality was 31% in thrombocytopenic patients and 16% in non thrombocytopenic patients (p=0.03) (32). Untreated thrombocytopenia can have catastrophic consequences for the patient, including concealed bleeding into the thoracic cavity and internal organs, hemorrhagic shock, and a higher fatality rate (48).

An observational study done in Turkey found that thrombocytopenia on the fifth day of the ICU stay increases ICU mortality 3 times with OR: 3.03, 95% CI: 1.15–7.45, p= 0.025 (38). A prospective study of thrombocytopenia in surgical ICU found that thrombocytopenia occurred in 52 (35%) patients with an intensive care unit mortality rate of 38% compared with a 20% mortality rate in non-thrombocytopenic patients (p=0.02) (39).

## 6.1 Strength and Limitation of the study

### 6.1.1 Strength of the study

The strength of this study was multi-center study was employed

### 6.1.2 Limitation of the study

The limitation of this study was unable to do prospective cohort study due to time constraints.

# CHAPTER SEVEN: CONCLUSION AND RECOMMENDATION

## 7.1 Conclusion

The incidence of mortality among patients undergone thoracic surgery was high in the intensive care units. Prolonged intensive care unit stays (greater than 7 days), patients who were not managed by thoracic epidural analgesia, low intensive care unit platelet count (less than 150000), and patients who need blood transfusion requirements were a risk factors for intensive care unit mortality underwent thoracic surgery. Therefore health professionals should be cautious for patients who had prolonged stays in the ICU, apply and trend thoracic epidural analgesia for pain management during thoracic surgery, treat the underlying cause of low platelet count, and apply blood conservation strategies and quantify the amount of blood loss perioperatively.

## 7.2 Recommendation

According to the results of this research, the following recommendations are forwarded to the Anesthetist, ICU Health Professionals, and Researchers.

**For Anesthetist**

The responsible anesthetist should manage thoracic surgical patients' pain by the provision of thoracic epidural analgesia, normalize and correct platelet count by transfusing platelets, decreasing and quantify the amount of blood loss by applying different blood conservation strategies and it is preferable for the anesthetist to inform the ICU personnel of the patient's condition during the perioperative phase, monitor the patient till discharge, and monitor the length of ICU stay.

**For ICU Health Professionals**

Thoracic surgical patients who were admitted to ICU better to managed appropriately and in principle and consider complications that occur in the ICU when the length of stay is prolonged, take measures that correct the low level of platelet count, and recognize early to avoid the untoward effect of such imbalance in laboratory result and all possible factors should be determined and develop a strategy for prevention of intensive care unit mortality.

**For future Researchers**

Researchers to carry out a prospective cohort study regarding on the incidence and risk factors of mortality among thoracic surgical patients admitted to intensive care units and also identify the time to death relationships.

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# ANNEX I: INFORMATION SHEET

**Title of the Research**

Incidence and Risk factors of mortality among thoracic surgical patients admitted to intensive care units of Governmental Hospitals in Addis Ababa, Ethiopia 2023 G.C

Name of Principal Investigator: Shitalem Tadesse (BSc in Anesthesia)

Name of advisors: Mr.Leulayehu Akalu (Assistant Professor in Anesthesia)

Mr.Mulualem Sitot (BSc, MSc lecturer in anesthesia)

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

Name of the Sponsor: Addis Ababa University

**Introduction**:

This information sheet is prepared with the aim of assessing Incidence and risk factors of mortality among thoracic surgical patients admitted to intensive care units of governmental hospitals in Addis Ababa. The research group includes the principal investigator and three data collectors and two advisors.

**Purpose of the Research Project**

This study will aim to assess the Incidence and risk factors of mortality among thoracic surgical patients admitted to intensive care units of governmental hospitals in Addis Ababa. Assessing the Incidence and risk factors of mortality among thoracic surgical patients admitted to the intensive care unit will be very important to reduce the incidence and risk factors of mortality among thoracic surgical patients admitted to the intensive care unit by avoiding the risk factors and giving appropriate treatment or other measures. The results of this study will be used to design appropriate intervention programs to reduce the occurrence of postoperative mortality and to manage patients appropriately by integrating different health professionals.

**Person to contact**

For any questions or concerns you can contact the principal investigator using the following addresses:

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# ANNEX II: ENGLISH VERSION QUESTIONNAIRES CONSENT FORM

This questionnaire will be used as a guide to collect information for the data collectors!

Questionnaires to assess Incidence and risk factors of mortality among thoracic surgical patients admitted to intensive care units of Governmental Hospitals in Addis Ababa, Ethiopia.

Hello! My name is --------------I am one of the members of the research team. The purpose of this questionnaire is to gather information on Incidence and risk factors of mortality among thoracic surgical patients admitted to the intensive care units of Governmental Hospitals in Addis Ababa.

I have identified your Hospital as a study area hoping that you would be willing to help me by Providing patient medical charts and some information. Your commitment is important to assess the Incidence and risk factors of mortality among thoracic surgical patients admitted to the intensive care unit of Governmental Hospitals in Addis Ababa. All information we get from the medical charts will be kept confidential. I will not include any identifiers, such as name or exact address. Your role in the success of the research is important and I appreciate your contribution to the research.

Would this be okay with you?

I understood the advantage of the research and the roles I will have in the research. I have agreed to give the patients' medical records to participate in the research.

Questionnaire Code ________

Date of data collection______

Name of data collector _____________________________signature____________

## ANNEX III: AMHARIC VERSION QUESTIONNAIRE CONSENT FORM

ይህ መጠይቅ ለመረጃ ሰብሳቢዎች መረጃ ለመሰብሰብ እንደ መመሪያ ሆኖ ያገለግላል!

በአዲስ አበባ ሆስፒታሎች በፅኑ ህሙማን ክፍል የገቡት በደረት ቀዶ ጥገና በሽተኞች መካከል የሚደርሰውን ሞት እና ተያያዥ ምክንያቶችን የሚገመግሙ መጠይቆች።

ጤና ይስጥልኝ! ስሜ ----------ይባላል፡፡በአዲስ አበባ ዩኒቨርሲቲ አንስቴዝያ ትምህርት ክፍል የምርምር ቡድን ውስጥ እየሰራሁ እገኛለሁ፡፡ጥናቱን የሚያካሂደው በአዲስ አበባ ዩኒቨርስቲ አነስቴዝያ ት/ክፍል የሁለተኛ ድግሪ ተማሪ ሽታአለም ታደሰ ነው፡፡ወደዚህ የመጣሁበት አላማ በአዲስ አበባ ሆስፒታሎች ውስጥ በፅኑ ህሙማን ክፍል የገቡት በደረት ቀዶ ጥገና በሽተኞች መካከል የሚደርሰውን ሞት እና ተያያዥ ምክንያቶችን መረጃ ለመሰብሰብ ነው።

የታካሚ የሕክምና መዝገቦችን እና አንዳንድ መረጃዎችን በማቅረብ ሊረዱኝ እንደሚችሉ ተስፋ በማድረግ ሆስፒታልዎን እንደ የጥናት ቦታ ለይቼዋለሁ።በአዲስ አበባ የህዝብ ሆስፒታሎች ውስጥ በጽኑ ህሙማን ክፍል ውስጥ የደረት ቀዶ ጥገናን ተከትሎ የሚከሰተውን ሞት እና ተያያዥ ምክንያቶችን ለመገምገም ቁርጠኝነትዎ በእርግጠኝነት አስፈላጊ ነው።ከህክምና መዝገቦች የምናገኘው መረጃ ሁሉ በሚስጥር ይጠበቃል። እንደ ስም ወይም ትክክለኛ አድራሻ ያሉ ማንኛውንም መለያዎችን አናካትትም።በጥናቱ ስኬት ውስጥ ያለዎት ሚና ጠቃሚ ነው እና ለምርምሩ ያደረጋችሁትን አስተዋፅዖ አደንቃለሁ።

ይህ ለእርስዎ ችግር ይሆናል?

ስለጥናቱ ጥቅም እና በምርምር ውስጥ ስለሚኖረኝ ሚና ተረድቻለሁ. ተስማምቻለሁ::

በምርምር ውስጥ ለመሳተፍ የታካሚዎችን የሕክምና መዝገቦች ለመስጠት ፍቃደኛ ነኝ::

የጥያቄው መለያ ቁጥር------------

መረጃው የተሰበሰበበት ቀን--------

የመረጃ ሰብሳቢው

ስም----------　　　　　　　　　　ፊርማ-----------

# ANNEX IV: QUESTIONNAIRES

| | | |
|---|---|---|
| | **Part I: Socio-demographic characteristics** | |
| 100 | Age | ---------------years |
| 101 | Sex | 1.Male 2.Female |
| 102 | Weight | ----------------kg |
| 103 | Height | ----------------cm |
| 104 | BMI | ----------------kg/cm$^2$ |
| 105 | ASA status | 1. I 4. IV<br>2.II 5.V<br>3.III 6.VI |
| 106 | Type of surgery | 1. Esophageal surgery 6.Decortication<br>2. Lobectomy 7. Lung volume reduction<br>3. Pneumonectomy 8. Gastrostomy<br>4. Cystectomy 9. Heller myotomy<br>5. Bullectomy 10.If other specify |
| 107 | Presence of coexisting disease | 1. Hypertension 7. Renal disease<br>2. Diabetes mellitus 8. Neurologic disease<br>3. Chronic smoker 9. Infectious disease<br>4. Cancer 10. Psychiatric disorder<br>5. COPD 11. Hepatic disease<br>6. Cardiac illness 12. Chronic alcohol drinker<br>13.If other specify |
| | **Part II: Intraoperative patient characteristics** | |
| 108 | Vital sign at admission | 1. BP--------<br>2. PR--------<br>3.$SPO_2$----- |
| 109 | Laboratory results before admission | 1. WBC----- 5. AST ---------------<br>2. HCT----- 6. Serum $Na^+$ --------<br>3. PLT------ 7.Serum $K^+$-----------------<br>4.Creatinine------ 8.Serum $Cl^-$------------- |
| 110 | Type of endotracheal tube | 1. Single lumen tube<br>2. Double lumen tube |
| 111 | Pain management | 1. Fentanyl 4. Erector spine plane block<br>2. Morphine 5. Thoracic paravertebral block<br>3. Thoracic epidural analgesia 6. Thoracic paravertebral block with opioids |
| 112 | Blood loss | 1.<500 ml<br>2.500ml-1000ml<br>3.1100ml-1500ml<br>4.>1500 ml |
| 113 | Does the patient transfuse blood | 1.Yes 2.No |
| 114. | If yes how many units given | 1. One<br>2. Two<br>3.>Two |
| 115 | Duration of surgery | 1.60-120 minutes<br>2.121-240 minutes<br>3.241-360 minutes<br>4.Greater than 480 minutes |
| 116 | Duration of anesthesia | 1.60-120 minutes |

| | | |
|---|---|---|
| | | 2.121-240 minutes<br>3.241-360 minutes<br>4.Greater than 480 minutes |
| 117 | Complication at OR | 1. Yes 2.No |
| 118 | If Q117 yes what type of complication | 1. Hypotension<br>2. Cardiac arrest<br>3. Anaphylactic shock<br>4. Bradycardia |
| 119 | Does the patient need inotropic support | 1. Yes 2. No |
| 120 | If Q119 yes what type of drug given | 1. Norepinephrine<br>2. Labetalol<br>3. Adrenaline |
| 121 | Does the patient extubated | 1.Yes 2.No |
| 122 | The skill of the anesthetist | 1.MSc anesthesia student<br>2.Senior MSc anesthetist<br>3.Anesthesiology resident<br>4. Anesthesiologist |
| 123 | The skill of the surgeon | 1. Fellow surgeon<br>2. Senior surgeon |
| | **Part III: Intensive care unit patient follow up** | |
| 124 | Does the patient need MV | 1.Yes 2.No |
| 125 | If Q122 yes for how long | 1.<1 days<br>2.1-2 days<br>3.3-4 days<br>4.>5 days |
| 126 | Intervention at ICU | 1.Vassopressor support 1.yes 2.no<br>2.Fluid 1.yes 2.no<br>3. Feeding 1. yes 2.no<br>4.GIT prophylaxis 1.yes 2.no<br>5. Blood transfusion 1. yes 2.no |
| 127 | Complication at ICU | 1. Cardiac arrest 1. yes 2.no<br>2. Aspiration 1. yes 2.no<br>3. Arrhythmia 1. yes 2.no<br>4.Anemia 1.yes 2.no<br>5.Hypotension 1.yes 2.no<br>6. Infection 1. yes 2.no<br>7. Hypoxia 1. yes 2.no<br>8.Hypertension 1.yes 2.no<br>9. If others specify------ |
| 128 | Duration on ICU | 1.<1 days<br>2.1-2 days<br>3.3-4 days<br>4.>5 days |
| 129 | Laboratory result at ICU | 1.WBC-------- 5.Serum creatinine-------<br>2.HCT--------- 6.Serum $Na^+$--------<br>3.PLT--------- 7.Serum $K^+$--------<br>4.AST------- 8.Serum $Cl^-$ |
| 130 | Status of the patient at the end of the ICU | 1. Alive 2. Died |