

**ADDIS ABABA UNIVERSITY**

**COLLEGE OF HEALTH SCIENCE**

**SCHOOL OF NURSING AND MIDWIFERY**

**DETERMINANTS OF CARDIOTHORACIC SURGERY  
OUTCOMES AMONG PATIENTS UNDERWENT  
CARDIOTHORACIC SURGERY AT TIKUR ANBESSA  
SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA: A  
RETROSPECTIVE STUDY.**

**BY: HEWAN GETAHUN**

**A THESIS SUBMITTED TO ADDIS ABABA UNIVERSITY  
COLLEGE OF HEALTH SCIENCE SCHOOL OF NURSING  
AND MIDWIFERY DEPARTMENT OF NURSING FOR  
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR  
THE DEGREE OF MASTER OF SCIENCE IN  
PERIOPERATIVE CARDIOTHORACIC SURGERY.**

**JULY 2021 G.C**

**ADDIS ABABA, ETHIOPIA**

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COLLEGE OF HEALTH SCIENCE  
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**DETERMINANTS OF CARDIOTHORACIC SURGERY OUTCOME  
AMONG PATIENTS UNDERWENT CARDIOTHORACIC SURGERY  
AT TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA,  
ETHIOPIA: A RETROSPECTIVE STUDY.**

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ADDIS ABABA, ETHIOPIA**



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## ACRONYMS AND ABBREVIATIONS

ASD	Atrial septal defect
ASOS	African surgical outcomes study
BMI	Body mass index
CABG	Coronary artery bypass and grafting
CAD	Coronary artery disease
CHD	Congenital heart disease
COPD	Chronic obstructive pulmonary disease
CVD	Cardiovascular disease
DM	Diabetic mellitus
ENT	Ear, nose and throat
EUROSCORE	European System for Cardiac Operative Risk Evaluation
IMT	Intermediate thickness
LMIC	Low and middle income countries
OR	Operation room
PDA	Patent ductus arteriosus
PVD	Pulmonary vascular disease
SSI	Surgical site infection
SSA	Sub Saharan African
TOF	Teratology of fallout
USA	United States of America
VSD	Ventricular septal defect
WHO	World health organization

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## ABSTRACT

**Background:** Associated diseases and risk factors are the major causes of postoperative complications after cardiothoracic surgery. Outcome of Cardiothoracic surgery is generally associated with high incidence of myocardial, neurological, renal dysfunction, bleeding, surgical site infection which account up to 10% mortality depending on age, sex, comorbidity, preoperative medication and reoperation.

**Objective:** To assess the determinants of cardiothoracic surgery outcomes at Tikur Anbessa Specialized Hospital Addis Ababa Ethiopia.

**Methodology:** A retrospective institutional based cross-sectional study design was conducted among 323 randomly selected patient records. Systematic random sampling technique was used to select medical records. Data was gathered from the medical records of cardiothoracic patients registered during the past five years (from November 2015- November 2020) using a pretested checklist.

**Result:** Male participants were found to be involved more than female participants. The following were final predictors of cardiothoracic surgery outcomes. Ages between 18 and 28, 1.398 times more likely to develop poor outcomes postoperative compared to the rest age groups. [AOR=1.398, 95% CI=1.179-1.656]. Patients with chronic pulmonary disease are 1.713 times more likely to develop poor outcomes as compared to patients with other comorbidities and no known comorbidities [AOR=1.713, 95% CI=1.041-2.818]. And patients whose duration of surgery is 2-3hrs 2.306 times more likely to develop poor outcomes postoperative as compared to 3-4hrs duration of surgery [AOR=2.306 95% CI=1.241-4.283]. Personal habits, waiting time for surgery since admission lost their significance.

**Conclusion:** In this study age, comorbidities (chronic pulmonary disease), and duration of surgery were factors associated with the outcomes. Further investigation during perioperative period like adjusting medications, chest physiotherapies, preoperative and postoperative patient care in order to reduce the poor outcomes.

**Key words:** Surgery, cardiac surgery, thoracic surgery, determinants, and outcomes.

# 1. INTRODUCTION

## 1.1 Background of the study

Cardiothoracic surgery is the surgical treatment of diseases of the organs contained within the chest, including the heart, major blood vessels and the lungs [1]. It involves major technically demanding operations on patients who have life threatening disease. Surgery is relatively low volume and high cost that carries a measurable mortality rate [1].

Cardiac surgery is dominated by coronary heart disease, but in ageing population the requirement for valve surgery is rising fast. Thoracic surgery is concerned with conditions of the lungs, chest wall, esophagus and diaphragm and is generally dominated by treatment of malignant disease. The post-operative data included occurrence of post-operative complications such as arrhythmias, heart failure, pulmonary congestion with chest infection, wound infection and bleeding as well as hospital stay of the patients [2].

There are over 1.5 million open heart operations done each year worldwide by over 6,000 surgeons in over 3000 centers or units. Unfortunately only 2 billion among the world's 6.5 billion populations has access to these operations. There are 1,222 open heart operations per million population in North America compared to 18 per million in Africa. This is 1 center (hospital) or unit per 120,000 people in the USA to 1 center (hospital) or unit per 33 million people in Africa [4].

Diseases of the organs and systems are common in England. Seven million people have cardiovascular diseases and it accounts for 27% of all deaths. Lung cancer is the most common cause of cancer related death, with survival rates the second lowest amongst the 20 most common cancers in England [1].

In Addition to these, cardiothoracic or cardio vascular surgeries are both attributable to cardiovascular diseases over 16million (7.2 million ischemic heart disease), tuberculosis over 1.5 million, esophageal cancer over 440,000, rheumatic heart disease over 325,000, congenital heart disease over 280,000 and over 1.1million road traffic accidents in Sub-Saharan Africa (SSA) the incidence of death from cardiovascular disease (CVD) rose from 8.15% in 1990 to 9.20% in 2000. This incidence continues to rise. Road traffic accidents mortality in SSA is >25/100,000 in contrast to 15/100,000 in the Americas. Smoking,

hypertension, stress, and dietary changes continue to impact on SSA with resultant increases in non-communicable diseases, especially ischemic heart disease and lung cancer [4].

In Ethiopia, according to the study of a five-year retrospective analysis of all adult surgical admissions to all surgical wards from September 2010 to September 2015, there were a total of 8,698 surgical admissions of which 716 (15.2%) esophageal diseases, cardiothoracic surgical cases 1,942 (22.33%) in the Ethiopia largest tertiary teaching and referral hospital, Tikur Anbessa specialized hospital [3]

Currently in Tikur Anbessa specialized hospital, there are around eleven operation rooms like ear, nose and throat (ENT), Cardiothoracic, neurosurgery, pediatrics, general surgery, urology, gynecology, orthopedics and emergency and also cesarean section delivery service operating room (OR).

Cardiothoracic surgery department is one of the surgical departments of Tikur Anbessa specialized hospital. Approximately 2000 patients were admitted and had surgery for different kinds of cardiothoracic problem from November 2015 to November 2020. Of these, most patients had esophageal cancer, lung mass and chest wall mass, achalasia, and empyema. And also had a surgical intervention of esophagectomy, pneumonectomy, lobectomy and heller's myotomy.

And also there was a patient admitted for cardiac surgical intervention. Of these most of the patients had patent ductus arteriosus, ventricular septal defect (VSD), atrial septal defect (ASD), teratology of fallout (TOF) and coronary heart disease (CHD).

Esophageal diseases, mainly esophageal cancer, is the most common cause of elective admission to the cardiothoracic surgery unit followed by pleural diseases and lung tumors. Chest trauma and foreign body swallowing and aspiration are the major emergency admissions to these units [3].

## **1.2. Statement of the Problem**

Cardiothoracic surgery is generally associated with high incidence of myocardial, neurological, renal dysfunction, bleeding, wound site infection which account up to 10%

mortality depending on age, sex and comorbidity of the patients preoperative medication and reoperation [4].

Esophageal disease, mainly esophageal cancer 716(37.7%) is the most common cause of elective admission to the cardiothoracic surgery unit followed by plural diseases 210(11.1%) and lung tumors 146(7.7%) [3].

The most common complications were atelectasis 22(24%), arrhythmia 6(12%), stroke (2%) and pulmonary infection 5(10%) in a patient undergoing cardiothoracic surgery post operatively [5].

Estimating the risk of serious complications associated with cardiac surgery is a fundamental aspect of both surgery and clinical anesthesia. Given fairly low operative mortality but an increasing number of disturbances from vital organs, more sensitive models predicting forthcoming problems are needed. The target should be on comparing different methods of treatment and planning optimal sharing of limited resources [6].

From the patients stand point the main goals of preoperative risk assessment are quantification of the individual operative risk and the potential reduction of this risk by various interventions. These interventions may include modifying drug therapy, intensified physical training, and individually planned operative procedure, more intensive intraoperative monitoring, anesthetic and surgical techniques and post-operative care [6].

According to a study conducted at Tampere University, Outcomes of postoperative cardiac surgery include mortality, morbidity, major adverse events that is perioperative myocardial infarction, stroke, acute kidney injury, resource utilization, functional postoperative status and patient satisfaction. Independent predictable variables affecting outcome can be categorized as preoperative patient characteristics, type and severity of the cardiac disease, physiologic parameter and type and extent of the surgical procedure. Unpredictable variables include intraoperative events with a fundamental impact on postoperative outcome [6].

Knowing the determinants of cardiothoracic outcomes after cardiothoracic surgery is the main route for resources of data in order to know the root sources of the problem that cause complications and mortality (death) in the patients.

## **2. LITERATURE REVIEW**

Cardiovascular disease is the leading cause of death worldwide, responsible for 17.5 million deaths every year, of which 80% occur in low and middle-income countries. Some 75% of the world does not have access to cardiac surgery when needed because of lack of infrastructure, human resources, and financial coverage (17).

### **2.1 Cardiothoracic Surgery Outcomes**

#### **2.1.1 Acute kidney injury**

According to Brazilian journal of cardiovascular surgery study, acute kidney injury is a common severe complication after cardiac surgery with an incidence of 3.4%; 19% which requires dialysis treatment. The incidence of AKI in patients receiving isolated conventional coronary artery bypass grafting (CABG) and off pump coronary artery bypass are 2.9% and 1.4% respectively with 38.5% of the AKI patients requiring dialysis. A retrospective cohort study of patients undergoing CABG in a single hospital in Brazil the incidence of postoperative AKI was 9.3%. This study does not show the relationship between AKI and the patient's gender and their mean ages. [8].

#### **2.1.2 Myocardial infarction**

Cardiac surgery carries a well-known risk of perioperative myocardial infarction which is associated with high morbidity and both in hospital and late mortality. Perioperative MI is also associated with an increased use of health resources and it correlates with an increased risk progressive heart failure in the years after cardiac surgery. According to American college of cardiology/American heart association guidelines major surgery is associated with increased myocardial oxygen demand and risk of coronary plaque rupture resulting in MI. Postoperative MI occurs in 1% of the 230 million patients undergoing surgery each year and remains the leading cause of mortality and morbidity in patients undergoing cardiovascular surgery with a reported incidence ranging from 5% to 20% [9].

#### **2.1.3 Bleeding**

Bleeding is an important issue in cardiothoracic surgery and about 20% of all blood products are transfused in this clinical setting worldwide. Bleeding and allogeneic blood transfusion are associated with increased morbidity, mortality and hospital costs [9].

Postoperative bleeding is common after cardiac surgery. Major bleeding is a determinant of red blood cell (RBC) transfusion, especially in patients with preoperative anemia. Preoperative anemia and RBC transfusion are recognized risk factors for operative mortality. The role of major bleeding as an independent determinant of operative mortality in cardiac surgery. The main complications associated with major bleeding were thromboembolic complication, infection, and re-exploration. This study does not show the significance between age of patients and blood transfusion [10].

Excessive bleeding leading to re-exploration is associated with a twofold increased early postoperative mortality rate. Re-exploration for bleeding is also associated with mortality beyond 90 days after operation [11].

#### **2.1.4 Neurological Dysfunction**

According to a study in Japan, postoperative delirium developed in 153(50%) of 306 patients who underwent esophagectomy. Moreover, it is associated with poor outcomes and high costs. Post-operative delirium is an acute brain dysfunction that occurs because of surgical stress. It is a transient disturbance of consciousness accompanied by inattention, disorganized thinking, and an altered level of consciousness. According to a study in the Netherlands recurrent laryngeal nerve injury caused by esophagectomy may lead to postoperative morbidity. The incidence of laryngeal nerve palsy after esophagectomy varies, ranging from 0% to 59%. This study try to show the occurrence of delirium after esophagectomy on single institution and smallest sample size without comparison of age and sex of patients [12].

#### **2.1.5 Mortality**

According to the African surgical outcomes study (ASOS), a 7-day prospective cohort study of adult patients undergoing surgery in Africa, surgical patients in Africa have a mortality twice the global average The composite outcome of severe postoperative complication and death occurred in 423/8799 (4.8%) patients [13].

### **2.1.6 Pulmonary complication**

According to the study at university hospital of Giessen, Germany, department of general, visceral, thoracic, transplant and pediatric surgery, esophageal cancer is one of the leading cancer diagnoses with a high cancer related mortality and rapidly growing incidence over the past years worldwide. The surgical therapy is challenging for the patients since it is associated with high rates of postoperative complication and morbidity. Overall, up to 60% of the patients experience any type of postoperative complication and the mortality rate up to 14% after transthoracic esophagectomy for esophageal cancer is high. Especially pulmonary complications including atelectasis, pneumonia, pulmonary embolism, respiratory failure and acute respiratory syndrome are overrepresented after esophagectomy with an incidence ranging between 20% and 40% and consequently contribute to postoperative morbidity and mortality. After transthoracic esophagectomy pneumonia 22%, respiratory failure 6% and acute respiratory distress syndrome accounts 1.5%. This study shows only a single case study [14].

Prolonged air leak is the most common complication after pulmonary resection, with a reported incidence of 15-18%. Prolonged air leak is defined as a leak lasting more than 7 days after pulmonary resection. Pneumonia is a significant concern after lung resection with an incidence is reported up to 6% in some studies. Patients are at increased risk after chest surgery for pulmonary hygiene, which can lead to the development of atelectasis, pneumonia and mucous plugging. Atelectasis causes ventilation mismatch that results in hypoxemia and respiratory decline [23].

### **2.1.7 Surgical site infection**

According to study in Taiwan, surgical site infection with or without bacteremia is a common postoperative complication responsible for increased morbidity, mortality, and health care cost. The most important cause of SSI among patients undergoing surgery is staphylococcus aureus which frequently colonize the nares and skin in the healthy population. In the study 7647 patients were included overall 165 out of 7647 patients 2.1% developed s. aureus SSI and blood stream infection, including 122 (1.6%) patients with SSI without bacteremia, 28(0.4%) patients with bacteremia SSI and 15 (0.2%) patients with postoperative bacteremia without SSI [14].

## **2.2 Determinants of cardiothoracic surgery outcomes**

### **2.2.1 Patient characteristics**

#### **2.2.1.1 Age**

Age is an elementary determinant of outcome. The relationship between age and poor outcome is neither linear nor consistent from person to person. Mortality rises steadily after the age of 60 years [6]. Population aging is a global phenomenon with significant implications for health care systems in the developed world. In 2012, over 5.2 million people in Canada were aged over 65 years, representing 14.9% of total populations. Of these, approximately 1.4 million (4.2% of total population) were octogenarians (aged  $\geq 80$  years). Associated with this increasingly older population, the demand for surgery, in particular cardiac surgery, is expected to markedly increase. [15]

#### **2.2.1.2 Sex**

Many studies quote female sex as a risk factor for both mortality and morbidity and this variable is included in most cardiac surgery risk scoring methods. The higher prevalence of hypertension, diabetes, and obesity in older women precedes a greater risk in women than men. Female patients referred to CABG are often older and have several comorbidities such as age, hypertension, diabetes or metabolic syndrome. Heart failure, renal disease, peripheral vascular disease, and worse lipid profile. Women undergoing cardiac surgery have a higher incidence of morbidities such as stroke and bleeding compared with men. Additionally in comparison to men, women also more often have unstable angina, severe angina and congestive heart failure [6].

### **2.2.2 Comorbidities**

#### **2.2.2.1 Chronic Pulmonary Disease**

Pulmonary disease defined according to European System for Cardiac Operative Risk Evaluation (EUROSCORE) criteria provides long term use of bronchodilators or steroids for lung disease patients with severe chronic obstructive pulmonary disease (COPD) are known to be at increased risk of mortality and morbidity [6].

#### **2.2.2.2 Extra Cardiac Arteriopathy**

The extent and severity of atherosclerotic lesions in major and peripheral arteries correlate with the extent and severity of coronary artery disease. Peripheral vascular disease (PVD)

was identified as an independent risk factor for late mortality or death at any time after hospital discharge but not for early mortality or death within 30 days or before discharge.

Symptomatic carotid disease increases the risk of stroke, and the management of patients with both symptomatic coronary and carotid artery diseases demands careful consideration [6].

#### **2.2.2.3 Neurological dysfunction**

Stroke remains a devastating complication after cardiac surgical procedures in addition to several known risk factors for postoperative neurologic events. A history of preoperative neurologic events has also been reported to be associated with an increased risk of postoperative neurologic events. Patients with preoperative neurologic events also had longer duration of postoperative ventilation and longer hospital stay [7].

#### **2.2.2.4 Diabetes mellitus**

Diabetes mellitus type 2 preceded by long standing symptomatic hyperglycemia which accounts for the development of long-term diabetic complications. The connection was demonstrated in a prospective study on elderly people. Whose risk of fatal and non-fatal cardiovascular events after 3.5 years was greater than 4-fold in the presence of diabetes than its absence? DM is as much a vascular disease as it is a metabolic disorder. The main complications for which diabetes has been a well-established risk factor throughout the cardiovascular system are coronary artery disease (CAD), peripheral vascular disease (PVD), increased intermediate thickness (IMT) and stroke.

United Kingdom and worldwide data show that the proportion of people with diabetes undergoing isolated CABG surgery has increased by 33% in recent years to 25-40%. These patients face increased morbidity and mortality following cardiac surgery and represent a sizable medico economic predicament worldwide. Studies show that patients with diabetes have a significantly greater risk up to 40% of readmission following discharge after CABG [16].

### **2.2.3 Personal habit**

#### **2.2.3.1 Tobacco use**

According to a study in Australia Fiona Stanley hospital current cigarette smoking status is thought to be related to perioperative morbidity in cardiac surgery. Overall, 34,230 patients were included in the statistical meta-analysis; current smokers were shown to have a significantly increased risk in postoperative overall pulmonary complication (45%), and postoperative pneumonia (67%). There was a trend towards an increased risk in postoperative myocardial infarction. Almost 6 million people die from tobacco use each year, both from direct tobacco use and second-hand smoke. Smoking is estimated to cause about 71% of lung cancer, 42% of chronic respiratory disease and nearly 10% of CVD. The highest incidence of smoking among men is in lower-middle income countries for total population, smoking prevalence is highest among upper middle-income countries [18].

The prevalence of smoking in this study is comparable to the 2008 GDHS report which revealed that smoking in Ghana is higher among men (6%) than women. The prevalence of smoking among men in this study (6.4%) was high compared to 2.0% in the Ghana STEPS Survey<sup>24</sup> but less than 42% in a survey in Kerala, India<sup>10</sup> and 15.6% in Gambia.<sup>25</sup> Smoking is generally five times more prevalent among males than females; however the gender gap declines with younger age. <sup>12</sup> Tobacco affects health in many ways: through nicotine, tar and the effect of carbon monoxide in the smoke, on the function of the body [8].

### **2.2.4 Factors related to facility**

#### **2.2.4.1 Year of surgeon's experience**

Single surgeon series investigating the learning curve involved in surgery for spinal deformity may be confounded by changes in technology and techniques. The objective with the study of prospective study was to present cross sectional analysis of the impact of surgeon's experience on surgery for adolescent idiopathic scoliosis, the operative results and health related quality of life following surgery for adolescent idiopathic scoliosis were significantly and positively correlated with surgeon experience. This study does not show the variation between other types of surgeries (19).

#### **2.2.4.2 Duration of surgery**

A study conducted in Canada, pooled analysis shows that the likelihood of complications increased significantly with prolonged operative duration, approximately doubling with operative time thresholds exceeding two or more hours. Meta-analysis also demonstrated a 14% increase in the likelihood of complications for every 30 min additional time (20).

#### **2.2.4.3 Surgeons qualification**

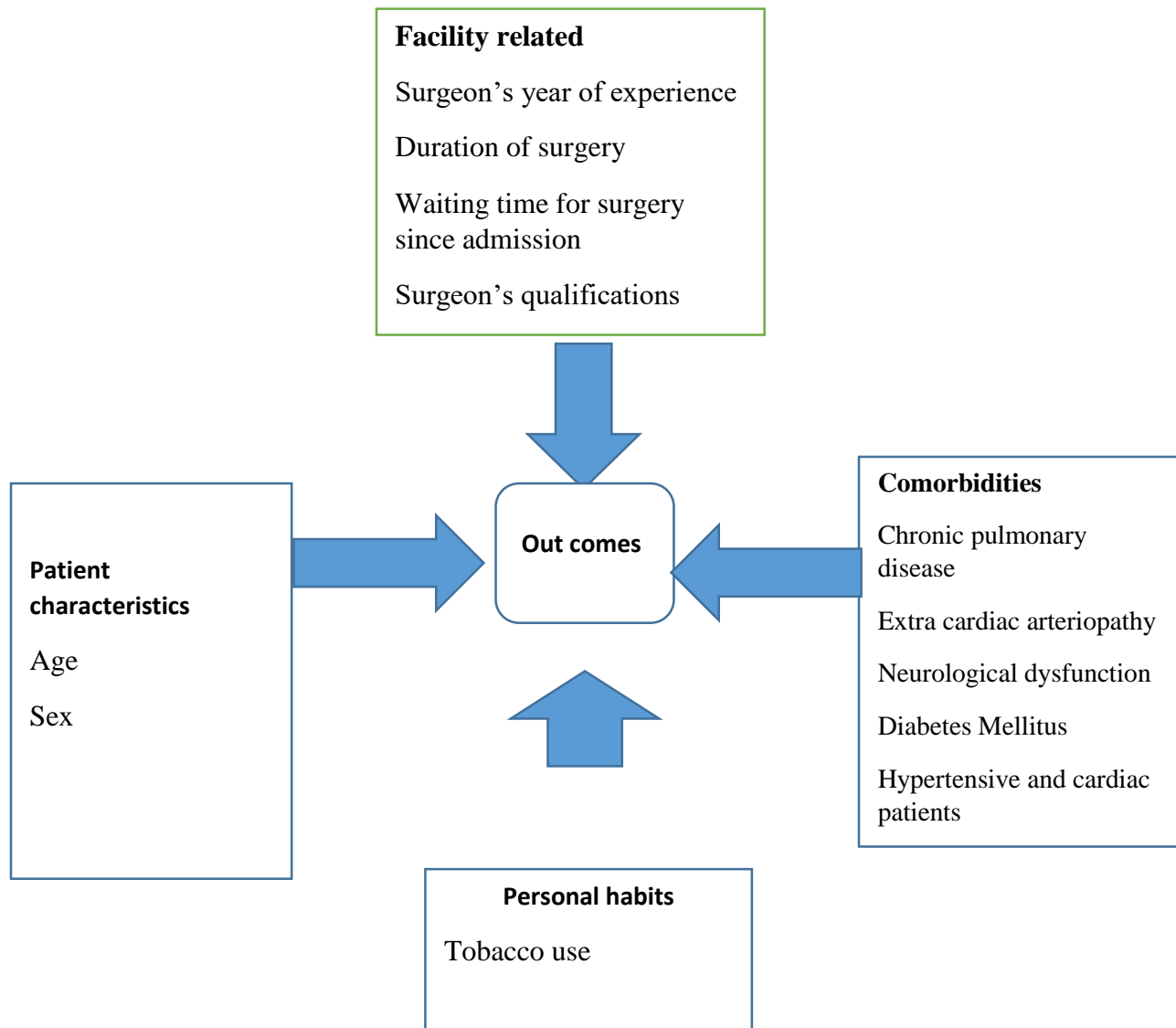
According to the study in Chicago, Northwestern memorial hospital, an extensive literature search identified 29 studies: 27 examined surgeon's specialization, one assessed surgeon certification and four evaluated surgeon's experience. Of the 27 studies examining specialization, 25 found that specialized surgeons had better outcomes than non-specialized surgeons (19).

#### **2.2.4.4 Waiting time since diagnosis**

Impact of time between diagnoses and surgical treatment have a significant effect on postoperative complications. Surgery performed more than 8hrs after diagnosis carries the highest mortality, which may be exacerbated by longer intervals since symptom onset. On the other hand early diagnosis and treatment are paramount in achieving successful outcomes (22).

### 2.3 Conceptual framework

The conceptual framework of this study is constructed from different literatures and articles done in different parts of the world at different times. The variables which list patient outcomes together and determinants affect the outcomes[6,7,8,11,13,14,15,16,18,19,20,22]. (Figure 1)



**Figure 1:** Determinants of cardiothoracic surgery outcome at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: 2021

### **3. JUSTIFICATION OF THE STUDY**

The purpose of this study was identifying the factors that determine the cardiothoracic surgery outcomes, It will help the health care givers to give more emphasis on adjusting perioperative patient care and decision making by monitoring patient status, performing different investigation, adjusting medications, performing proper wound care and dressing, enhance mobilization depending on type of surgeries, performing chest physiotherapy and deep breathing this will help the patients to recover fast and gain satisfaction.

#### **4. SIGNIFICANCE OF THE STUDY**

This study will help to understand the determinants of cardiothoracic surgical outcome at Tikur Anbessa Specialized Hospital. Since there is no study conducted in this specific topic at Tikur Anbessa Specialized Hospital the results from this retrospective study will be used as sources of information, enable surgeons a better basis for judging and improving their practices, offer patients the basis to make informed choices about their care, evidence for service improvement and quality assurance of operations and to get greater public transparency and accountability.

## **4. OBJECTIVES**

### **4.1 General objectives**

To assess the determinants of cardiothoracic surgery outcomes among patients who underwent cardiothoracic surgery at Tikur Anbessa Specialized Hospital, Addis Ababa Ethiopia.

### **4.2 Specific objectives**

To assess the cardiothoracic surgery outcomes among patients who underwent cardiothoracic surgery at Tikur Anbessa Specialized Hospital, Addis Ababa Ethiopia.

To identify factors that determine the outcomes of cardiothoracic surgery among patients who underwent cardiothoracic surgery at Tikur Anbessa Specialized Hospital, Addis Ababa Ethiopia

## **5. METHOD AND MATERIAL**

### **5.1. Study area**

The study area of this research was Tikur Anbessa Specialized hospital which is the largest public teaching and tertiary referral hospital in Ethiopia and it is located at the capital city Addis Ababa. The hospital was established in the year 1964 E.C for the memorial of prince Mekonnen. Duke of Harrere, was the son of his imperial majesty Haile Selassie I. The hospital receives patients coming from all corners of the nation and surgical diseases and admissions take the major share of its activities. It offers diagnosis and treatment for approximately 370,000-400,000 patients a year. The hospital has more than 800 beds of which 120 beds are dedicated to surgical patients annually with 6000-8000 operations done. The cardiothoracic surgery department is one of the surgical department which most patient is admitted for elective and emergency procedures. There were around 1942 surgeries per year out of a total of 8698 surgeries for both cardiac and thoracic operations (3).

### **5.2. Study Period**

The study was conducted from March 25 to April 30, 2021.

### **5.3. Study Design**

Institution-based retrospective cross-sectional study design was used from November, 2015- November, 2020.

### **5.4. Population**

#### **5.4.1. Source Population**

All cardiothoracic patients underwent surgery at Tikur Anbessa Specialized Hospital from November, 2015 to November, 2020.

#### **5.4.2. Study Population**

The study population was randomly selected cardiothoracic patients who underwent cardiac and thoracic surgical procedure from 2015-2020.

### **5.5. Eligibility Criteria**

#### **5.5.1. Inclusion Criteria**

Charts of patients who fulfill the following criteria

- Adult patient who were operated for cardiac problems
- Adult patient who were operated for thoracic problems

### 5.5.2. Exclusion Criteria

Chart of patients excluded from the study

- Patients who were transferred to other hospital to better intervention
- Patients operated for Achalasia, feeding jejunostomy, chest tube insertion and esophageal dilatation
- Patients chart with incomplete data

### 5.6. Sample Size and Sampling Procedure

#### 5.6.1. Sample size determination

The sample size was calculated by using the single population proportion formula.

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

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

$$n = 384$$

$$Z = 95\% \text{ confidence interval} = 1.96$$

P= 0.5 maximum population proportion, since there are no previous studies found.

d = the margin of sampling error tolerated = 0.05 (5%)

By using correction formula for finite population since source population are less than 10,000

$$n_f = \frac{n}{1 + n/N}$$

Where n = the sample size = 384

N = Total No of patients who undergo elective operation = 1264

n<sub>f</sub> = Final sample study

$$n_f = \frac{384}{1 + 384/1264}$$
$$= 293$$

10% contingency was added considering illegible handwriting and incomplete cards. Hence, the minimum sample size will be 323

### 5.6.2. Sampling Technique and Procedure

Systematic random sampling technique was used to select study participants by using skip interval of  $K = N/n$

Where N = Total No of patients = 1264

n = Total sample size = 323

$$K = 1264/323=4$$

The first study participant was selected by lottery method and the rest was selected by adding the skip interval  $K=4$ .

Cardiothoracic patient medical cards for the specified period were reviewed from TASH. The number of study subjects for each year was allocated proportionally after identifying the number of cardiothoracic patients in each year. During the last five years (Nov 2015 to Nov 2020), 1264 major cardiothoracic surgeries were done. From Nov2015 to Oct 2016 year 1 (NY1) 345, from Nov2016 to Oct 2017 year 2 ( NY2) 295, From Nov 2017 to Oct 2018, year3 (NY3) 210, from Nov 2018 to Oct 2019, year4 (NY4) 242, from Nov 2019 to Oct 2020, year5 (NY5) 172 patients were done. Based on this, proportional allocation of the sample size = 323 for each was done using the following formula.

$$n_y = \frac{n * NY}{N}$$

Where  $n_y$  = required sample size from each years

$$n = \text{Total sample size} = 323$$

$$N_y = \text{Total No of patient in each year}$$

$$N = \text{Total No of patients} = 1264$$

After that the sample size was allocated to each years as follows

$$N_{y1} = 323 * 345 / 1264$$

$$= 88$$

$$N_{y2} = 323 * 295 / 1264$$

$$= 75$$

$$N_{y3} = \frac{323 * 210}{1264}$$

$$= 54$$

$$N_{y4} = \frac{323 * 242}{1264}$$

$$= 62$$

$$N_{y5} = \frac{323 * 172}{1264}$$

$$= 44$$

S. No	Year	Sample size calculation per proportion	Sample size
1	2015/16	$N_{y1} = 323 * 345 / 1264$	88
2	2016/17	$N_{y2} = 323 * 295 / 1264$	75
3	2017/18	$N_{y3} = \frac{323 * 210}{1264}$	54
4	2018/19	$N_{y4} = \frac{323 * 242}{1264}$	62
5	2019/20	$N_{y5} = \frac{323 * 172}{1264}$	44

$N_y$  = numbers of procedures in a year.

## **5.7. Study Variables**

### **5.7.1. Dependent Variables**

Outcome of cardiothoracic surgery

### **5.7.2. Independent Variables**

Socio demographic characteristics

- Age
- Sex

Factors related to outcome determinants

#### **Comorbidities**

- Chronic pulmonary disease
- Extra cardiac arteriopathy
- Neurologic dysfunction
- DM
- Hypertensive
- Cardiac patients

#### **Personal habits**

- Tobacco use

#### **Institutional factors**

- Surgeons year of experience
- Surgeons qualification
- Waiting time for surgery since admission
- Duration of surgery

## **5.8. Operational definitions**

**Outcome:** Cardiothoracic surgery is the end consequence of cardiothoracic patients at the end of surgery mentioned on the patient card. It will be categorized as a good outcome and poor outcome.

**Good outcome:** is considered as good if patients were not developing any complications postoperative and had a smooth postoperative period.

**Poor outcome:** is considered as poor if any of the following has happened postoperatively: bleeding, surgical site infection, mortality, neurological dysfunction, renal dysfunction, and pulmonary complication.

**Bleeding:** A blood loss  $> 1.5\text{ml/kg/hr}$  for six consecutive hours within 24hrs after surgery.

**Surgical site infection:** occurs in the surgical incision area, muscle and surrounding tissue that was involved in surgery.

**Mortality:** occurs within 30 days after surgery in the hospital.

**Neurological dysfunction:** is an impairment of cognitive function arising after surgical procedure.

**Renal dysfunction:** a condition characterized by persistent oliguria and elevated serum creatinine levels.

**Pulmonary complication:** complication affecting the respiratory system after anesthesia and surgery.

## **5.9. Data collection tools and procedure**

Data was collected from patients' medical record by using pretested tool. Data collection check list was adopted from previous researches done on similar studies (6). Data was gathered from cardiothoracic patients registered for past five years (from November 2015- November 2020) was reviewed. This involves going through logbook records of cardiac and thoracic patients on the specified period. Data was collected by two trained data collectors one for cardiac and one for thoracic medical record.

## **5.10. Data quality assurance**

Before data collection, the checklists were pretested on 5% of the calculated sample size. Hence, sixteen patient cards were used to test the data collection sheet from the same institution and pretest subjects were excluded from the actual study.

## **5.11. Data processing and analysis**

The data was checked manually for completeness and consistency and then coded and entered into Epi- data version 3.1 then exported to SPSS (statistical package for social science) version

21 for analysis. Data entry was made by the principal investigator. Frequency, proportion means and SDs were used to describe socio-demographic variables. Texts, tables and charts were used for data presentation. Binary and multivariate logistic regression analysis was used to determine the association between dependent (outcomes of cardiothoracic surgery) and independent variables (socio-demographic characteristics, comorbidities, personal habit, and facility related factors). Those variables with p-value less than 0.25 were deemed for the multivariable logistic regression analysis. Level of significance was declared at P-value < 0.05 and 95% confidence interval (CI).

### **5.12. Ethical Consideration**

Ethical clearance was obtained from Addis Ababa University College of health science, school of nursing, and midwifery institutional review committee. Official letter from the department was submitted to the Tikur Anbessa Specialized Hospital cardiothoracic surgery department. The letter obtained from the institutional review board was given to the head of the cardiothoracic department.

## 6. RESULTS

In these five years of retrospective study from November 2015 to November 2020 a total of 1264 patients had cardiothoracic surgeries in Tikur Anbessa Specialized Hospital. Of which 323 patients were randomly selected and reviewed for this study with 100% of response rate.

### 6.1. Socio-demographic characteristics of cardiothoracic patients

A total of 323 charts were reviewed. The mean age of the cardiothoracic patient was 39.3 SD (mean  $39.3 \pm 14.3$ ). Patient age ranges from 18-78 years. The mean age of male and female were (38.7 and 40.12). Among these 323 cardiothoracic patients, the majority of them were males 179(55.4%) and the rest 144(44.6%) were females. (Table 1)

Table 1: Socio demographic characteristics of patients who underwent cardiothoracic surgeries from November 2015 to 2020.

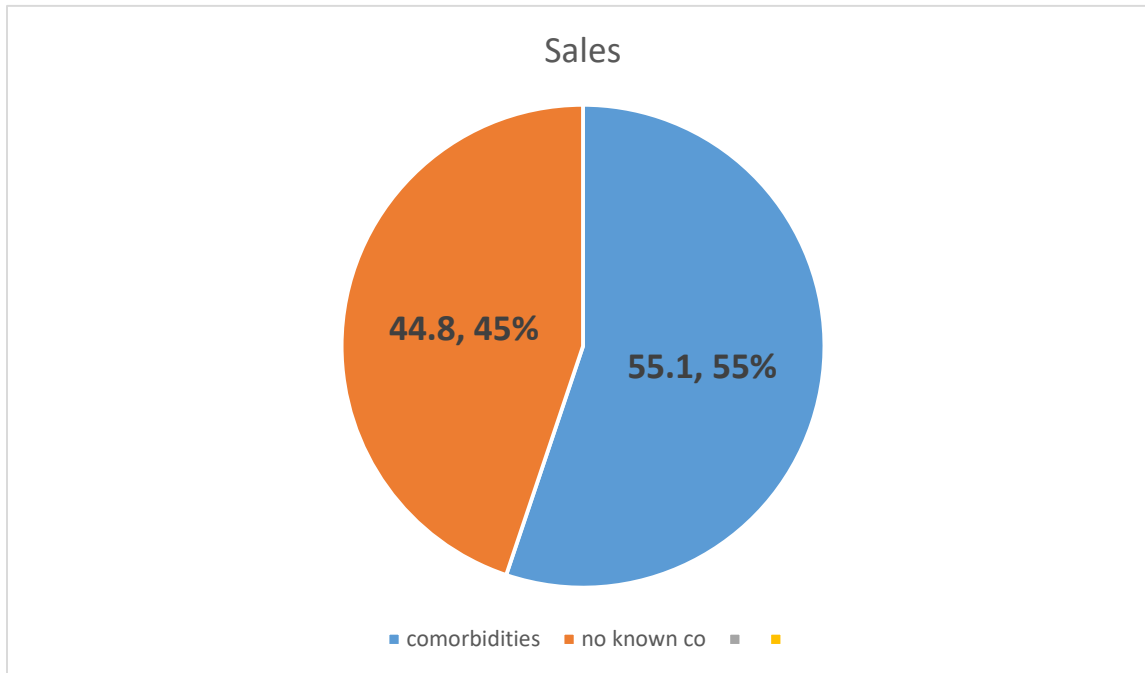
VARIABLES	CATEGORY	FREQUENCY	PERCENTAGE
SEX	Male	179	55.4
	Female	144	44.6
AGE	18-28	94	29.1
	29-38	74	22.9
	39-48	59	18.3
	49-58	54	16.3
	59-68	34	10.5
	>69	8	2.5

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### 6.2 Comorbidities

Among the study patients 178(55.1%) had comorbid illness while 145 (44.8%) had no known comorbid illness of those who had comorbid illness 129 (39.9%) had chronic pulmonary disease with more than three quarters. 83.5% of the patients had poor outcome postoperatively. From a

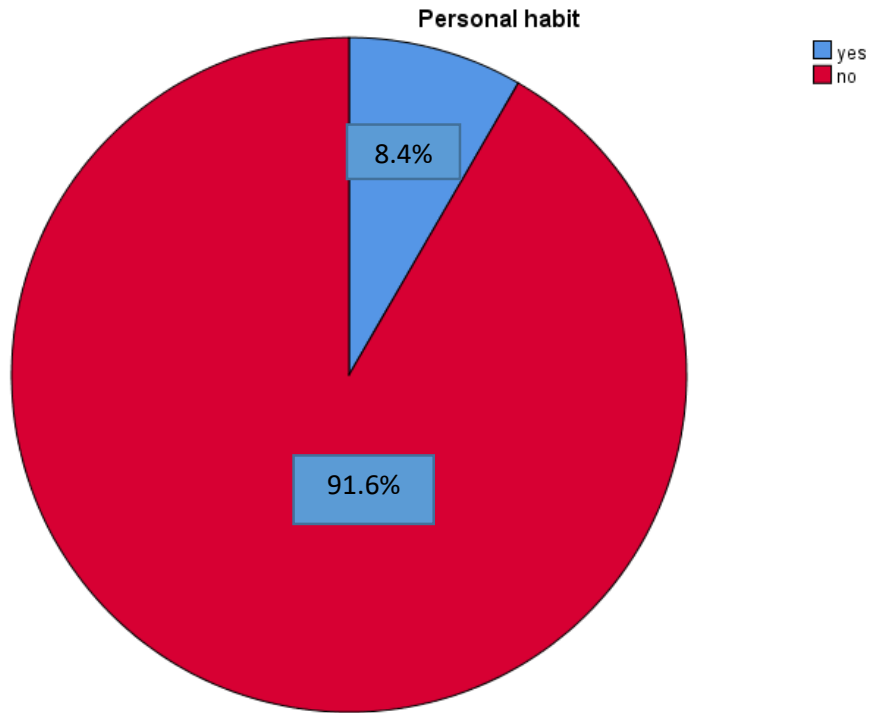
total of 39(12%) patients who had cardiac diseases, 18(46.1%) had poor outcomes, and from 145(44.8%) patients who had no known comorbidities 58(40%) of them had poor outcomes postoperatively. (Figure 2)



**Figure 2:** Comorbidities among cardiothoracic surgery patients at TASH, Addis Ababa, Ethiopia, 2021 (N=323)

### 6.3 Smoking habits

Among the study subjects only 27(8.4%) of patients had an experience of cigarette smoking. (Figure 3)



**Figure 3.** Smoking habits among cardiothoracic surgical patients at TASH, Addis Ababa, Ethiopia, 2021 (N=323)

#### **6.4 Facility related factors**

Among the study subjects only 2(0.6%) patients had surgery by fellow, the rest 321(99.4%) patients were operated by senior cardiothoracic surgeons. Duration of surgery of study subjects took 2-3 hours for 58(18%) patients and 3-4 hours for 265(82%) patients. Among patients who waited for surgery after admission 85(26.3%) waited 2-5 days, 165(51.1%) waited 5-7 days and 73(22.6%) waited 7-10 days. (Table 2)

**Table 2.** Facility related factors for patients who underwent cardiothoracic surgeries at TASH Addis Ababa, Ethiopia 2021 (N=323)

		<b>FREQUENCY</b>	<b>PERCENTAGE</b>
<b>WAITING TIME FOR SURGERY SINCE ADMISSION</b>	2 – 5 days	85	26.3%
	5 – 7 days	165	51.1%
	7 – 10 days	73	22.6%
<b>DURATION OF SURGERY</b>	2 – 3 hrs.	58	18%
	3 – 4 hrs.	265	82%
<b>SURGEON’S QUALIFICATION</b>	Senior	321	99.4%
	Fellow	2	0.6%

### **Outcomes of cardiothoracic surgery patients**

Most, 176(54.5%) patients in this study were cured without developing complications, after surgical intervention some 74(22.9%) patients develop pulmonary complication, from those patients who underwent surgeries had mortality 42(13%) and surgical site infection were 17(5.3%).In this study, 47 (14.5%) of patients with chronic pulmonary disease showed to have developed postoperative pulmonary complications. (Table 3)

**Table 3.** Distribution of cardiothoracic surgery outcomes among cardiothoracic surgical patients in TASH, Addis Ababa, Ethiopia: 2021 (N=323)

		OUTCOME OF CARDIOTHORACIC SURGERY				
		BL	SSI	M	PC	CWC
AGE	18-28	3(0.9%)	2 (0.6%)	10 (3.1%)	20(6.19%)	59 (18.2%)
	29-38	1 (0.3%)	3(0.9%)	6 (1.85%)	17(5.29%)	46 (14.2%)
	39-48	2 (0.6%)	1 (0.3%)	10 (3.1%)	13(4.02%)	33 (10.2%)
	49-58	2 (0.6%)	4(1.23%)	10 (3.1%)	11 (3.4%)	25 (7.7%)
	59-68	1 (0.3%)	4(1.23%)	4 (1.23%)	12 (3.1%)	11 (3.4%)
	>69	-	3(0.9%)	2 (0.6%)	2 (0.6%)	1 (0.3%)
SEX	Female	6 (1.9%)	7(2.16%)	12 (3.1%)	41(12.6%)	77 (23.8%)
	Male	3 (0.9%)	11(3.4%)	30(9.28%)	39(12.1%)	99 (23.8)
COMORBIDITIES	Chro.Pulm	3 (0.9%)	2 (0.6%)	15(4.02%)	47(14.5%)	63 (19.5%)
	Extra.cardiac	-	-	1 (0.3%)	-	-
	Neuro..Dysf	-	-	-	-	1 (0.3%)
	DM	-	1 (0.3%)	-	-	3 (0.9%)
	HTV	-	1 (0.3%)	-	2 (0.6%)	1 (0.3%)
	Cardiac	1 (0.3%)	-	9 (2.8%)	6 (1.9%)	21 (6.5%)
	No known	5 (1.5%)	14(4.3%)	17 (5.3%)	25 (7.7%)	87 (26.9%)
SMOKING HABIT	Smoker	-	2 (0.6%)	5 (1.5%)	9 (2.8%)	12 (3.7%)
	Non-smoker	9 (2.8%)	16(4.9%)	37(11.4%)	71 (22%)	164(50.7%)
DURATION OF SURGERY	2-3hrs	1 (0.3%)	2 (0.6%)	3 (0.9%)	11 (3.4%)	41 (12.6%)
	3-4hrs	8 (2.5%)	16(4.95%)	39(12.1%)	69(21.3%)	135(41.7%)
SURGEON QUALIFICATION	Senior	9 (2.9%)	18(5.6%)	42 (13%)	80(24.7%)	174 (53%)
	Fellow	-	-	-	-	2 (0.6%)
WAITING TIME FOR SURGERY AFTER ADMISSION	2-5days	4 (1.23%)	6 (1.9%)	2 (0.6%)	21 (6.5%)	51 (15.7%)
	5-7days	2 (0.6%)	5(1.54%)	39 (12%)	34(10.5%)	85 (26.3%)
	7-10days	3 (0.9%)	7(2.16%)	1 (0.3%)	25(7.73%)	40 (12.3%)

BL= bleeding, SSI= surgical site infection, M= mortality, PC= pulmonary complication, CWC= cure without complication, chr.pul.dis= chronic pulmonary disease, ettra.card.arth.= extra cardiac arteriopathy, neuro. dys. = neurologic dysfunction, DM= diabetic mellitus, HTN= hypertensive

## **6.5. Determinants of cardiothoracic surgery outcome**

To identify determinants associated with outcome of cardiothoracic surgery, each variable was assessed independently whether they were a predictor of outcome of cardiothoracic surgery or not. Variables with  $P < 0.2$  in bivariate analysis were considered for the multivariate logistic regression analysis. Finally, those variables with  $P < 0.05$  in multivariate analysis were deemed to have significant association with the outcomes. Accordingly, Ages between 18 and 28, 1.398 times more likely to develop poor outcomes postoperative compared to the rest age groups. [AOR=1.398, 95% CI=1.179-1.656]. Patients with chronic pulmonary disease are 1.713 times more likely to develop poor outcomes as compared to patients with other comorbidities and no known comorbidities [AOR=1.713, 95% CI=1.041-2.818]. And patients whose duration of surgery is 2-3hrs 2.306 times more likely to develop poor outcomes postoperative as compared to 3-4hrs duration of surgery [AOR=2.306 95% CI=1.241-4.283]. Smoking habits, waiting time for surgery after admission lost their significance.

**Table 4.** Bivariate and multivariate logistic regression of outcomes of cardiothoracic surgery and their determinants of TASH, Addis Ababa, Ethiopia: 2021 (N=323)

Variables		POOR OUTCOME S	GOOD OUTCOMES	COR(95%CI)	AOR(95%CI)
Age	18-28	36(11.1%)	58(18.9%)	<b>11.3(1.332-95.487)*</b>	<b>1.398(1.179-1.656)**</b>
	29-38	27(8.3%)	47(14.5%)	<b>12.1(1.422-104.407)</b>	
	39-48	26(8.04%)	33(10.2%)	8.9(1.027-76.640)	
	49-58	29(8.9%)	25(7.7%)	6.03(0.694-57.456)	
	59-68	22(6.8%)	12(3.7%)	3.8(0.419_34.812)	
	>69	7(2.16%)	1(0.3%)	1(ref)	
Sex	Female	67(20.7%)	77(23.8%)	1.077(0.693-1.673)	
	Male	80(24.7%)	99(30.6%)	1(ref)	
<b>Comorbidities</b>	Chroni. PulDis	65(20.1%)	64(19.8%)	0.656(0.407-1.060)*	<b>1.713(1.041-2.818)**</b>
	ExtraCard.Art	1(0.3%)	-	-	
	Neurologic dy	-	1(0.3%)	-	
	Diabetic melli	2(0.6%)	2(0.6%)	0.667(0.091-4.867)	
	Hypertensive	3(0.9%)	1(0.3%)	0.222(0.023-2.189)	
	Cardiac	18(5.57%)	21(6.5%)	0.778(0.382_1.585)	
	No known com.	58(17.9%)	87(26.9%)	1(ref)	
<b>Smoking habits</b>	Smokers	15(4.6%)	12(3.7%)	1.553(0.703-3.432)	
	Non smokers	132(40.8%)	164(50.7%)	1(ref)	<b>2.306(1.241-4.283)**</b>
	2-3hrs	17(5.2%)	41(12.6%)	2.322(1.256-4.294)	
<b>Duration of sur.</b>	3-4hrs	130(40.2%)	135(41.7%)	1(ref)	
<b>Waiting time Since diagnosis</b>	2-5days	32(9.9%)	53(16.4%)	1.525(0.808-2.879)	
	5-7days	80(24.7%)	85{26.3%}	0.979(0.564-1.699)	
	7-10day	35(10.8%)	38(11.7%)	1(ref)	
<b>Surgeon's qualif.</b>	Fellow	0	2(0.6%)	-	
	Senior	145(44.8%)	176(54.4%)	-	

Chr pul dis= Chronic pulmonary disease, extra cardi.arthur= extra cardiac arteriopathy, DM= Diabetic Mellitus, HTV= hypertensive. COR=crude odds ratio, AOR= adjusted odds ratio, CI=confidence interval, \*= p<0.2, \*\*=p<0.05

## 7. DISCUSSION

In this study male cardiothoracic patients were higher (55.4%) compared to female patients. In the study conducted at Temper University press (6) female patients were more prevalent than male. In our country from the tradition related to controlling emotion, men are more susceptible to heart disease. And the mean age was between 39.3 ranges SD (mean  $39.3 \pm 14.3$ ) from 18-78 years. Most procedures were esophagectomy 76 (23.5%). This result is the same as a five year retrospective study, patterns of surgical admissions at TASH (3). This similarity is because of similarity among the participant population.

In this study, patients' age between 18 and 28 years were 1.6 times more likely to develop poor postoperative outcomes compared to their counterparts. The result differs from the studies conducted in Canada, which showed older ages were more likely to have poorer outcome (15), this difference may be due most cases were in the younger age in the current study.

In this study patients with chronic pulmonary disease were more likely to develop poor outcomes postoperatively as compared to patients who had no known comorbidities. Post pulmonary complication after thoracic surgery is common and is associated with a poorer long term outcome. Respiratory complication occurs after major surgery particularly after general anesthesia: atelectasis, pneumonia and acute respiratory distress syndrome is the most common pulmonary complication postoperatively (14, 23). This study was conducted in the division of respiratory diseases, department of internal medicine, jikei university school of medicine, Tokyo, japan (21).

Longer duration of surgery in this study was associated with poor outcomes postoperatively. The likelihood of complication increased significantly with prolonged operative duration. This study was the same as the findings in Canada, where prolonged operation duration is associated with development of complications (20).

## **8. STRENGTH AND LIMITATION OF THE STUDY**

### **Strengths**

This study was the first study that attempted to assess the determinants of cardiothoracic surgery outcome in Tikur Anbessa Specialized hospital it can be used as baseline data for researchers. Probability sampling was used to enroll participants and the study achieved the required sample size with 100% response rate.

### **Limitations**

The cross-sectional nature of the study may hinder cause and effect relationship and it has used a single institution which may limit to draw conclusions beyond the study area.

## **9. CONCLUSION AND RECOMMENDATION**

### **Conclusion:**

In the study of determinants of cardiothoracic surgery outcomes among patients underwent cardiothoracic surgery at TASH was to show the relationships between the determinants and outcomes of surgeries. In this studies age, comorbidities (chronic pulmonary disease), and duration of surgery were associated with poor outcomes, of this result further investigation needs to adjust perioperative activities like adjusting medications, chest physiotherapies, preoperative and postoperative patient care in order to reduce the poor outcomes, to facilitate patients turn overs and increase satisfactions.

### **Recommendation:**

#### **To researchers:**

Further studies must be done in different hospitals to assess the factors that affect the cardiothoracic surgical outcomes.

#### **To health facilities**

Assessing patients past health status before surgery is mandatory in order to reduce postoperative complications.

Other research should be conducted by involving large sample sizes to identify the other factors that affect the outcomes of cardiothoracic surgery.

There should be education or training regarding perioperative nursing care to improve patient outcomes.

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## 11. ANNEX

Data extraction sheet used to assess the determinants of cardiothoracic outcomes at Tikur Anbessa specialized hospital

1. Data collector codes .....
2. Date of data collection .....
3. Checked by supervisor ..... Signature .....

### Part 1. Socio demographic data of a patient

- i. Serial number .....
- ii. Card number.....
- iii. Age of patients .....
- iv. Sex of patients      a) Female      b) male

### Part 2. What procedure was performed?

- A. Esophagectomy
- B. Lobectomy
- C. Pneumonectomy
- D. Hydatid Cystectomy
- E. PDA ligation
- F. VATS lobectomy
- G. pericardiectomy

### Part 3. What was the outcomes of surgeries?

- |                              |        |       |
|------------------------------|--------|-------|
| A. Bleeding                  | a) Yes | b) No |
| B. Surgical site infection   | a) Yes | b) No |
| C. Mortality                 | a) Yes | b) No |
| D. Neurologic dysfunction    | a) Yes | b) No |
| E. Renal dysfunction or AKI  | a) Yes | b) No |
| F. Pulmonary complication    | a) Yes | b) No |
| G. Cure without complication | a) Yes | b) No |

**Part 4. Comorbidities**

- |                               |        |       |
|-------------------------------|--------|-------|
| A. Chronic pulmonary disease  | a) Yes | b) No |
| B. Extra cardiac arteriopathy | a) Yes | b) No |
| C. Neurologic dysfunction     | a) Yes | b) No |
| D. Diabetes mellitus          | a) Yes | b) No |
| E. Hypertensive               | a) Yes | b) No |
| F. Cardiac                    | a) Yes | b) No |

**Part 5. Personal habits**

- A. Tobacco use
- a) Smoker                      b) non smoker

**Part 6. Facility related factors**

- A. surgeons year of experience or surgeons qualification
- a) senior                      b) fellow
- B. waiting time for surgery after admission
- a) 2-5 days                      b) 5-7 days                      c) 7-10 days
- C. duration of surgery
- a) 2-3hrs                      b) 3-4hrs

