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PATTERNS OF CARDIOTHORACIC SURGERY PRACTICE AT TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA: A CROSS-SECTIONAL MEDICAL RECORD REVIEW STUDY

BY:

NATNAEL MULUNEH (MD)

THESIS SUBMITTED TO DEPARTMENT OF SURGERY, COLLEGE OF HEALTH SCIENCES, AAU IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR SUBSPECIALITY CERTIFICATE IN CARDIOTHORACIC SURGERY

JULY, 2025

ADDIS ABABA,
ETHIOPIA

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ABSTRACT

Introduction: Cardiothoracic surgery (CTS) addresses critical conditions like coronary artery disease, valvular disorders, and congenital heart defects, which are rising globally. In Ethiopia, CTS demand is increasing, yet data on practice patterns remain limited. This study evaluates CTS practices at Tikur Anbessa Specialized Hospital (TASH), Ethiopia.

Objectives: Patterns of cardiothoracic surgery practice at Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia, 2022-2024.

Methods: A retrospective cross sectional study was conducted among patient operated at Tikur Anbessa specialized hospital. The study subjects was all CTS patients treated at TASH over the past three years. Data was collected using a semi-structured questionnaire and checklist. Data was entered and analyzed using SPSS version 20. In the analysis process, frequency distribution of variables was calculated. To ascertain the association between dependent and independent variables, odds ratio with 95% confidence interval was calculated.

Results: Mean patient age was 30.59 years (±20.28), with 33.9% young adults and 34.9% pediatric cases. Gender distribution was balanced (50.9% male, 49.1% female), and most patients were urban residents (68.7%). Cardiac surgeries (35.7%) is less frequent than thoracic (64.7%), peaking in 2024 (73cardiac surgery). Leading indications were congenital heart defects (26.5%) and malignancies (22.7%). Survival rate was 97.2%, with 2.8% mortality and 10.4% readmission.

Conclusion: TASH manages Ethiopia's high burden of congenital and infectious cardiac diseases effectively, though infrastructure and surgical volume lag behind high-income settings. Recommendations include expanding training, improving referrals, and enhancing postoperative care.

Keywords: Cardiothoracic surgery, treatment outcomes, TASH, Ethiopia.

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LIST ACRONYMS AND ABBREVIATIONS

AAU	Addis Ababa University
AOR	Adjusted Odds Ratio
ASD	Atrial septal defect
CABG	Coronary Artery Bypass Grafting
COR	Crud Odds Ratio
CNCD	Chronic Non Communicable Disease
EC	Esophageal cancer
FB	Foreign body
GERD	Gastro Esophageal Reflex Disorder
NCDs	Non Communicable Disease
PDA	Patent ductus arteriosus
SPSS	statistical package for social science
STS	Cardiothoracic surgery
TASH	Tikur Anbessa Specialized Hospital
VSD	Ventricular septal defect
WHO	World Health Organization

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1. INTRODUCTION

1.2 Background

Cardiothoracic surgery is a specialized surgical discipline dedicated to the diagnosis and treatment of diseases affecting the heart, lungs, and other structures within the chest cavity [1]. It demands a deep understanding of the complex anatomy and physiology of the cardiovascular and respiratory systems, requiring a multidisciplinary approach that integrates surgical skills, medical knowledge, and technological advancements [1,2]. The field has evolved significantly over the past century, driven by advancements in surgical techniques, imaging modalities, and patient management strategies.

Cardiothoracic surgery encompasses a wide spectrum of procedures, ranging from minimally invasive techniques to complex open-heart surgeries. Key areas of practice include: Coronary Artery Bypass Grafting (CABG), Valve Surgery, Congenital Heart Surgery, heart and Lung Transplantation [1,3].

Global reports are showing that there is increasing incidence and prevalence in cardiothoracic diseases [3]. An average total cardiac surgical volume of is 123.2 per 100,000 populations per year [4]. These changes are especially seen in developing countries [5]. Coronary artery diseases, rheumatic heart diseases, congenital heart disease, trauma and thoracic malignancies are increasing and becoming more urgent problem(7) The concept of improving overall global healthcare is taking surgery as necessary component of public health policy. The most commonly performed procedures are for the pathologies of heart, lung cancer and emphysema, esophageal cancer(3).

Within cardiothoracic surgeons practicing in USA, the most commonly performed procedures are adult cardiac surgery, pulmonary surgery and esophageal surgery. A cardiothoracic surgeon deals with the deadliest health conditions worldwide; like ischemic heart disease, lung cancer and esophageal cancer [8].

Cardiovascular diseases have significant burden on the global health, surgical and interventional healthcare service, mostly prevalent cases being ischemic heart disease, congenital heart disease, Rheumatic heart disease, valvular and Aortic conditions.

Non-communicable diseases (NCD) are responsible for 17 million people death each year before they reach age of 70 years. Ischemic heart disease and stroke being the commonest cause for cardiovascular disease related death globally [8, 9].

Cardiovascular diseases represent a leading cause of death globally, responsible for an estimated 17.9 million deaths annually representing 32% of all global deaths. Of these deaths, 85% were due to heart attack and stroke. Cardiothoracic surgery plays a vital role in treating these conditions, but access to specialized care varies significantly across the world [10].

In Africa, cardiovascular diseases pose a significant public health burden, contributing to substantial morbidity and mortality [11]. In 2019, >1 million deaths were attributable to CVD in sub-Saharan Africa alone While the need for cardiothoracic surgery is substantial, access to specialized care remains limited in many parts of the continent, reflecting a gap in resource allocation, training, and infrastructure [5,11].

In Ethiopia, cardiovascular diseases pose a substantial public health burden, contributing to significant morbidity and mortality [6]. Tikur Anbessa, a tertiary care center in Addis Ababa, is a crucial provider of cardiothoracic services, offering essential care to a large population within Ethiopia [13]. Understanding the patterns of surgical procedures performed at this hospital is crucial to assess the current state of cardiothoracic care, identify emerging trends, and inform future initiatives to improve patient outcomes.

1.2 Statement of the Problem

Cardiothoracic surgery plays a critical role in the management of cardiovascular and thoracic diseases, which are among the leading causes of morbidity and mortality globally. In Ethiopia, particularly at Tikur Anbessa Specialized Hospital (TASH), the demand for cardiothoracic surgical interventions has been on the rise, reflecting the increasing prevalence of conditions such as coronary artery disease, valvular heart disease, and lung malignancies. As the largest referral hospital in the country, TASH serves a diverse patient population, including individuals from various socioeconomic backgrounds and regions, making it a vital hub for advanced cardiac care.

Understanding the patterns of cardiothoracic surgery at TASH is essential for several reasons. First, it provides insights into demographic trends, clinical characteristics, and surgical outcomes that can inform healthcare policies and resource allocation. Second, identifying the specific needs and challenges faced by patients undergoing these procedures can enhance preoperative assessments and postoperative care protocols. Finally, this knowledge can contribute to the development of targeted training programs for healthcare professionals, ultimately improving surgical outcomes and patient safety.

Globally, there are several studies from the developed countries, showing the pattern, trend and evolution of cardiothoracic surgery, conducted at nation level and institutional base. Having the procedural pattern enabled to analyze the overall progress of their surgical expertise and effect on the patient outcome, as well improvisation of better work habit.

Despite the growing body of literature on cardiothoracic surgery in various global contexts, there is a notable lack of comprehensive data specific to Ethiopia. This gap underscores the importance of conducting a systematic review of surgical patterns at TASH to better understand the factors influencing patient outcomes and to identify areas for improvement.

Additionally the increasing demand for cardiothoracic surgical interventions at Tikur Anbesa Specialized Hospital (TASH), there is exists a significant gap in understanding the patterns and outcomes associated with these procedures. TASH is the pioneer public hospital to provide cardiothoracic surgery service and the only academic institution site for sub-specialty in cardiothoracic surgery in Ethiopia. The hospital has been the only public health institution in the country at which cardiothoracic surgery was being done. Throughout these long service years there were variety of cardiothoracic surgical procedures performed, both by local team and missionaries. Yet there is only one study conducted about the patterns of cardiothoracic surgery admission done 10 years back as per my searching ability.

The absence of study showing the surgical practice trend leaves the hospital with no landscape to evaluate the progression throughout the years of practice. In such cases it is invaluable to study the patterns of cardiothoracic surgery performed at this hospital. The study provide a benchmark to evaluate CTS practice at TASH and compare with worldwide and regional trends.

There for by examining demographic information, clinical characteristics, surgical details, and postoperative outcomes, this study aims to provide a holistic view of cardiothoracic surgery practices at Tikur Anbessa Specialized Hospital and to contribute valuable insights to the field of cardiac care in Ethiopia.

1.3 SIGNIFICANCE OF THE STUDY

The study provides data on the pattern of cardiothoracic surgical procedures performed. First, it provides insights into demographic pattern, surgical characteristics, and surgical outcomes that can inform healthcare policies and resource allocation.

The data regarding the commonly performed cardiothoracic surgical procedures is a great input initiating local treatment guideline and building an excellence center. The study showed what cardiothoracic surgical procedures are less commonly performed.

The regional referral pattern helps in designing region specific interventions. It is a great input for drawing the roadmap in capacity building programs that can level up the cardiothoracic surgery service and introduction and adoption of new skills. The study allows to evaluate the institutional stand with the regional and international status and to share in experience exchange programs.

2. LITERATURE REVIEW

2.1 Patterns of Cardiothoracic Surgery Practice

This literature review highlights the complex nature of cardiothoracic surgery and the diverse factors influencing patterns of practice. Understanding these patterns is essential for improving surgical outcomes, enhancing patient care, and ensuring equitable access to specialized services. Future research should continue to investigate the influence of demographic, clinical, surgical, and postoperative factors on cardiothoracic surgery patterns, ultimately contributing to the continuous improvement of patient care and outcomes.

2.2 Demographic Information

Demographic trends indicate that patients undergoing cardiothoracic surgery are increasingly older, reflecting the aging global population and a rise in cardiovascular disease among seniors, necessitating specialized surgical and postoperative care to address comorbidities and enhance recovery. While cardiovascular disease predominantly affects men, there are notable gender-specific differences in disease presentation and surgical outcomes, with women facing heightened risks for complications post-coronary artery bypass grafting (CABG). Additionally, socioeconomic factors such as healthcare access, insurance coverage, and social support significantly influence the availability of cardiothoracic surgery, with lower socioeconomic status linked to poorer health outcomes and greater disparities in care access. The presence of comorbidities like diabetes, obesity, COPD, or renal insufficiency complicates surgical procedures, leading to increased complication rates, prolonged hospital stays, and worse long-term outcomes for affected patients [14,15].

2.3 Clinical Characteristics of CTS

Cardiothoracic surgery encompasses various procedures, with the most common being coronary artery bypass grafting (CABG), valve surgery, lung transplantation, and thoracic oncology surgery. Indications for these surgeries differ; CABG is typically indicated for stable or unstable angina, myocardial infarction, and coronary artery disease, while valve surgery addresses valvular heart diseases, and lung transplantation is reserved for patients with end-stage lung disease. A thorough preoperative assessment is vital for identifying patient risks and optimizing surgical planning, focusing on factors such as ejection fraction, left ventricular function, and pulmonary function tests to ensure patient suitability for surgery [10,16].

2.3. Surgical Details of CTS

The surgical details of cardiothoracic surgery (CTS) encompass several key factors, including the date of surgery, which helps identify trends in the adoption of new techniques and shifts in patient demographics and conditions. The duration of surgery varies based on procedure complexity, surgical approach, and patient characteristics, with longer durations potentially increasing complication risks. Additionally, while general anesthesia with cardiopulmonary bypass is commonly used for procedures that necessitate stopping the heart, there is a growing trend towards regional anesthesia and minimally invasive techniques, which contribute to shorter surgery times and potentially improved outcomes.

2.4. Postoperative Outcomes

Postoperative outcomes in cardiothoracic surgery are influenced by various factors, including the type of surgery, patient health status, and complications. The length of hospital stay can vary significantly, with minimally invasive techniques and enhanced postoperative care leading to shorter stays for certain procedures. Complications such as infection, bleeding, and arrhythmias can adversely affect recovery and are influenced by patient age, comorbidities, and the specific surgical intervention [17,18]. Additionally, 30-day mortality rates serve as a crucial measure of surgical success, with improvements in minimally invasive methods and perioperative management contributing to reductions in these rates across different procedures and patient [19].

More over **f**ollow-up data in cardiothoracic surgery encompasses readmission rates and long-term outcomes, both of which are critical for assessing post-operative care effectiveness. Readmission rates within 30 days of discharge serve as indicators of the quality of post-operative management and the incidence of complications. Meanwhile, long-term outcomes, including quality of life assessments and functional status, provide insights into the overall impact of surgery on patients' lives, influenced by factors such as the type of procedure, patient demographics, and post-operative rehabilitation programs [18]

2.5. Conceptual Frame Work

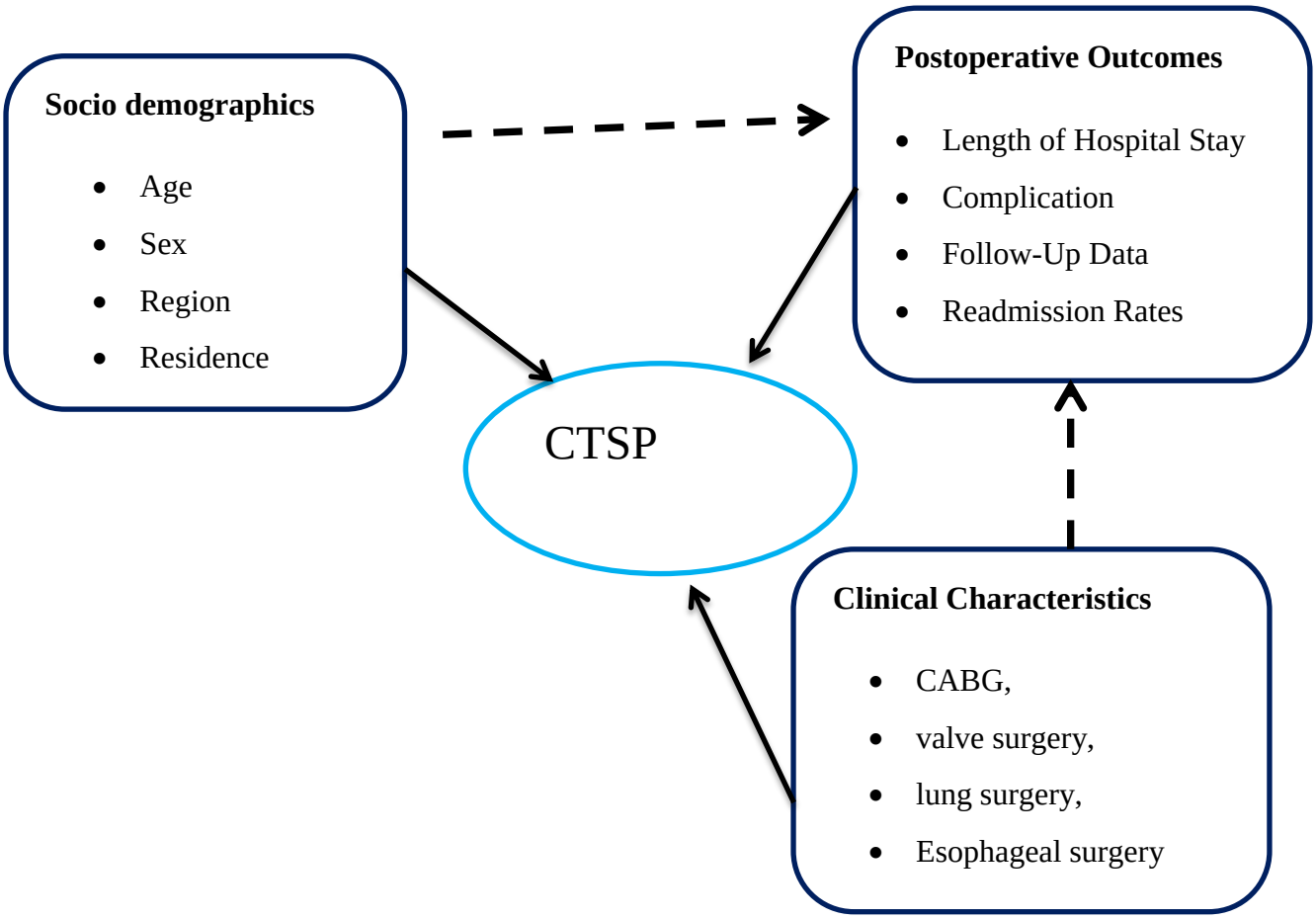

Figure 1 Adapted Conceptual Frame for CTS pattern at TASH (11, 17–20)

3. OBJECTIVES OF THE STUDY

3.1 GENERAL OBJICETIVE

- ✓ To assess the patterns of cardiothoracic surgical procedures done from Jan, 2022 to Dec, 2024 at TASH, Addis Ababa, Ethiopia.

3.2 Specific objectives

- ➢ To assess the patterns of thoracic surgical procedures done from Jan, 2022 to Dec, 2024, TASH, Addis Ababa, Ethiopia
- ➢ To assess the patterns of cardiac surgical procedures done from Jan, 2022 to Dec, 2024, TASH, Addis Ababa, Ethiopia
- ➢ To evaluate the indications for cardiothoracic surgical procedures done from Jan, 2022 to Dec, 2024, TASH, Addis Ababa, Ethiopia

4. METHODS AND MATERIALS

4.1 Study Setting and Period

The study was conducted at Tikur Anbessa Specialized hospital Addis Ababa, Ethiopia, officially the Federal Democratic Republic of Ethiopia. Ethiopia is a landlocked country located in the Horn of Africa region of East Africa. It shares borders with Eritrea to the north, Djibouti to the northeast, Somalia to the east and southeast, Kenya to the south, South Sudan to the west, and Sudan to the northwest. Ethiopia covers a land area of 1,112,000 square kilometers (472,000 sq. miles). As of 2022, its projected population is estimated to be 105.17 million (19) making it the 2nd-most populous country in Africa next to Nigeria. Addis Ababa is a national capital and largest city.

TASH, established in 1972, is a public teaching hospital of the AAU, CHS. TASH is the largest and one of the most advanced government healthcare facilities in Ethiopia. The hospital serves a diverse population and is equipped with specialized cardiothoracic surgical units. It is the largest referral hospital in the country with 700 in-patient beds. The hospitals provide different service range from chemotherapy to surgical services for cardiac, lung, and esophageal surgery.

The study was conducted on patients operated from January 1, 2022, and December 31, 2024.

4.2 Study design

A three years retrospective cross sectional study was conducted using medical record review during the study period.

4.3 Population

4.3.1 Source Population

The source population was all patients who had major cardiothoracic surgical procedures between January 1, 2022 and December 31, 2024 at TASH

4.3.2. Study Population

The study population includes all patients who underwent cardiothoracic surgery at Tikur Anbessa specialized Hospital between January 1, 2022, and December 31, 2024 who met the eligibility criteria.

4.4. Inclusion and Exclusion Criteria

4.4.1. Inclusion Criteria

- Adults and children who underwent elective or emergency cardiothoracic surgical procedures.
- Patients with documented preoperative, intraoperative, and postoperative data.

4.4.2. Exclusion Criteria

• Patients who had incomplete medical records.

• Those that underwent non-surgical management for cardiothoracic diseases.

4.5 Sample Size Determination

Sample size was determined using single population proportion formula by taking 50% expected proportion and 5% margin of error (d), with 95% confidence level (CI) the sample size was 384. Then after adding 10% non-response rate sample size was 422 and finally adjusting for finite population correction resulting final sample size of 297

$$n = \frac{(z \propto /2)2\, p(1-p)}{d2}$$

$$n = \frac{(1.96)2(0.5)(0.5)}{(0.05)2}$$

0.9604/0.0025

=384

n=384+10% non-response rate = **422**

4.6 Study Variables

4.6.1. Outcome Variables

- Cardiothoracic surgery

4.6.2 Independent Variables

1. Socio-demographic Characteristics;

- Age,
- Sex
- Residence
- Religion
- Region
- Socioeconomic status Monthly income,
- Comorbidities

2. Clinical Characteristics:

• Type of cardiothoracic surgery (coronary artery bypass, valve replacement, lung resection)

• Indications for surgery

3. Surgical Details:

• Date of surgery

• Duration of surgery

4. Postoperative Outcomes:

• Length of hospital stay

• Complications (infection, bleeding…)

• Patient status at discharge

• Readmission rates within 30 days

4.7 Operational Definition

Cardiothoracic surgery is a surgical procedure done under general anesthesia for lung, pleura, esophageal, cardiac, chest wall diseases [1].

4.8 Data Collection Tool and Procedures

Data were collected using data abstracting checklists, which are prepared in English. Data were extracted from OR logbook, preoperative patient medical record, operation notes, pathologic record and postoperative follow up records. Patients was also be contacted by telephone address for additional information on their postoperative conditions. Patients who have surgery for recurrence CTS were included once and CTS Pattern were determined from the date of the first surgery. At least three resident physicians were selected and trained on the purpose of the study and data collection procedures. Data were filled by trained physicians.

4.9 Data processing and analysis

After the collected data was compiled, organized, coded, entered to cleaned google sheet and was analysed using SPSS version 20. In the analysis process, frequency distribution of variables was worked out in order to describe them.

Descriptive statistics was employed to summarize demographic and clinical characteristics, including means, medians, frequencies, and percentages.

4.10 Data quality management

To assure the quality of data, Instruments were commented by advisors and then pre-tested was made on 5% of the sample size to identify problems on the data abstracting check list and correction was incorporated in the final data abstracting check lists.

Training of data collectors and supervisor was given on the objectives and relevance of the study, confidentiality of information, and how to extract data from logbook and medical records.

Daily supervision was carried out by the principal investigator to monitor quality of the data collection process and checking the completeness and consistency of collected data. Double data entry with Epi-info and SPSS was used.

4.11 Primary Ethical consideration

Ethical approval for the study was obtained from the Research Ethical Committee of surgery Department/Institutional Review Board (IRB) of AAU, college of health sciences, school of medicine. Patient confidentiality was strictly maintained by anonymizing data during collection and analysis. Informed consent was not required for this retrospective study, as it involves the use of existing medical records. Medical record number was used for the data collection and personal identifier of the patient was not used in the research report. Access to the collected information was limited to the principal investigator and trained data collectors, so confidentiality was maintained throughout the project.

4.12 Data presentation and dissemination

The results of this study disseminates to AAU, TASH, Regional health bureau, Ministry of health and other concerned bodies.

5. RESULTS

5.1 Socio-demographic characteristics

The study analyzed total 422 cardiothoracic surgery cases with 100% response rate performed at Tikur Anbessa Specialized Hospital (TASH), Addis Ababa, Ethiopia, from January 2022 to December 2024. The mean age of reviewed patients was 30.59 years with (SD: 20.28). The majority of patients (33.9%) were young adults (20–39 years)**,** 34.9% Pediatric cases (1–19 years)**.** Out of the total (50.9%) were males and (49.1%) were females. Most (50.7%) of the CTS patient were married and (68.7 %) from urban residency. Majority of the patients were from Oromia (32.5%) and Amhara (23.2%) regions, Addis Ababa residents (23.0%) also formed a large group. Peripheral regions (Somali, Tigray, others: 4.0%) had fewer cases. About 36.7% reviewed patients were had no formal education, whereas 32.7% had above secondary education. Regarding occupation majority of the respondent were Government employment and Unemployed and Student 14.2%, 23.7% and 18.2% respectively (Table 1)

Table 1 Socio-demographic characteristics of the study participants to assess the patterns of cardiothoracic surgical procedures done from Jan, 2022 to Dec, 2024 at TASH, Addis Ababa, Ethiopia (n=422)

Variable		Frequency	Percent
Age	1-12	94	22.3%
	13-19	53	12.6%
	20-39	143	33.9%
	40-59	86	20.4%
	60-90+	46	10.9%
Sex	Female	207	49.1%
	Male	215	50.9%
Marital status	Child	110	26.1%
	Married	214	50.7%
	Single	87	20.6%
	Widow	11	2.6%
Region	Addis Ababa	97	23.0%
	Amhara	98	23.2%
	Oromo	137	32.5%
	SNNPR	73	17.3%
	Somali	8	1.9%

	Tigray	6	1.4%
	Others	3	0.7%
Resident	Rural	132	31.3%
	Urban	290	68.7%
Educational	No formal education	155	36.7%
Status	Primary school	49	11.6%
	Secondary school	80	19.0%
	Above secondary	138	32.7%
Religion	Muslim	109	25.8
	Orthodox	242	57.3
	Others	6	1.4
	Protestant	65	15.4
Occupation	Government employment	60	14.2
	Unemployed	100	23.7
	Private	36	8.5
	Farmer	43	10.2
	Merchant	35	8.3
	House wife	59	14.0
	Student	77	18.2
	Others	12	2.8

5.2. Patterns and Volume of Cardiothoracic Surgery

Overall trends of cardiac and thoracic surgical procedures performed at TASH from January 1, 2022 to December 31, 2024 total of 422 cardiothoracic surgeries (CTS)**,** Cardiac surgeries (151 cases, 35.7%) were less frequent than thoracic surgeries (271 cases, 64.3%)**,** reflecting TASH's role in managing more thoracic surgical diseases.

Patterns CTS in terms of yearly Distribution; 2022 had the highest surgical volume (153 cases)**,** with more frequent thoracic surgical procedures (120 cases) compared to 2022and 2024. In subsequent years of volume of thoracic surgery has decreased, with notable decline in year 2024 becoming 71 cases. In contrast cardiac surgical procedures are increasing throughout the study period, more than two times of cases done in 2022 are performed in 2024.

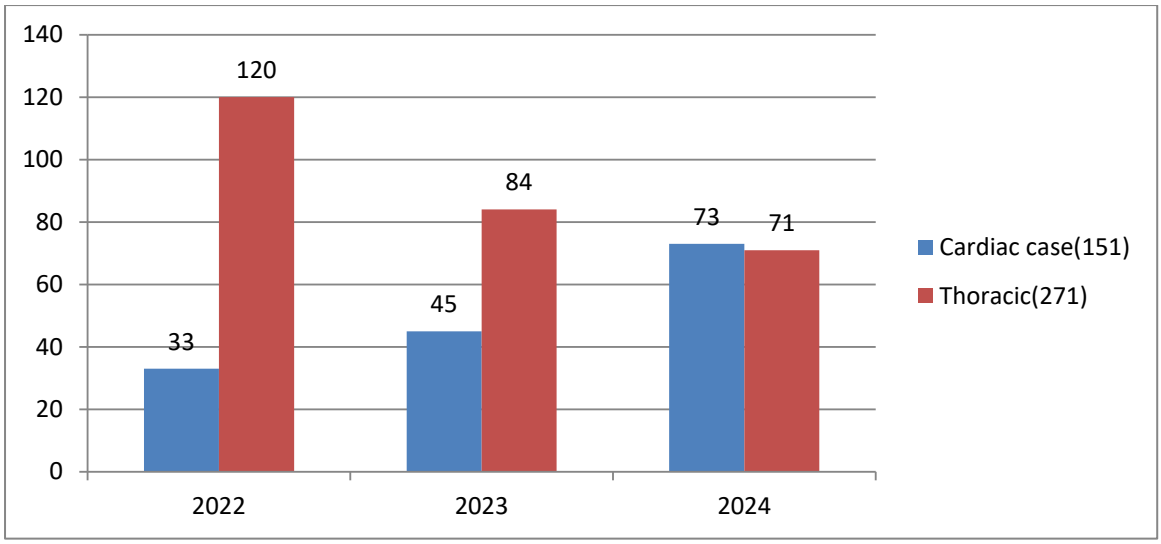

Figure 2 Annual Surgical Volume of CTS to assess the patterns of cardiothoracic surgical procedures done from Jan, 2022 to Dec, 2024 at TASH, Addis Ababa, Ethiopia

5.3. Clinical Characteristics and Surgical Details of CTS

Most patients 378 (89.6%) had no documented comorbidities, while HIV, hypertension, diabetes and Down syndrome were the most common comorbidities accounts for 44 (10.4%).

The surgical caseload was nearly evenly divided between cardiac (35.8%) and lung (34.6%) procedures, with esophageal surgeries comprising about a quarter of cases (24.2%). Chest wall and mediastinal operations were relatively uncommon, accounting for just 5% and 0.5% respectively. This distribution reflects TASH's dual role in managing both congenital heart conditions and acquired thoracic diseases.

Regarding to disease indications, congenital heart defects (26.5%) formed the largest single category of surgical indications, dominated by conditions like PDA, ASD and VSD. Malignant diseases collectively accounted for nearly a quarter of cases, with esophageal cancer (15.4%) being more prevalent than lung cancer (7.3%). Non-cancerous lung conditions (13.3%) and pleural diseases (10.4%) represented significant portions of the thoracic surgery caseload. Constrictive pericarditis cases (5.5%) indicate Ethiopia's burden of infectious and inflammatory cardiac conditions.

The hospital achieved excellent surgical outcomes, with 97.2% of patients surviving to discharge. The low mortality rate (2.8%) suggests effective perioperative care despite resource limitations. Follow-up compliance was remarkably high at 96%, though the 10.4%

readmission rate may indicate challenges in postoperative management or disease complexity.

Table 2 Clinical characteristics and surgical indication of CTS to assess the patterns of cardiothoracic surgical procedures done from Jan, 2022 to Dec, 2024 at TASH, Addis Ababa, Ethiopia (n=422)

Variable		Frequency	Percent
Comorbidity	HIV	12	2.8%
	Hypertension ± Stroke	12	2.8%
	Diabetes ± hypertension	10	2.4%
	Down Syndrome	10	2.4%
	None Reported	378	89.6.0%
Type Of CTS	Cardiac	151	35.8
	Lung	147	34.8
	Esophagus	101	23.9
	Chest wall	21	5.0
	Mediastinum	2	.5
Indication			
Cardiac	Cardiac, acquired	16	3.8
	Cardiac, congenital	112	26.5
	Constrictive pericardium	23	5.5
Thoracic	Chest wall	21	5.0
Esophagus	Esophagus non caner	37	8.8
	Esophageal cancer	65	15.4
Lung	Airway	11	2.6
	Lung cancer	31	7.3
	Lung, non-cancer	56	13.3
	Mediastinum	6	1.4
	Pleura	44	10.4
Follow up	No	17	4.0
	Yes	405	96.0
Re-admission	No	378	89.6
	Yes	44	10.4
status at discharge	Alive	410	97.2
	Death	12	2.8

5.4 Common types of cardiothoracic surgical procedure

Out of total 422 CTS procure 147 lung surgeries were performed, with the most common being lobectomy 54 (36.7%) followed by decortication 35(23.8%). Cystectomy accounted for 20 (13.6%), while pneumonectomy was performed in 12(8.1%) of cases. Less frequent procedures included bullectomy 9(6.2%), tracheal resection and anastomosis 10(6.8%) and thoracotomy 7(4.8%).

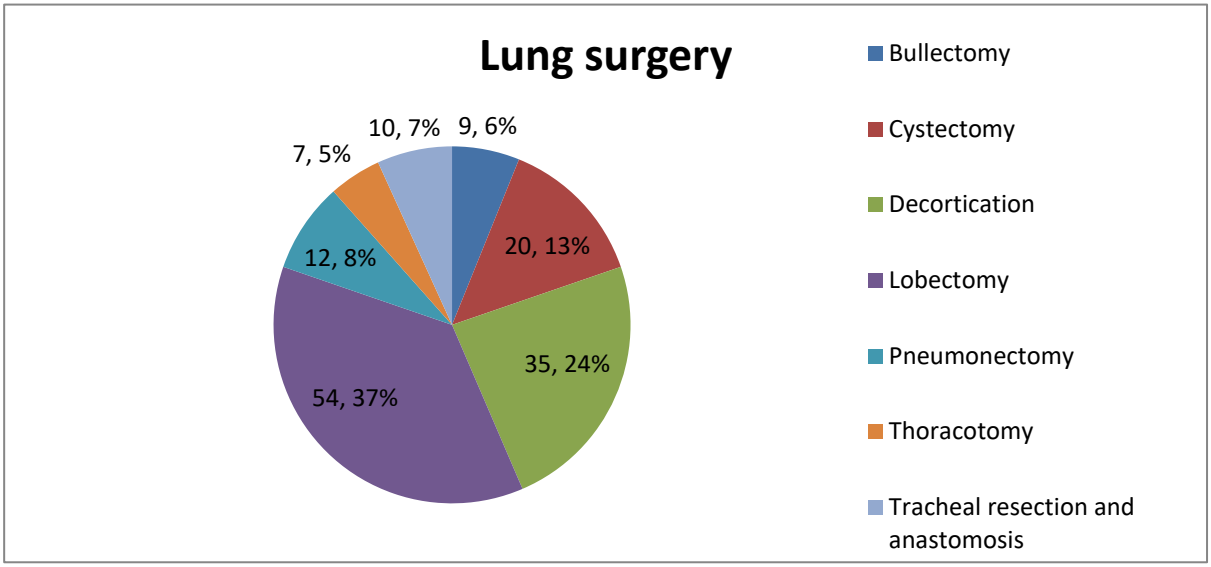

Figure 3 Common types of lung surgeries performed at TASH From 2022-2024

Among 150 cardiac surgeries, PDA division and closure was the most frequent 81(54%) followed by pericardiectomy 28(18.7%) and ASD repair 26(17.3%). Other procedures, such as VSD repair and aortic surgery, valve replacement and Tetralogy of Fallot repair were less common.

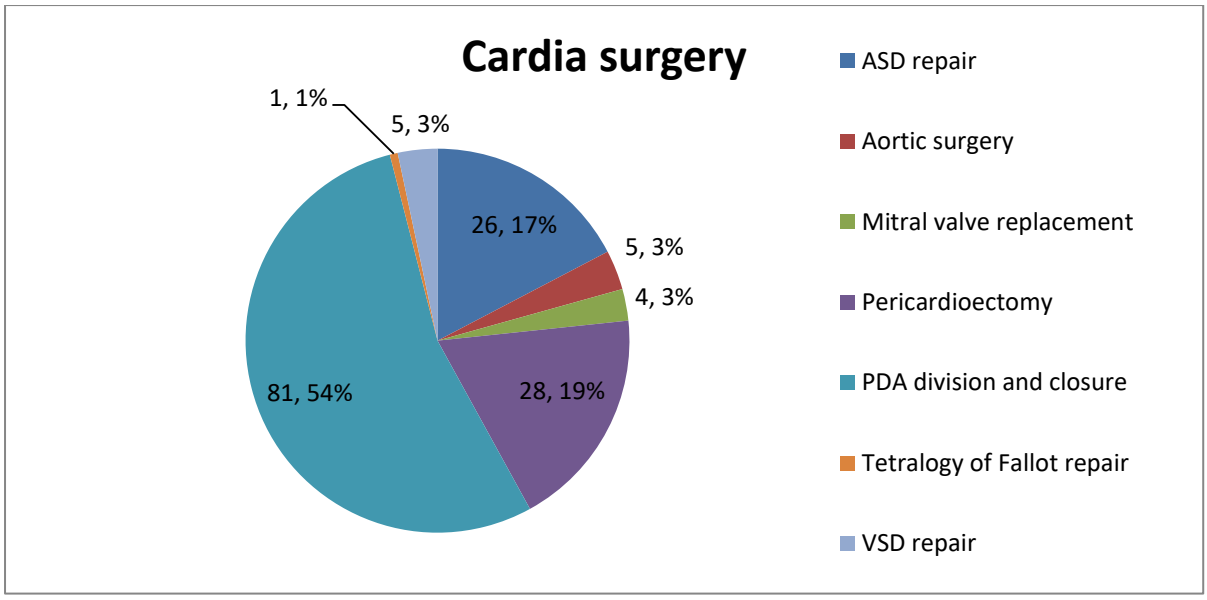

Figure 4 Common types of cardiac surgery performed at TASH from 2022-2024.

A total of 101 esophageal procedures were recorded. Transhiatal esophagectomy was the most performed 32 (31.7%), followed by Mckeown 16 (15.8%) and Heller's myotomy 15 (14.9%). Sweet 13 (12.9%) and Ivory Lewis 7 (6.9%) approaches were also used.

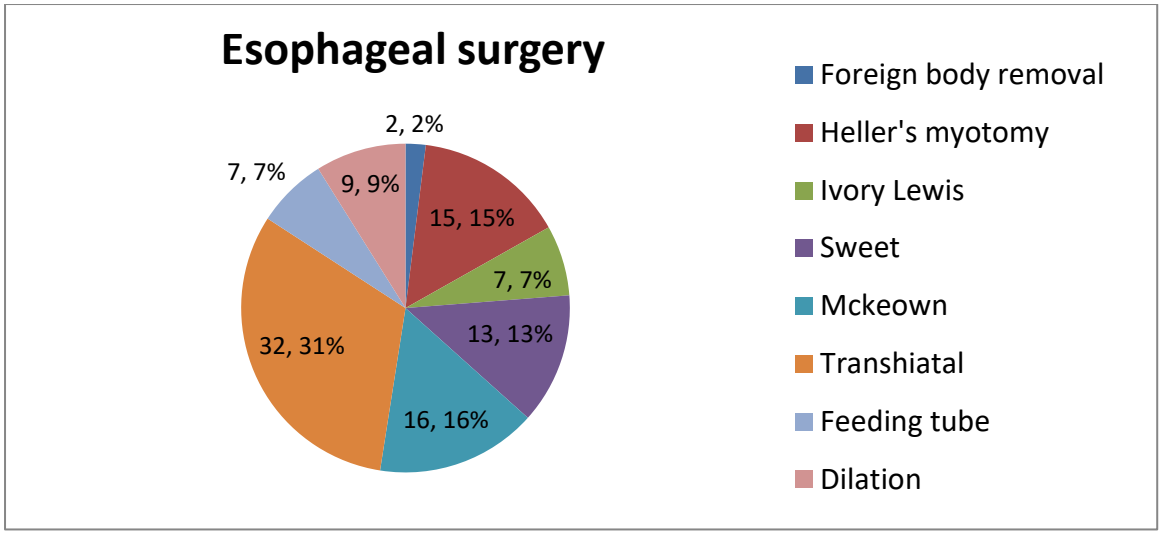

Figure 5 Common types of esophageal surgical procedures performed at TASH from 2022-2024

6. DISCUSSION

The TASH study revealed a mean age of 30.59 years, with a significant proportion being young adults (20–39 years, 33.9%) and pediatric cases (1–19 years, 34.9%). This aligns with findings from other African countries, where congenital and rheumatic heart diseases dominate due to infectious etiologies and limited access to early intervention [23,24]. For example, in South Africa, a study on infective endocarditis reported a mean age of 37.3 years, reflecting a similar young patient demographic [25].

Gender distribution at TASH was nearly equal (50.9% male, 49.1% female), differing from some international trends where males often dominate due to higher cardiovascular risk factors. However, this balance is consistent with other African studies, where rheumatic heart disease affects both genders equally [23,26,31].

Regionally, most patients came from Oromia (32.5%) and Amhara (23.2%), with fewer from peripheral regions (4.0%). This mirrors Ethiopia's surgical access disparities, where rural populations face significant barriers due to distance and limited infrastructure [27]. Similar trends are seen in South Africa, where centralized tertiary hospitals serve urban populations while rural areas remain underserved. In contrast, High-Income Countries (HICs) report older patient demographics (mean age >60 years) due to degenerative and ischemic heart diseases [23,25]. Additionally, HICs have more equitable access to surgical care, with fewer geographic disparities [28].

The Patterns and Volume of Cardiothoracic Surgery at TASH performed 422 CTS procedures over three years (~140/year), with cardiac surgeries (35.7%) and thoracic (64.3%). This is comparable to South Africa's Tygerberg Hospital, which reported 160 cardiac surgeries over a decade (~16/year) [25,26]. Our study has revealed similar distribution between cardiac and thoracic surgery procedures with that of seen in Nigeria and Pakistan. In contrast to report from Gahan cardiac surgery is more performed than thoracic surgeries, and lower cardiothoracic surgery procedures performed at TASH (12). However, TASH's volume is higher than in many African countries, such as Zimbabwe, which had only one pediatric cardiothoracic surgeon serving 15.1 million people [23,24].

Despite its higher volume of cardiac surgery compared to other Sub Saharan African countries, it still lags behind the country's demand of cardiac surgery as there are more than 40,000 patients are waiting for cardiac surgery in Ethiopia since 2020 stated by the Ethiopian ministry of health[13,32].

The decline in thoracic surgeries in 2024 (71 cases) at TASH may reflect emerging competition from new thoracic surgery centers (e.g., Hawassa, Adama, Jimma). Similar fluctuations occur in other LMICs due to inconsistent surgical capacity and referral systems [26, 27].

High-income countries perform thousands of CTS procedures annually. For example, the U.S. and Europe report surgical volumes exceeding 5,000 per 100,000 population, far surpassing Ethiopia's rate of 148 per 100,000 [27]. This is expected due to the difference in number of centers and professionals.

Regarding Clinical Characteristics; Only 10.4% of TASH patients had documented comorbidities (HIV, hypertension, diabetes), lower than in South Africa, where infective endocarditis cases often present with advanced disease due to delayed care. Similarly Surgical Indications such as Congenital heart defects (26.5%) and malignancies (22.7%) were leading causes at TASH, differing from South Africa, where rheumatic heart disease and infective endocarditis dominate [24, 25].

Mortality and Readmission TASH achieved a 2.8% mortality rate lower than some LMICs 5–10% in similar settings [10,24], but higher than high-volume centers in developed nations (<1%) [23]. the 10.4% readmission rate indicates challenges in post-operative care, a common issue in resource-limited settings [27].

The findings reveal the distribution of cardiothoracic surgical procedures at TASH, non-malignant lung and pleura pathologies are the most common indication for lung surgery, with lobectomy being the most common type lung surgery, likely due to its role in treating lung cancer and severe infections. Lobectomy is also the most common lung surgery performed in report from Gahan [12]. Decortication was also frequent, suggesting a notable prevalence of empyema or pleural diseases requiring intervention.

In contrast to ours findings at TASH, other study in comparable country showed decortication (16.4%) and cystectomy for hydatid cyst of lung (10.7%) are the most common lung surgeries, while lobectomies accounts for 2.5% of lung surgeries [34]. The study from Nigeria has different lung procedure pattern to TASH, thoracotomy for trauma related chest injuries and decortication being the prevalent procedures and lung resection is far less commonly performed [31]. This may be due to a difference in diagnostic tools for lung pathologies and managing the pleuropulmonary infectious diseases.

Our study shows similarity with studies from HIC, like USA and Japan, as lobectomies and decortications are the most common thoracic surgery performed. However, global trend shows there is a growing shift toward accepting video assisted thoracic surgery as gold standard approach for almost all of lung surgeries [15].

Our study shows almost all of cardiothoracic surgeries are done as open approach. In spite of the use of minimal invasive surgeries in cardiothoracic surgery at TASH can be said yet in the introduction phase, TASH can be the ideal teaching institution for unified approach.

In cardiac surgeries, (54%) PDA division and closure dominated, reflecting a high incidence of congenital heart conditions in the patient population. The substantial number of (17.3%) **ASD** repairs and (18.7%) pericardiectomies further indicates a significant burden of congenital and acquired cardiac conditions requiring surgical correction. Though surgery for CHD is the most commonly performed in Ghana, 71% of cardiac surgery, higher compared to study done in other LMIC of Africa like; Ghana, 24% PDA and 8%ASD surgeries [12] and Nigeria where only 6 PDA ligation and 1 pericardioectomy done [31].

Despite congenital heart diseases are the most common reason for cardiac surgery in our study and from Ghana, the report from Gahan shows complex cardiac surgeries for both congenital and acquired heart diseases are more frequently performed than at TASH, which may be because of longer study period and more number of trained cardiac surgeons at single center [12].

When compared to cardiac surgery trends in developed countries, our study reveals less cardiac surgery for both complex congenital and acquired cardiac diseases. This is because LMIC, especially in Africa, where foreign missions and organizations care for the majority of complicated cardiac surgical patients, access to secure and affordable cardiac surgical therapy is a substantial issue [13,23].

In addition to this it's also due to lack of adequate trained surgical surgeons, diagnostic infrastructures and specialized tools. In Africa, just one surgeon conducts cardiothoracic surgery for every 4 million patients, equivalent for ~1% of the global capacity, where as in HICs; there are 9.51 pediatric cardiac surgeons and 7.15 adult cardiac surgeons per million individuals, respectively. Furthermore, the region has a very limited number of cardiac surgery centers, with sub-Saharan Africa (SSA), excluding South Africa, possessing just one facility for every 38 million individual [23].

For esophageal procedures, esophagectomy for esophageal cancer is the most common indication and transhiatal esophagectomy was the most performed type, possibly due to its less invasive nature in treating esophageal cancer or severe strictures. All esophageal surgeries are performed with open approach. This study showed similarity regarding esophageal surgeries are the commonest thoracic surgery in other Sub-Saharan Africa countries [12,31]. This is similar to study from HIC, where 61% of esophagectomies done for esophageal cancer.

This study has found the indication and procedure type are different from other Sub-Saharan African countries [12,31]. Corrosive esophageal stricture being the most common indication for esophageal surgery and colon by pass is the frequently performed esophageal surgery (9.1% of indication for major CTS in Nigeria) [31]. In contrast to our study Ivory Lewis esophagectomy is the most common type of esophagectomy and transhiatal approach becoming less commonly performed [33]. In addition to this difference more than two-third of esophagectomies were performed with minimal invasive component. Even though there are limited comparative studies comparing open and minimal invasive surgery approach for esophageal surgery in countries like Ethiopia, minimal invasive approach has shown significant better outcome as compared to open approach, 15 -20% increased incidence of complications with open approach[33]. This may be due to the late clinical stage at presentation of patients in LMIC, which is one factor in choosing surgical approach and availability of surgical tools and trained surgeons for minimal invasive surgery.

Finally these results provide awareness into the common cardiothoracic conditions managed surgically at TASH and may guide resource allocation and training programs to address prevalent surgical needs. Further studies could explore patient outcomes and long-term survival rates following these procedures.

7. CONCLUSION AND RECOMMENDATION

7.1 Conclusion

TASH's CTS outcomes reflect Ethiopia's unique disease burden and healthcare challenges. While mortality rates are favorable compared to similar LMICs, disparities in access, follow-up care, and surgical volume persist. Strengthening regional centers, improving post-operative care, and expanding workforce training are critical to aligning with global standards.

7.2 Recommendations

Addressing these challenges, Ethiopia can improve CTS outcomes and reduce disparities in surgical care access.

- **Expand Surgical Capacity:** Increase CTS training programs and partnerships with international institutions to address workforce shortages.
- **Improve Referral Systems:** Enhance coordination between rural health centers and tertiary hospitals to reduce delays.
- **Strengthen Post-Operative Care:** Implement standardized follow-up protocols to reduce readmission rates.
- **Increase Health Insurance Coverage:** Reduce financial barriers to surgical care through policy reforms.
- **Enhance Data Tracking:** Establish robust surgical registries to monitor outcomes and guide resource allocation.

8. REFERENCE

1. Cardiothoracic Surgery — Royal College of Surgeons.html.

2. De Groot EM, Van Der Horst S, Kingma BF, Goense L, Van Der Sluis PC, Ruurda JP, et al. Robot-assisted minimally invasive thoracolaparoscopic esophagectomy versus open esophagectomy: long-term follow-up of a randomized clinical trial. Dis Esophagus. 2020 Nov 26;33(Supplement_2):doaa079.

3. Darling GE, Maziak DE, Clifton JC, Finley RJ. The practice of thoracic surgery in Canada.

4. Thomas Pezzella; 2018; Global Advances and Challenges in CT Surgery_figsharePDF.docx.

5. Vervoort et al. - 2024 - Global Cardiac Surgical Volume and Gaps Trends, T.pdf.

6. Effiom VB, Michael AJ, Ahmed FK, Anyinkeng ABS, Ibekwe JL, Alassiri AK, et al. Cardiothoracic surgery training in Africa: History and developments. JTCVS Open. 2024 Jun;19:370–7.

7. Pezzella AT. Global Aspects of Cardiothoracic Surgery with Focus on Developing Countries. Asian Cardiovasc Thorac Ann. 2010 Jun;18(3):299–310.

8. Byrd et al. - 2022 - A brief overview of thoracic surgery in the United.pdf.

9. Choi S, Vervoort D, Kim WH. The role of cardiac surgery in global surgery and global health: a case study from Tashkent. J Glob Health Rep. 2019 Nov 21;3:e2019074.

10. Wondimu S, Bekele S, Giorgis DG, Getachew F, Seyoum N. Pattern of surgical admissions to Tikur Anbessa Specialized Hospital, Addis Ababa, Ethiopia: A five-year retrospective study. East Cent Afr J Surg. 2018 Sep 28;23(2):66–70.

11. World Health Organization. (2021). Cardiovascular diseases. Retrieved from https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases.

12. Tettey M, Tamatey M, Edwin F. Cardiothoracic surgical experience in Ghana. Cardiovasc Diagn Ther. 2016 Oct;6(S1):S64–73.

13. Argaw S, Genetu A, Vervoort D, Agwar FD. The state of cardiac surgery in Ethiopia. JTCVS Open. 2023 Jun;14:261–9.

14. Asombang AW, Chishinga N, Nkhoma A, Chipaila J, Nsokolo B, Manda-Mapalo M, et al. Systematic review of esophageal cancer in Africa: Epidemiology, risk factors, management and outcomes. World J Gastroenterol. 2019 Aug 21;25(31):4512–33.

15. Byrd CT, Williams KM, Backhus LM. A brief overview of thoracic surgery in the United States. J Thorac Dis. 2022 Jan;14(1):218–26.

16. Hussain N, Zafar AA. Pattern of Thoracic Surgical Diseases at a Tertiary Care Hospital. J Surg Pak. 2015;

17. Akintoye OO, Adu BG, Otorkpa MJ, Olayode OO, Fodop S, Alemede PO, et al. The current state of minimally invasive cardiac surgery in Africa: a systematic review and meta-analysis. Cardiothorac Surg. 2024 Aug 2;32(1):15.

18. Udzik J, Sienkiewicz S, Biskupski A, Szylińska A, Kowalska Z, Biskupski P. Cardiac Complications Following Cardiac Surgery Procedures. 2020;

19. Seese L, Sultan I, Gleason TG, Navid F, Wang Y, Thoma F, et al. The Impact of Major Postoperative Complications on Long-Term Survival After Cardiac Surgery. Ann Thorac Surg. 2020 Jul;110(1):128–35.

20. De Groot EM, Goense L, Kingma BF, Haverkamp L, Ruurda JP, Van Hillegersberg R. Trends in surgical techniques for the treatment of esophageal and gastroesophageal junction cancer: the 2022 update. Dis Esophagus. 2023 Jul 3;36(7):doac099.

21. Otto CM, Nishimura RA, Bonow RO, Carabello BA, Erwin JP, Gentile F, et al. 2020 ACC/AHA Guideline for the Management of Patients With Valvular Heart Disease: A Report of the American College of Cardiology/American Heart Association Joint Committee on Clinical Practice Guidelines. Circulation [Internet]. 2021 Feb 2 [cited 2024 Oct 27];143(5). Available from: https://www.ahajournals.org/doi/10.1161/CIR.0000000000000923

22. Sihoe ADL. Thoracic surgery worldwide. J Thorac Dis. 2022 Jan;14(1):216–7.

23. Awuah WA, Adebusoye FT, Wellington J, Ghosh S, Tenkorang PO, Machai PNM, et al. A reflection of Africa's cardiac surgery capacity to manage congenital heart defects: a perspective. Ann Med Surg. 2023 Aug;85(8):4174–81.

24. Tadege M, Tegegne AS, Dessie ZG. Cardiac patients' surgery outcome and associated factors in Ethiopia: application of machine learning. BMC Pediatr. 2024 Jun 18;24(1):395.

25. Nel R, Janson J, Esterhuizen T, Van Der Westhuizen C. The Surgical Outcome of Infective Endocarditis in South Africa over 10 Years: A Retrospective Review. J Clin Med. 2024 Sep 3;13(17):5226.

26. Osebo C, Grushka J, Deckelbaum D, Razek T. Assessing Ethiopia's surgical capacity in light of global surgery 2030 initiatives: Is there progress in the past decade? Surg Open Sci. 2024 Jun;19:70–9.

27. Starr N, Carpenter S, Carvalho M, Souza A, Chin R, Kasotakis G, et al. Diagnosis and management of surgical disease at Ethiopian health centres: cross-sectional survey of resources and barriers to care. BMJ Open. 2019 Oct;9(10):e031525.

28. Boyd R, Robinson J, Jindani R, Lehtinen M, Dorr F, Perazzo A, et al. Global cardiothoracic surgery: outcomes from a survey on current worldwide training programmes. Interdiscip Cardiovasc Thorac Surg. 2025 Mar 5;40(3):ivaf049.

29. Ramirez AG, Nuradin N, Byiringiro F, Ntakiyiruta G, Giles AE, Riviello R. General Thoracic Surgery in Rwanda: An Assessment of Surgical Volume and of Workforce and Material Resource Deficits. World J Surg. 2019 Jan 15;43(1):36–43.

30. Chen-Yoshikawa TF, Fukui T, Nakamura S, Ito T, Kadomatsu Y, Tsubouchi H, et al. Current trends in thoracic surgery [Internet]. Nagoya University Graduate School of

Medicine, School of Medicine; 2020 [cited 2024 Oct 26]. Available from: https://doi.org/10.18999/nagjms.82.2.161

31. Aliyu and Inuwa: Indications for major cardiothoracic surgeries in Kano, Journal of Medicine in the Tropics | Vol. 17 | Issue 1 | Jan-Jun 2015

32. Abera, Etenesh. "Addis Standard." Addis Ababa: Addis Standard (2019).

33. A 10-year ACS-NSQIP Analysis of Trends in Esophagectomy Practices, Zheng, Richard et al. Journal of Surgical Research, Volume 256, 103 – 111

34. Pattern of Thoracic Surgical Diseases at a Tertiary Care Hospital Niaz Hussain, Aneeqa Ahsan ZafarJournal of Surgery Pakistan (International) 20 (3) July - September 2015

Annex 1; Questioners in English

Questionnaire ID code_____

Checklist as following with instruction:

1. Please answer all questions by providing a “circle” on alternative choice or write on space given
2. Please answer all questions as honestly, frankly and objectively as possible
3. Please hand in the questionnaire to the researcher immediately after completion.

Answer the questions by placing a “circle” on answer a corresponding to the question which is applicable to you.

Part: I Socio-Demographic Characteristics of patient treated for esophageal cancer TASH, Addis Ababa, Ethiopia, 2021/4 (n=).			
s. no	Question	Response	Skip to
101	Sex of the respondent	A. Male B. Female	
102	How old are you?	_____Years	
103	Where is your Region	A. Amara B. Oromo C. Tigre D. Somali E. Others_____	
104	Current marital status	A) Single B) Married	
105	How many Family sizes do you have?	_____	
106	Residency	A. Rural B. Urban	

107	Educational status	A. No formal education B. Primary school C. Secondary school D. Above Secondary school E. College/University	
108	What is your religion?	A. Orthodox B. Muslim C. Protestant D. Others	
109	What is your occupation?	A. Government B. House wife C. Merchant D. Farmer E. Private worker F. Others, specify_____	
110	Average monthly income	A. <5000 EBR B. 6000-10,000 EBR C. 11,000-15,000 EBR D. 16,000-20,000 EBR E. >21,000 EBR	
111	Comorbidities: (Please check all that apply)	A. Diabetes B. Hypertension C. Chronic Obstructive Pulmonary D. Disease (COPD) E. Chronic Kidney Disease F. Chronic Liver disease(CLD) G. HIV H. Obesity I. Other (specify_____)	
Part II: Clinical Characteristics of Patient with CTS at TASH, Addis Ababa, Ethiopia, 2021/4 (n=			

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201	Type of Cardiothoracic Surgery:	A. Esophagectomy B. Coronary Artery Bypass Grafting (CABG) C. Heart Valve Surgery (Replacement or Repair) D. Lung Resection (Lobectomy, Pneumonectomy) E. Lung Transplantation F. Aortic surgery G. Decortication H. Tracheal resection and anastomosis I. Other (specify_____)	
202	Type of Esophagectomy	A. Ivory lewis B. Transhital C. Mckeown	
203	Type of lung surgery	A. Lobectomy B. pneumonectomy	
304	Type of congenital heart surgery	A. ASD repair B. .VSD repair C. PDA D. Others	
205	7. Indications for Surgery:	A. Esophageal cancer B. Pleural empyema C. Angina (Chest Pain) D. Myocardial Infarction (Heart Attack) E. Valvular Heart Disease F. Congenital Heart Defect G. Tracheal stenosis H. Esophageal stenosis	

		I. Lung Cancer J. Other (Please specify)	
Part III: Post-operative of Patient status with CTS at TASH, Addis Ababa, Ethiopia, 2021/4 (n =).			
301	Length of hospital stay	_____ in days	
302	Complication	A. No B. Infection C. Bleeding D. Arrhythmias E. Stroke F. Respiratory Failure G. Kidney Failure H. Other (specify_____)	
303	Follow up	A. Yes B. No	
304	Readmission	A. Yes B. No	
305	Status at discharge	A. Alive B. Death	

Annex: ASSURANCE OF PRINCIPAL INVESTIGATOR AND ADVISORS

The undersigned research work on 'PATTERNS OF CARDIOTHORACIC SURGERY PRACTICE AT TIKUR ANBESSA SPECIALIZED HOSPITAL, ADDIS ABABA, ETHIOPIA: A CROSS-SECTIONAL MEDICAL RECORD REVIEW STUDY"; is my original work thesis to be submitted to Addis Ababa university, college of health sciences, school of medicine department of surgery, in partial fulfillment of the requirements for subspecialty certificate in cardiothoracic surgery.

ASSURANCE OF PRINCIPAL INVESTIGATOR

The undersigned research work is my original work for partial fulfillment of the requirements for subspecialty certificate in cardiothoracic surgery.

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