SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

PATTERNS AND DETERMINANTS OF SURVIVAL OUTCOMES OF CARDIOTHORACIC CONDITIONS AT A TERTIARY REFERRAL CENTRE: THE CASE OF A NATIONAL CARDIOTHORACIC CENTRE, KORLE BU TEACHING HOSPITAL

BY

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A PRACTICUM REPORT SUBMITTED TO THE SCHOOL OF PUBLIC HEALTH, COLLEGE OF HEALTH SCIENCES, UNIVERSITY OF GHANA IN PARTIAL FULFILMENT OF THE AWARD FOR MASTER OF SCIENCE IN HEALTH INFORMATICS.

MARCH, 2021

DECLARATION

I declare that this project proposal represents my work and has not been previously included in any thesis, dissertation, or report submission to the university or any other institution for any other degrees. All that is written herein is my original work, except where otherwise indicated by due acknowledgment of the source(s).

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DATE: 22nd March, 2021

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ABSTRACT

Background: Cardiovascular diseases (CVDs) are estimated to cause approximately 17.7 million deaths globally, with over 80% occurring in low and middle-income countries specifically from sub-Saharan Africa. Data on cardiothoracic conditions is largely limited in Ghana, hence clinical audit of cardiothoracic emergencies will improve clinical care and outcomes.

Study Aim: To describe the pattern and outcomes of cardiovascular conditions presented at the National Cardiothoracic Centre (NCTC), Korle Bu Teaching Hospital (KBTH).

Methods: A retrospective cohort study on cardiothoracic conditions from January 2015 to December 2019 was conducted at the NCTC. Diagnosis obtained from the medical records was recategorized using the international classification of diseases (ICD 10). The primary outcome was cardiothoracic mortality. Descriptive statistics, equality of survival, and survival analysis were performed to describe, determine the cumulative incidence and mortality rate per 1000 person-days at risk and hazard ratio respectively.

Results: The study involved a retrospective cohort of 2903 patients from 2015-2019 with age ranging from an infant with 1-month-year-old to 102 years (overall mean±standard deviation= 49.4±25.5) and the overall proportion of male versus female differential was restively 56.1% versus 43.9%. The commonest reported conditions were; circulatory system diseases (59%), congenital malformations (18.2%), abnormal clinical and laboratory findings, and others (14.7%). The overall mortality rate was 10.3/1000 person-days at risk (95%CI=9.0-11.6) and ranged from 6.3/1000 person-days at risk in 2018 to 17.1/1000 person-days at risk in 2016. More than twice the hazard ratio (HR) was estimated among patients with circulatory system diseases and abnormal clinical and laboratory findings respectively compared with congenital malformation [aHR(95%CI)=2.05(1.20-3.50) and 2.41(1.06-5.46) respectively]. Increasing age was significantly associated with the risk of mortality and was

highly significant among patients aged 60 years and above (crude Hazard Ratio= 2.05; 95%CI= 1.20-3.50).

Conclusion: There has been a steady rise in cardiovascular conditions at the NCTC, vis-á-vis a decline in the mortality rate within the period. Circulatory system diseases and abnormal clinical and laboratory findings were high-risk factors for mortality confounded with increasing age. The Ghana national aging policy must consider the cardiothoracic conditions among the aged to create a good picture of aging and to promote the health and wellbeing of the aged.

DEDICATION

This study is dedicated to my family, my wife, Mr. John Tetteh and Dr. Lawrence A. Sereboe (Director, National Cardiothoracic Centre).

ACKNOWLEDGEMENT

My greatest thanks go to the Almighty Allah for making this a possibility

Secondly, gratitude to my supervisor Dr. Duah Dwomoh for all the roles he has placed in this endeavor from the beginning till now.

To Dr. Lawrence A. Sereboe, you have been a father like no other.

To Dr. Nii Armah Adu-Aryee for your advice and Mr. John Tetteh (a brother from another mother) for your tutelage, patience, and direction.

A special mention goes to my family for all the support received and the immediate ones (Zaria, Abdul-Muqeet, and Hilwana) love you all.

To all who contributed especially the data collectors, I am grateful.

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LIST OF ABBREVIATIONS

ACC	-	American College of Cardiology
ACS	-	Acute coronary syndrome
AHF	-	Acute Heart Failure
AD	-	Aortic dissection
AF	-	Atrial fibrillation
COPD	-	Chronic obstructive pulmonary disease
CTAs	-	Computed tomography angiograms
CT	-	Computed tomography
CVDs	-	Cardiovascular diseases
ECG	-	Electrocardiogram
HF	-	Heart failure
KBTH	-	Korle Bu Teaching Hospital
PCE	-	Pericardial effusion
PE	-	Pulmonary embolism
MI	-	Myocardial infarction
MRI	-	Magnetic resonance imaging
NCTC	-	National Cardiothoracic Center
NSTEMI	-	Non-ST-segment elevation myocardial infarction
STEMI	-	ST-segment elevation myocardial infarction
UA	-	Unstable angina
VF	-	Ventricular Fibrillation
VTE	-	Venous thromboembolism
VT	-	Ventricular Tachycardia

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

Global reported cases of CVDs in 2015 were estimated at 422.7 million and varied widely among countries (Roth et al., 2017). The age-standardized CVDs prevalence in 2015 declined in many well-resourced countries, (Roth et al., 2017) but the prevalence of CVDs is fast increasing in developing countries (Balakumar et al., 2016), like most parts of the region urbanizes and life expectancy increases (Maron et al., 2013). It has been estimated that approximately 17.7 million people died from CVDs in 2015, representing 31% of all global deaths, of these deaths, an estimated 7.4 million were due to coronary heart disease and 6.7 million were due to stroke (WHO, 2017). Due to the lack of financial resources and health workforce proficiency in the prevention and management of CVDs, the less developed countries are not in a good position to handle this menace (Deaton et al., 2011). Cardiovascular conditions are the leading causes of morbidity and mortality in the world (Campagne, 2009). Rapid assessment, diagnosis, and treatment of cardiac emergencies are essential because of its associated high mortality (Avner, 2011). In adults, cardiac emergencies are mostly caused by atherosclerotic coronary heart disease whereas in children it is usually due to congenital heart disease (Avner, 2011; Frazier et al., 2011), rheumatic valvular heart disease, dysrhythmias, or infections such as myocarditis and endocarditis (Avner, 2011). Even though cardiac emergencies are common in adults but uncommon in children (Avner, 2011; Barata, 2014). delay in the diagnosis and management in children is detrimental (Barata, 2014).

The study of cardiac emergencies, their presentation at the emergency health facilities, and outcomes are significant in the preparation and the development of institutional capacity in dealing with the ever-increasing burden of these diseases.

1.2 Problem Statement

Cardiovascular conditions are associated with high morbidity and mortality, and as such most emergency healthcare systems develop a protocol to manage them promptly (Avner, 2011). In Ghana, as high as 76% prevalence rate of Heart Failure has been reported in a cardiac clinic (Owusu & Adu-Boakye, 2013). However, cardiothoracic emergencies often present with non-specific symptoms and may mimic other diseases (Avner, 2011). The diagnosis and management of pediatric cardiothoracic emergencies are particularly difficult and complex (Barata, 2014). For instance, it has been established that about 14-29% of patients with acute heart failure are misdiagnosed (Ventura & Pina, 2017).

Knowledge of the diverse presentations of cardiothoracic condition increases the likelihood of prompt diagnosis and management (Frazier et al., 2011). The lack of relevant data on cardiac and thoracic conditions in Sub-Saharan Africa more especially in Ghana has created a knowledge gap in cardiothoracic conditions, the management, and the outcome (Reynolds et al., 2012). In Ghana the trend or the patterns of cardiothoracic conditions is not well established and lacking behind, this overtime has led to an unknown real estimate of cardiothoracic conditions and treatment outcomes in Ghana.

1.3 Justification for the Study

This study sorts to determine the patterns and treatment outcomes of cardiothoracic conditions seen at the National Cardiothoracic Centre, KBTH. Data from the emergency care facility will increase preparedness and disease management capabilities (Reynolds et al., 2012). Findings from the study will contribute to filling the gaps in institutional data which are largely lacking and also contribute to the epidemiological data required for the adequate assessment of cardiothoracic conditions. Additionally, the findings of the study will help inform clinical and public health interventions in the treatment, management, and control of the risk factors for cardiothoracic conditions.

1.4 Research question

1. What are the patterns of cardiothoracic conditions in the NCTC, KBTH?
2. What are the treatment outcomes of cardiothoracic conditions at the NCTC, KBTH?
3. What factors contribute to the survival of cardiothoracic treatment outcomes at NCTC, KBTH

1.5 Aim and objectives of the study

1.5.1 Aim

The main aim of the study is to describe the pattern and outcomes of cardiovascular conditions at the National Cardiothoracic Centre (NCTC), Korle Bu Teaching Hospital (KBTH).

1.5.2 Objectives of the study

- To describe the patterns of cardiothoracic conditions presented at the National Cardiothoracic Centre, KBTH.
- To determine the mortality outcomes of cardiothoracic conditions at NCTC
- To determine factors contributing to the survival of cardiothoracic treatment outcomes

CHAPTER TWO

2.0 LITERATURE REVIEW

The most common cardiovascular emergencies of clinical importance include arrhythmias, pulmonary embolism, acute heart failure, aortic dissection, pericardial tamponade, and acute coronary syndrome.

2.1 Arrhythmias

Arrhythmias are commonly encountered in clinical practice and some are life-threatening, requiring prompt recognition and treatment (Ban, 2017). Bradyarrhythmias consists of disorders of sinus node dysfunction and atrioventricular conduction disturbances and tachyarrhythmias are characterized as supraventricular tachyarrhythmias or ventricular tachyarrhythmias whiles the ventricular tachyarrhythmias are the most important cause of morbidity and sudden death in almost all forms of heart diseases (Burnett et al., 2017; Premkumar et al., 2016). The prevalence of arrhythmias is dependent on the underlying condition. In the study by Batte et al(2016) to determine the prevalence of arrhythmias among children below 15 years old with congenital heart diseases, arrhythmias were found in 53/194 (27.3 %) (Batte et al., 2016) and among adults who present to emergency departments with myocardial infarction, 90% had a rhythm abnormality and 25% had a conduction disturbance (Frazier et al., 2011). In a study among 9841 hospitalizations for peripartum cardiomyopathy between 2007 and 2012, an 18.7% prevalence of arrhythmias was found (Mallikethi-Reddy et al., 2017).

Atrial fibrillation is associated with ischemic stroke, heart failure, cognitive dysfunction, sudden death; patients with AF are five (5) times more likely to suffer a stroke (Andrade et al., 2014; Schmidt et al., 2011). Symptoms of AF may include palpitations, dizziness, lightheadedness, anxiety, and reduced exercise capacity, and could be linked in part to the underlying conditions (Andrade et al., 2014; Schmidt et al., 2011). Treatment of AF involves the management and treatment of underlying

conditions, control of cardiac rhythm and rate, and the prevention of thromboembolism and complications (Andrade et al., 2014; Schmidt et al., 2011). The prevention of thromboembolism is significant in the management and treatment of AF to reduce morbidity and mortality (Andrade et al., 2014; Schmidt et al., 2011).

Ventricular arrhythmias are linked to sudden cardiac deaths in all forms of heart diseases and across Europe and North America, about half of sudden cardiac deaths are attributable to ventricular tachycardia (VT) or ventricular fibrillation (VF) which is the most common form of broad complex tachycardia and could be non-sustained VT if it lasts less than 30 seconds and doesn't require immediate termination or sustained VT if it lasts for more than 30 seconds and requires immediate termination (John et al., 2012; Sudan et al., 2017). The underlying causes of VT vary but ischemic heart diseases and non-ischemic cardiomyopathies are among the most common (Sudan et al., 2017). Coronary artery disease is present in 70% of all cases and other precipitating factors include dilated non-ischemic cardiomyopathy, valvular heart disease, congenital heart disease, sarcoidosis, and other cardiomyopathies whiles Idiopathic VT accounts for 10% of all patients seen for VT (Goel et al., 2013). The symptoms and hemodynamic consequences of VT depend on its rate and underlying heart diseases. The presentation of VT depends on the rate of the tachycardia, underlying myocardial dysfunction and valvular abnormalities, location and origin of the tachycardia, and the degree of AV dissociation VT and sustained VT is a recognized cause of out-of-hospital sudden-death (Goel et al., 2013). Sustained VT is a potentially life-threatening arrhythmia that occurs in two major forms: monomorphic and polymorphic (usually ischemia-related) and VT degenerates into VF and if not attended to, fatal without urgent intervention (Alonso et al., 2009; Sudan et al., 2017). Management strategies for ventricular arrhythmias are guided by the risk of sudden death and the severity of symptoms. Patients with a substantial risk of sudden death usually need an implantable cardioverter-defibrillator (ICD) (John et al., 2012).

Atrioventricular (AV) block refers to delayed or terminated conduction of the electrical impulse through the AV node and intranodal tissues, preventing normal transmission of the signal from the atria to the ventricles. The third-degree AV heart block is also known as complete heart (AV) block is regarded as a serious condition requiring prompt therapy and commonly presents as syncope, seizure, weakness, or lethargy, or with signs of dyspnea due to heart failure (Bachani et al., 2016; Malakoff et al., 2012). Complete AV block is indicated to be caused by degeneration of the conducting system, congenital, acute myocardial infarction, and metabolic disorders (such as azotemia and hyperkalemia) (Bachani et al., 2016). Complete heart block (CHB) is a relatively frequent complication in patients hospitalized with acute myocardial infarction (AMI), with an incidence of between 3% and 13% depending on the type and anatomical location of the AMI being investigated and is associated with 3 to 5-fold increase in in-hospital death compared with those without CHB (Harikrishnan et al., 2015). Established risk factors of AVB include valve replacement (aortic and mitral), preexisting conduction disorders, age, and redo surgery and in the management of complete heart block patient usually requires permanent pacemaker implantation (Alonso et al., 2009; Socie et al., 2017).

2.2 Acute Heart Failure

Heart Failure (HF) accounts for a significant portion of global morbidity and mortality, and the increased cardiovascular risks and age are set to drive high its prevalence. The prevalence of Heart Failure is estimated to range from 1% -12% of the population in the USA and Europe (Khera et al., 2017). An estimated over 5.8 million people in the USA and excess of 23 million people around the world are said to be suffering from the disease and data on the prevalence and incidence of Heart Failure are limited in most countries, and in developing countries in particular epidemiological data are inadequate for making any better evaluation (Bui et al., 2011; Khera et al., 2017). However, Heart Failure has been recognized as a contributor to the cardiovascular disease burden in Africa for many

years, and that the rate of hospital admissions for Heart Failure is comparable to rates in the rest of the world, and the prevalence of congenital Heart Failure is reported at 5.7% in rural Cameroun and as high as 76% prevalence of Heart Failure in a cardiac clinic in Ghana (Owusu & Adu-Boakye, 2013; Tantchou et al., 2011).

In sub-Saharan Africa (SSA), Heart Failure has mostly been attributed to rheumatic heart disease, hypertensive heart disease, and cardiomyopathy (Bloomfield et al., 2013). Heart Failure represents the first cause of hospital admission among patients with high blood pressure in Africa (Tantchou et al., 2011). Owusu and Adu-Boakye (2013) have reported the main etiologies of Heart Failure at a cardiac clinic in Ghana as hypertension (45%), rheumatic heart disease (23%) and cardiomyopathy (15%; n=58), degenerative valvular disease (7.6%) and ischemic heart disease (2.3%) (Owusu & Adu-Boakye, 2013).

Acute Coronary Syndrome, Arrhythmias, and Acute Respiratory Disease have been identified as being the most common precipitating factors of Acute Heart Failure. Arrigo et al, 2016 have identified in their study that Atrial Fibrillation and Acute Coronary Syndrome were associated with more readmissions whereas acute pulmonary disease was associated with fewer readmissions especially in patients aged 75 years or younger (Arrigo et al., 2016). These factors further influence the clinical outcomes of Acute Heart Failure. In a study to determine the independent association of precipitating factors with 90-day risk of death in AHF, it was found that AHF precipitated by ACS or infection was independently associated with higher, while AHF precipitated by AF is associated with lower 90-day risk of death and further reported that Acute Heart Failure precipitated by acute pulmonary disease at admission is associated with higher mortality especially in patients aged 75years or younger (Arrigo et al., 2016).

A report across 9 countries in four continents the clinical presentation of AHF included decompensated congestive HF (38.6%), pulmonary edema (36.7%), cardiogenic shock (11.7%),

hypertensive HF (7.4%), right HF (4.5%), and high-output HF (1.1%) (Follath, Yilmaz, Delgado, Parissis, Porcher, Gayat, Burrows, Mclean, et al., 2011).

The management of acute heart failure involves primarily two phases of care; phase 1: the stabilization phase, which commonly begins in the emergency department, and phase 2: stabilization during hospitalization, and continues into the post-discharge period (Pang et al., 2018). The main aim in the management of acute heart failure is to prevent progression, recover cardiac function, or remodeling of the heart based on accepted guidelines (Pang et al., 2018). Preliminary signals suggest the importance of early management. Rapid and accurate diagnosis and management of signs and symptoms such as flash pulmonary edema, malignant dysrhythmias, STEMI, and others at the emergency department, determine the outcome (Pang et al., 2018). In an international study involving four continents with nine countries to describe management and characteristics of AHF, management of Acute Heart Failure was mostly (74%) done in the emergency rooms and management included IV diuretics in 89.7%, vasodilators (mainly nitroglycerine) in 41.1%, inotropic agents in 39% (dobutamine 22.3%, dopamine 13%, adrenaline and nor-adrenaline 7.8%, and levosidamine in 6.4% (Follath, Yilmaz, Delgado, Parissis, Porcher, Gayat, Burrows, & Mclean, 2011).

2.3 Large Pericardial Effusion and Pericardial Tamponade

The accumulation of excess fluid or blood in the pericardium is termed Pericardial Effusion (PCE) (Jung, 2012a), and can occur gradually or rapidly (Imazio & Adler, 2013). PCE is quite a regular finding in clinical practice (McIntyre et al., 2015). PCE is classified as mild when the echo-free pericardial space measure 1mm to 9mm; moderate when echo-free pericardial space is 10mm to 19mm; or severe effusions when echo-free pericardial space measures 20 mm and over (Jung, 2012b). PCE could be caused by acute myocardial infarction, renal disease, heart failure, diabetes, malignancies of other organs, chronic renal failure, pulmonary tuberculosis, thyroid disease, autoimmune disease, and iatrogenic and idiopathic cause but in some cases, pericardial effusion could

have no underlying pathological conditions and the presences of clinical findings such as acute inflammatory signs (chest pain, fever, pericardial friction rub) are significant in the diagnosis of the cause of pericardial effusion (Mitiku & Heidenreich, 2011; Sagristà-Sauleda et al., 2011). The clinical presentation of PCE is linked to the underlying condition, rate of fluid accumulation, size of the effusion, the hemodynamic status, and symptoms that relate to the underlying disease (Imazio & Adler, 2013; McIntyre et al., 2015).

PCE typically presents with symptoms including dyspnea on exertion, chest pain, and/or fullness and occasionally, also, presents with nausea, dysphagia hoarseness, and hiccups (Imazio & Adler, 2013). PCE could also present with non-specific symptoms such as cough, weakness, fatigue, anorexia, and palpitations (Imazio & Adler, 2013).

PCE can lead to fatal complications such as cardiac tamponade (causing obstructive shock), which is a cardiac emergency (Vakamudi, Ho, & Cremer, 2017). Pericardial tamponade is characterized by systemic venous distention, tachycardia, dyspnea, distant heart sound, and pulsus paradoxus (McIntyre et al., 2015), and in the more severe cases arterial hypotension and shock (Sagristà-Sauleda et al., 2011). The commonest symptom of pericardial tamponade is dyspnea which gives rise to a continuum of hemodynamic derangements (Argulian & Messerli, 2013). Sub-acute pericardial tamponade is a difficult diagnosis to make on mere clinical grounds because widely known signs of pericardial tamponade lack sensitivity and specificity. More than one-third of patients with Pericardial Effusion without clinical features of pericardial tamponade have at least one chamber collapse on echocardiography (Argulian & Messerli, 2013).

Evaluation of PCE includes chest x-ray and echocardiography. Echocardiography is most valuable as it provides information on the size, location, and hemodynamic consequences of the PCE (Vakamudi, Ho, & Cremer, 2017). Patients with PCE presenting with acute inflammatory signs and unknown etiology or idiopathic are treated with aspirin or non-steroid anti-inflammatory drugs

(Imazio et alSagristà-sauleda, Mercé, & Soler, 2011). In symptomatic PCE with no inflammatory signs or non-responsive to inflammatory drugs, pericardiocentesis (drainage of the effusion) is done (Burazor et al., 2013). In the management of effusion with tamponade, the primary treatment is pericardiocentesis. Pericardiocentesis guided by echocardiography with experienced operators is preferred as this approach has a high success rate of 97% with a low rate of complications emergency (Vakamudi et al., 2017).

2.4 Pulmonary Embolism

Pulmonary Embolism (PE) is a common and sometimes fatal form of Venous Thromboembolism (VTE) which refers to automatic obstruction of the pulmonary arterial system, with thrombus, tumor, fat, or air and the main cause of PE is the movement of thrombus from the veins to the pulmonary artery. Which may be classified based on the time of symptom onset, hemodynamic status, and the location of the clot based on the onset of symptoms. PE could be classified as acute, sub-acute, and chronic PE (Halligan et al., 2017; Lewis & Pilcher, 2017). PE may also be classified as unstable/massive or stable/sub-massive based on the hemodynamic status. PE may present mainly with symptoms including progressive dyspnea, pleuritic chest pain, hemoptysis (Dutta et al., 2017), cough, and orthopnea (Lewis & Pilcher, 2017).

The risk factors for developing PE may be inherited or acquired (Giordano et al., 2017). The inherited risk factors include factor V Leiden, prothrombin gene mutation, antithrombin deficiency, protein C deficiency, protein S deficiency, and hyper-homocysteinemia. The most common inherited factors include factor V Leiden and the prothrombin gene mutation (Giordano et al., 2017). The acquired risk factors include surgery, cancer, trauma, spinal cord injury, reduced mobility, prolonged air, and ground travels, advancing age, obesity, pregnancy (Tapson & Friedman, 2017). Cancer is known to account for 20%, and surgery and immobility also account for 15% of all VTE cases however, an estimated 50% of PE cases are not linked to any risk factor (Lewis & Pilcher, 2017).

The prevalence of PE documented varies depending on the condition under study. In a systemic review among patients presenting with syncope at an emergency department a low PE prevalence of 0.8% has been reported (Oqab et al., 2017). In a cross-sectional study in the USA, a prevalence of 9.0% was found among 589 patients undergoing chest computed tomography angiograms (CTAs) in the emergency department of a tertiary care hospital (Rivera et al., 2009). The processes of PE may result in circulatory shock and eventually cardiac arrest (Laher & Richards, 2018).

Patients with PE could benefit from early diagnosis and treatment, (Gunter et al., 2016) Undiagnosed and untreated PE is associated with high mortality of about 30% (Widimsky, 2013), and patients presenting with at least one symptom referable to chest pain, dyspnea, discomfort or loss of consciousness suggesting low cardiac output are suspected and considered for the initiation of intervention for PE (Kline, 2018). PE is highly considered in a patient with a present history of unexplained dyspnea (not explained by cardiopulmonary problem) (Kline, 2018). The rate of diagnosis of PE may be improved by the consideration of the risk factors associated with the development of PE but a missed diagnosis is a considerable risk and the management of PE is aimed at the prevention of further embolism and thrombosis, clearing of developed clots and provision of simultaneous hemodynamic support (Lewis & Pilcher, 2017).

Acute therapies with anticoagulants are speedily given in patients with high chances of PE before diagnostic testing (Lapner & Kearon, 2013) because anticoagulants reduce the high mortality associated with PE (Lewis & Pilcher, 2017). Anticoagulation is the mainstay of management. Thrombolysis and thrombectomy are largely and/or limited to massive PE and the use of thrombolysis in sub-massive PE is said to be controversial (Lewis, 2016).

2.5 Aortic dissection

Aortic dissection is the most common fatal disorder affecting the aorta (Braverman, 2010), and deaths from AD are caused mainly by aortic rupture, pericardial tamponade leading to obstructive shock, aortic valve regurgitation, and acute myocardial ischemia (Elsayed et al., 2017).

AD is classified based on the anatomic involvement of the aortic dissection (Braverman, 2010) and according to the Stanford classification which is widely accepted and most regularly used globally (Elsayed et al., 2017). Type A AD is the most frequent but both types A and B occur mostly in men aged 60 years (Elsayed et al., 2017). In a prospective study in Malmo, Sweden, more than half (58%) of those diagnosed with AD were Type A AD (Landenhed & Engstr, 2015). AD may present with extremely varied symptoms and may imitate that of similar conditions.

The risk of developing AD includes hypertension, genetic disorders affecting the blood vessel wall, atherosclerosis, cocaine use, trauma, pregnancy, and inflammatory or infectious diseases (Braverman, 2011), old age, and dyslipidemia (Elsayed et al., 2017). Hypertension is stipulated to be present in more than 80% of patients presenting with AD (Elsayed et al., 2017). In a study among pregnant women presenting with AD, hypertension was found to be present in 93% of pregnant women (Thalmann et al., 2017).

The management of AD involves emergency surgery particularly for type A aortic dissection, while type B dissection is normally treated medically except when complications happen (Braverman, 2011). Thalmann et al., 2017 have reported the successful treatment of AD through surgery among 40% of pregnant women with AD. Initial management of AD after diagnosis is to reduce the underlying high blood pressure using Beta-blockers or calcium channels (Elsayed et al., 2017).

2.6 Acute coronary syndrome

Acute coronary syndrome (ACS) refers to conditions that present with the clinical signs and symptoms of unstable angina (UA), non-ST-segment elevation myocardial infarction (NSTEMI),

and ST-segment elevation myocardial infarction (STEMI). ACS is associated with an increased risk of sudden cardiac death (Leeper et al., 2011). ACS classically presents with chest pain, shortness of breath, diaphoresis, nausea, and lightheadedness. Other signs and symptoms include tachycardia, tachypnea, hypertension, or hypotension, decreased oxygen saturation, or cardiac rhythm abnormalities (Leeper et al., 2011).

ACS is caused in part by rupture, fissuring, or erosion of atherosclerosis plague in the coronary arterial wall which leads to a thrombus blocking or reducing the flow of blood in the coronary artery resulting in ischemic injury to the myocardium (Timmis, 2015). The risk factors for developing ACS include non-modifiable factors such as age, sex, family history, and ethnicity or race. Other modifiable risk factors include dyslipidemia; elevated levels of serum cholesterol, low-density lipoprotein cholesterol, and triglycerides; lower levels of high-density lipoprotein cholesterol; and diabetes, cigarette smoking, obesity, a sedentary lifestyle, hypertension, stress (Timmis, 2015), a diet low in fruit and vegetables, and little or no alcohol drinking (Timmis, 2015). Modifiable risk has been indicated to account for over 90% cases of ACS, making ACS a preventable disease (Timmis, 2015). In acute coronary syndrome, the use of morphine, oxygen, nitrate, and aspirin is recommended as the first-line therapy (Mccarthy et al., 2017) and the main aim of this acute-phase therapy is to relieve symptoms, prevent infarction or limit its size, and improve outcomes (Mccarthy et al., 2017). A 12-lead ECG is normally obtained and interpreted on time and it is important for the identification of a patient in need of reperfusion treatment (Dzudie et al., 2012). In reperfusion treatment, primary percutaneous coronary intervention (PCI) is the preferred strategy (Timmis, 2015). Primary PCI is an emergency treatment recommended soon after arrival at the hospital but within 120 minutes of the time when "clot-busting" (Timmis, 2015), to restore blood flow and reduce the amount of heart muscle permanently damaged by a heart attack (Torky et al., 2018).

ACS may present with complications including tachyarrhythmias, bradycardia, heart failure, pericarditis, and myocardial rupture; heart failure reflects the extent of injury to the myocardial and the usual cause of death in hospital (Timmis, 2015). Accompanying pulmonary edema causes severe shortness of breath and may progress to cardiogenic shock which presents with hypotension, oliguria, and variable disorientation (Timmis, 2015). Death among patients with ACS is independently determined mainly by age, history or development of coronary failure, systolic blood pressure, renal function, increased troponin levels, peripheral vascular disease, cardiac arrest on admission, and ST-segment deviation (Kroidl et al., 2011).

2.7 Trend of Cardiovascular Diseases

Somewhere in Addis Ababa, research was conducted to assess the spectrum of cardiovascular disorders from 2001-2012. The analysis indicated that Valvular Heart Disease was the commonest (62.0%) and other diagnoses included hypertension (14.7%), cerebrovascular diseases or stroke (11.5%), congenital heart disease (8.5%), and ischemic heart disease (7.4%) (Abdissa et al., 2014). In Nigeria, a retrospective study was conducted among patients with cardiovascular conditions admitted at the University of Port Teaching Hospital between January 2013 and December 2014. The finding indicated that a total of 1,989 patients were admitted over the period, with CVDs accounting for 31.6% (Nwafor & Alikor, 2016). The pattern of CVDs observed in the study were heart failure (43.1%), cerebrovascular accident (24.3%), diabetes and its complications (15.6%), uncontrolled hypertension (14.8%), acute MI (1.6%), symptomatic bradycardia (0.3%), acute pericarditis (0.2%) and ventricular tachycardia (0.2%). Of the 629 cases of CVD seen, 536 (85.2%). Also, at Kanu Teaching Hospital in Nigeria, Mukadas, and colleague study on incidence and patterns of cardiovascular disease in northwestern Nigeria, a retrospective reviewed between 2001 and 2005 showed that there were 4103 CVD cases with a steady rise from 2001-2005 (Mukadas & Misbau,

2009). They further indicated that hypertension (39.1%) was the most prevalent CVDs while congenital heart disease (1.1 %) had the lowest (Mukadas & Misbau, 2009). Furthermore, a pattern of cardiovascular disease amongst medical admissions in a regional Teaching hospital in Southeastern Nigeria, a retrospective review from 200-2007 showed that about 20.5% of CVDs cases were reported out of 6162 admission cases. The pattern of CVD was observed and hypertension and its complications (86.36%), rheumatic heart disease (4.52%), dilated cardiomyopathy (3.09%), and alcoholic heart muscle disease (0.95%) were frequently reported (Oguanobi et al., 2013). In Ghana, a 5-year review of autopsy cases at Korle-Bu Teaching Hospital depict that, CVD constituted approximately 22% of all causes of deaths from autopsy cases at KBTH within the 5-year period (Sanuade et al., 2014).

2.8 Trend of CVDs Deaths

In a study by Lloyd-Sherlock et al, they found that older adults aged 70 years older and above were in the majority of people who died from cardiovascular disease in all countries (range 52% – 82%). They also observed considerable variations in deaths as a result of cardiovascular disease among all age categories between countries (Lloyd-Sherlock et al., 2019). Between 2000 and 2015, in most countries, the largest reductions in the age-standardized mortality rate were observed in ages more than 70 years. The number of CVDs deaths regional that could have been avoided hypothetically in 2015 for ages between 30 – 79 years old was 440 777, of which 48% occurred among people within the age 70 – 79 years old (Lloyd-Sherlock et al., 2019).

Wekesah et al in a 2008 survey on CVD risk factors and their linkage to cause of death which collected data between 2008 and 2018, out of a total of 385 deaths recorded during the 10-year follow-up period 2008 – 2018, 101 was as a result of CVDs (Wekesah et al., 2020). Participants who died from CVD were older age 64 years and above compared with 48 years and below and the majority

being women about 55%. Further findings revealed that twice as many individuals with hypertension (54.5% vs 24.2%), twice as many individuals with diabetes (15.9% vs 7.6%), died from CVD. Fewer individuals with higher levels of education (19.8% vs 56.7%) died from CVDs. A lot more individuals in informal employment died from CVD (65.4%) when compared to the unemployed (31.7%) and the formally employed (3.0%). The proportion who died from CVD who were physically inactive was 37.6% compared to 17.3% among those who did not die from CVD (Wekesah et al., 2020).

In another study by Virág & Nyári, 2018, they noted significant decreases in annual mortality rates for all cardiovascular diseases, but not for hypertension (Virág & Nyári, 2018). They also found that age-standardized death rates were higher for men for all causes, except for hypertension. Furthermore, the greatest sex difference in the average risk of death was observed in the middle-aged groups with the greatest percentage decrease in death rates during the study period seen for both sexes in people under 35-year group while the reverse was observed among participants aged over 75 years (Virág & Nyári, 2018).

CHAPTER THREE

3.0 METHOD

3.1 Study Design and Area

This study was a retrospective study to examine cardiovascular conditions patterns and treatment outcomes of cases presented at the National Cardiothoracic Center (NCTC) of the Korle Bu Teaching Hospital (KBTH). The KBTH is the third-largest hospital in Africa and the leading national referral hospital in Ghana. The hospital has a total bed capacity of 2,000, with 1,500 patients' visits and 500 admissions daily. The hospital has three centers of excellence namely, the National Cardiothoracic Centre, the National Plastic and Reconstructive Centre, and the Radiotherapy Centre. The National Cardiothoracic Centre is a tertiary institution that serves as a referral center for patients with cardiovascular and thoracic diseases in Ghana and the West Africa Sub-region.

3.2 Source of Data

The medical records/notes of patients seen or referred for the cardiovascular condition to the NCTC, KBTH within five years (January 2015 to December 2019) was retrospectively reviewed. Clinical written notes written in all patient's folders within the past 5 years were reviewed. The 5 years of data extraction aimed to help know whether there are a particular trend or pattern of cardiothoracic condition reported at NCTC, KBTH.

3.3 Inclusion and exclusion criteria

The study included all available medical records from January 2015 to December 2019. Medical records/notes with missing data without recovery or trace was not included.

3.4 Variables

The study extracted all cases of the cardiothoracic condition in addition to patients' demographic characteristics. Data on final diagnosis were further classified using the WHO International Classification of Diseases version 10 and presented in Appendix 1.

3.5 Data collection and tools

The data for the study were extracted retrospectively from the medical records of patients who were seen for the cardiothoracic condition at the NCTC at KBTH from January 2015 to December 2019, with the guide of an extraction form. The extraction form was self-designed/developed which collected data on the socio-demographic characteristics, clinical presentation, treatment, treatment outcomes, and cardiac diagnosis.

Because KBTH is not fully digitized to retrieved patient information from a centralized database, the hospital practice patient records keeping except only at the NCTC which practice hospital records keeping. All patient folders are kept since the inception of the Centre for research purpose and easy access. The data was collected at the records department of NCTC.

The data was collected by:

1. Gathering of documents on cardiovascular condition cases from 2015-2019,
2. A review of all cases was then carried out,
3. Variables on the abstraction form were used to collect information (see appendix 4).
4. The data on these variables were entered into EpiData version 3.1 and then exported to Stata 16.

3.6 Sampling method

Picking all cases from January 2015 to December 2019, the table below shows the number of cases that were extracted.

Table 3.1: Number of cardiothoracic cases extracted from January 2015 – December 2019

Year	Incidence
2015	549
2016	546
2017	597
2018	678
2019	533

3.7 Sample size

All cases that were admitted at the National Cardiothoracic Centre, Korle Bu Teaching Hospital between January 2015 to December 2019 was collected for this study.

3.8 Outcome measure

In this study, the main primary outcome of interest was cardiothoracic mortality outcomes among the patients after staying in admission within a period. Data was collected on the date of admission to date of discharge. Within this period patients were either discharged or died during the admission period. The outcome of interest (mortality) was coded as 1 and 0 for otherwise with patient's respective days spent at admission.

3.9 Covariate

Data were cleaned to eliminate all typographical errors, continuous variables such as age, systolic blood pressure, and diastolic blood pressure was recategorized into groups. The selection of the covariates used was based on the structure of the health records folder defined and used by the Centre. For clinically diagnosed cardiothoracic conditions, WHO International Classification of Diseases version 10 (ICD-10) was used to reclassify the conditions according to ICD-10 chapters and blocks for easy understanding. The individual cardiothoracic conditions classified into chapters and blocks adopted can be found in Appendix 1.

Table 3.2: Detailed covariates which were analyzed in the study can be found in the table below:

Variable	Type of variable	Description	Measurement	Scale of measurement
Outcome	Outcome variable	The outcome of treatment after patient admission	Survived/Discharged or Died	Binary
Age of patient	Explanatory variable	Participant as at the time of data collection	Raw ages recoded into <14, 15-29, 30-39, 40-49, 50-59 and 60+	Continuous Categorical
Gender of patient	Explanatory variable	Sex definition of patient	Male or Female	Binary
Marital Status	Explanatory variable	Marital status of the patient	Single, Married, Other	Discrete Categorical
Place of residence	Explanatory variable	Residence of patient	Rural or Urban	Binary
Nationality	Explanatory variable	Country of origin of the patient	Ghanaian or Other	Binary
Religion	Explanatory variable	Religion of patient	Christian, Islam, Other	Categorical
Systolic BP	Explanatory variable	Patients systolic blood pressure	Raw systolic BP recoded into Normal, Elevated, High, and Crisis	Continuous Categorical
Diastolic BP	Explanatory variable	Patients diastolic blood pressure	Raw diastolic BP recoded into Normal, Elevated, High, and Crisis	Continuous Categorical
Final Diagnosis	Explanatory variable	Diagnosis of Patient upon admission	Recategorized using ICD 10 into Chapter and Blocks	Categorical
Year	Explanatory variable	Year patient got admitted	Raw	Discrete
Treatment	Explanatory variable	Treatment patient received on admission	Medical or Surgical	Binary

3.10 Data analysis

Data was entered into Epidata and exported to Stata 16 for statistical analysis. Descriptive statistics were done to assess the frequencies of the covariate variables and the year presented to assess significant independence test of proportion. This was done by adopting the chi-square test of proportion. Also, cumulative incidence per total population of patients extracted was estimated.

Inferential analysis involving hazard ratio to test the risk of mortality per person-days at risk. This was firstly done by declaring data as a survival using days spent on admission and mortality as an outcome. After declaring, the mortality rate was estimated by covariates to assess the outcome of deaths per 1000 person-days at risk. Also, the expected event of mortality was assessed by adopting the Log-rank test of equality of survival with the corresponding χ^2 test. Finally, cox regression analysis was performed univariately to assess the risk. Meanwhile, before the reporting test of proportional hazard assumption was performed to check for thumb rule (thus, time-dependent and a significant test (p-value$\leq$0.05) violet the rule). Associated factors from cox regression analysis were then modeled together to assess the multivariate significant association. A significant test was set a p-value$\leq$0.05

3.11 Ethical Considerations

Ethical clearance for the study was sought from the scientific and technical committee of the Korle Bu Teaching Hospital. The patient's confidentiality was assured. All information obtained was kept confidential and data locked in a cabinet and on computers protected by passwords. The name and identity of the patients were not needed for the study, and the information gathered was identified by a code number and was treated strictly confidential.

3.12 Work Plan (Summary)

The study started with the actual work which took place with data collection in February 2020 and runs through with the final presentation of the work in October 2020. The study took a total period of eight months. More details are provided in appendix 2.

3.13 Budget (Summary)

Critical consideration was given to time and money that was needed to make sure this study was very possible because one of the significant criteria for selecting this research subject was its practicality in terms of resources. The study was self-financed and the total estimated budget for the study was GH₵1740. A detailed budget summary is provided in appendix 3.

CHAPTER FOUR

4.0: Results

The study involved a retrospective cohort of 2903 patients from 2015-2019 with age ranging from an infant with 1-month-year-old to 102 years older adults. The overall mean±standard deviation was 49.4±25.5 years and the overall proportion of male versus female differential was 56.1% versus 43.9%. Interestingly, the majority of the patients were from the urban place of residence (73.9%) and Ghanaians involved were over 93%. For clinical diagnosis, the commonest reported health conditions in descending order were; circulatory system diseases (59%), congenital malformations (18.2%), abnormal clinical and laboratory findings, and others (14.7%), and finally respiratory system diseases (8.1%). The type of treatment for the condition comprises of medical treatment (53.8) and surgical treatments (46.2) (Table 4.1).

Test of independence from Chi-square analysis showed that age group, marital status, place of residence, country, diagnosis (ICD-10 Chapter), diastolic BP, and treatment Outcome were significantly associated by year of diagnosis (p-value≤0.05) whiles sex, religion, treatment type, and systolic BP were insignificant (p-value>0.05).

Table 4.1: Description of patients characteristics by year of diagnosis among patients at the National Cardiothoracic Centre, 2015-2019

Sociodemographic	Overall	Year of data extraction					χ^2
		2015	2016	2017	2018	2019	
Age							**32.81***
Below 15	16.3	18	15.8	14.1	17.5	16.1	
15-29	7.1	7.8	6.8	7.5	5.9	7.7	
30-39	7.4	9.1	5	8	8.7	5.6	
40-49	10.2	9.8	9.9	10.4	9.3	11.6	
50-59	15.4	14.8	20.3	15.8	13.3	13.5	
60+	43.6	40.4	42.3	44.2	45.3	45.4	
Sex							**8.09**
Male	56.1	54.8	51.8	56.6	57.1	60	
Female	43.9	45.2	48.2	43.4	42.9	40	
Marital Status							**16.59***
Single	28.5	27.9	26.4	28.5	30.2	29.1	
Married	62.8	65.2	67.4	62	60.2	59.7	
Other	8.8	6.9	6.2	9.6	9.6	11.3	
Residence							**41.28*****
Rural	26.1	25.5	24.7	19.3	26.1	35.8	
Urban	73.9	74.5	75.3	80.7	73.9	64.2	
Religion							**11.14**
Christianity	86.2	87.1	87.7	88.1	83.6	84.6	
Islam	12.5	12.4	11	10.7	14.8	13.5	
Others	1.3	0.6	1.3	1.2	1.6	1.9	
Country							**12.73****
Ghana	93.7	91.4	93	95.3	92.9	95.9	
Others	6.3	8.6	7	4.7	7.1	4.1	
Diagnosis (ICD-10 Chapter)							**41.29*****
Congenital Malformations	18.2	19.9	15.4	15.6	20.5	19.5	
Circulatory system diseases	59	50.8	61.9	61.3	58	63.4	
Respiratory system diseases	8.1	12.2	7.9	8.2	7.4	4.7	
Abnormal clinical and lab. Findings and Others	14.7	17.1	14.8	14.9	14.2	12.4	
Treatment Type							**9.24**
Medical	53.8	50.6	51.1	54.8	53.8	58.7	
Surgical	46.2	49.4	48.9	45.2	46.2	41.3	
Systolic BP							**20.28**
Normal	18.4	19.2	19.2	19.3	18.7	15.4	
Elevated	31.4	33.6	31.6	31.7	32.9	26.7	
High	42.8	39.5	41.9	43.7	41.7	47.4	
Crisis	7.4	7.6	7.3	5.2	6.8	10.5	
Diastolic BP							**23.55****
Normal	21.1	22.7	18.8	22.4	21.3	20.3	
Elevated	37.5	40.8	37.6	40.8	36.1	32.1	

High	39.1	34.5	42.1	35.2	39.8	44.3	
Crisis	2.2	2	1.5	1.6	2.8	3.3	
Treatment Outcome							37.74***
Survived/discharge	91.6	88.9	86.6	92.8	94.7	94.4	
Died	8.4	11.1	13.4	7.2	5.3	5.6	

NOTE: P-value notation; *p-value≤0.05, **p-value≤0.01, ***p-value≤0.001

The mortality outcome was assessed and presented in Table 4.2 below. The analysis showed that the overall mortality prevalence was 8.4%(95%CI=7.4 to 9.4). The cumulative mortality incidence ranged from 5.3%(95%CI=3.7-7.3) in 2018 to 13.4%(95%CI=10.6-16.5) in 2016. In 2016, the mortality was approximately 17 deaths/1000 persons at risk whiles 6 deaths/1000 in 2018. By age groupings, mortality increased as age increases with a significant expected event difference (p-value≤0.001). Surprisingly, patients aged 60 years and above were expected to have high event expected days (91.4 days). The overall sex differential showed that the ratio of male : female mortality rate was approximately 1:1 per 1000 person-days at risk among the cohort studied with an insignificant difference in expected events days at risk (p-value>0.05). For rural-urban differential, the cumulative incidence was 8.7%(95%CI=6.8-10.9) and 8.3%(95%CI= 7.1-9.5) with mortality of 9.5 deaths/1000 and 10.5 deaths/1000 persons in rural and urban respectively. The expected difference of event days between rural and urban was statistically not significant (p-value>0.05) (Table 4.2).

Also, the difference in expected events days was statistically significantly associated with; marital Status, religion, diagnosis by ICD-10 Chapter, treatment type, and systolic BP (p-value≤0.05). The highest mortality rate was significantly higher among patients diagnosed with circulatory system diseases (14.1/1000 persons at risk). The mortality rate among medically treated patients was approximately thrice (15.7 deaths per 1000 persons) compared with patients treated with a surgical procedure (5.9%) and the difference in expected event days was statistically significant (p-value≤0.001) (Table 4.2).

Table 4.2: Demographic and clinical characteristics by cumulative incidence rate, mortality, and event expected days among patients at the National Cardiothoracic Centre, 2015-2019

demographic acteristics	Absolute Nos.	Cum. Incidence per 100[95% CI]	Person day at risk	No. of death	Rate per 1000 person-days at risk[95%CI]	Events expected	χ^2
							54.3
v 15	474	3.8[2.3-5.9]	5934	18	3.03[1.91-4.81]	55.55	
	206	7.3[4.1-11.7]	2058	15	7.29[4.39-12.09]	20.13	
	214	5.6[2.9-9.6]	1897	12	6.33[3.59-11.14]	18.95	
	295	7.5[4.7-11.1]	2278	22	9.66[6.36-14.67]	23.9	
	448	9.2[6.6-12.2]	3103	41	13.21[9.73-17.94]	33.04	
	1266	10.7[9.0-12.5]	8416	135	16.04[13.55-18.99]	91.44	
							0.
	1629	7.9[6.6-9.3]	12948	128	9.88[9.31-11.75]	133.9	
le	1274	9.0[7.5-10.7]	10738	115	10.71[8.92-11.86]	109.1	
tal Status							37.25
e	827	5.0[3.6-6.7]	8933	41	4.59[3.38-6.23]	85.71	
ed	1822	9.7[8.3-11.1]	12947	176	13.59[11.73-15.76]	137.79	
	254	10.3[6.8-14.6]	1806	26	14.40[9.80-21.14]	19.51	
lence							0.
	758	8.7[6.8-10.9]	6915	66	9.54[7.50-12.15]	69.78	
)	2145	8.3[7.1-9.5]	16771	177	10.55[9.11-12.23]	173.22	
ion							7.7
tianity	2501	8.2[7.1-9.3]	20014	204	10.19[8.89-11.69]	206.34	
	364	8.8[6.1-12.2]	3431	32	9.33[6.60-13.19]	34.08	
s	38	18.4[7.7-34.3]	241	7	29.05[13.85-60.93]	2.58	
try							4.8
	183	13.7[9.0-19.5]	1641	25	15.23[10.29-22.55]	16.44	
a	2720	8.0[7.0-9.1]	22045	218	9.89[8.66-11.29]	226.56	
nosis (ICD-10 Chapter)							
enital							42.00
ormations	529	3.8[2.3-5.8]	6577	20	3.04[1.96-4.71]	61.49	
latory system							
ses	1714	9.5[8.1-10.9]	11487	162	14.10[12.09-16.45]	123.95	
ratory system							
ses	234	9.0[5.6-13.4]	2205	21	9.52[6.21-14.61]	22.06	
rmal clinical							
ab. Findings and							
s	426	9.4[6.8-12.6]	3417	40	11.71[8.59-15.96]	35.51	
tment Type							
cal	1562	10.6[9.1-12.2]	10464	165	15.77[13.54-18.37]	113.23	45.85*
cal	1341	5.8[4.6-7.2]	13222	78	5.90[4.73-7.37]	129.77	

olic BP						24.6
ıal	452	5.3[3.4-7.8]	3730	24	6.43[4.31-9.60]	45.52
ited	771	7.4[5.6-9.5]	5677	57	10.04[7.74-13.02]	70.79
	1051	11.8[9.9-13.9]	7412	124	16.73[14.03-19.94]	93.23
s	181	11.0[6.9-16.5]	1207	20	16.57[10.70-25.68]	15.47
tolic BP						5.
ıal	519	7.1[5.1-9.7]	3811	37	9.71[7.03-13.40]	47.56
ited	921	8.8[7.0-10.8]	6979	81	11.61[9.33-14.43]	86.7
	960	10.3[8.5-12.4]	6747	99	14.67[12.05-17.87]	84.57
s	55	14.5[6.5-26.7]	489	8	16.36[8.18-32.71]	6.17
						38.9
	549	11.1[8.6-14.0]	4642	61	13.14[10.22-16.89]	47.34
	546	13.4[10.6-16.5]	4259	73	17.14[13.62-21.56]	43.82
	597	7.2[5.3-9.6]	4454	43	9.64[7.16-13.02]	46.39
	678	5.3[3.7-7.3]	5725	36	6.29[4.54-8.72]	59.04
	533	5.6[3.8-7.9]	4606	30	6.51[4.55-9.32]	46.42

NOTE: P-value notation; *p-value≤0.05, ****p-value≤0.0001

The mortality outcome was also assessed and presented for age below 15 in Table 4.3 below. The cumulative mortality incidence ranged from 2.5%(95%CI=0.5 to 7.2) in 2018 to 6.1%(95%CI=2.3 to 12.7) in 2015. Mortality in 2018 was approximately 2 deaths/1000 persons at risk compared with 4 deaths/1000 in 2015. By age groupings, mortality decreased as age increases with a significant expected event difference (p-value≤0.01). Surprisingly, patients aged below 5 years were expected to have high event expected days (9.2 days). Overall sex differential showed that, the ratio of male : female mortality rate was approximately 1:1 per 1000 person-days at risk among the cohorts with an insignificant difference in expected events days at risk (p-value>0.05). For rural-urban, the cumulative incidence was 6.3%(95%CI=3.3 to 6.6) and 2.1%(95%CI= 0.78 to 4.5) with mortality of 4.9 deaths/1000 and 1.7 deaths/1000 persons in rural and urban respectively. The expected difference of event days between rural and urban was statistically significant (p-value<0.05) (Table 4.3). Furthermore, country of origin had a cumulative incidence of 18.4%(95%CI=7.7 to 34.3) and 2.5%(95%CI=1.3 to 4.5) with mortality of 12.8 death/1000 and 2.0 death/1000 persons in other

countries and Ghana respectively while the expected difference of event days between the two categories was significant statistically (p-value<0.01).

Also, the difference in expected events days was not statistically significantly associated with; religion, diagnosis by ICD-10 Chapter, and treatment type (p-value>0.05). The highest mortality rate was high but not statistically significant among patients diagnosed with circulatory system diseases (28.2/1000 persons at risk). Again, the mortality rate among medically treated patients was approximately about five times (14.1 deaths per 1000 persons) compared with patients treated with a surgical procedure (2.9%) and the difference in expected event days was not statistically significant (p-value>0.05).

Table 4.3: Demographic and clinical characteristics by cumulative incidence rate, mortality, and event expected days among patients for children below 15 at the National Cardiothoracic Centre, 2015-2019

demographic icteristics	Absolute Nos.	Cum. Incidence per 100[95% CI]	Person day at risk	No. of death	Rate per 1000 person-days at risk[95%CI]	Events Expected
' 5	253	5.9[3.4-9.6]	3074	15	4.88[2.94-8.09]	9.18
	221	1.4[0.28-3.9]	2860	3	1.05[0.34-3.25]	8.82
	235	3.4[1.5-6.6]	2981	8	2.68[1.34-5.37]	8.7
e	239	4.2[2.0-7.6]	2953	10	3.39[1.82-6.29]	9.3
ence						
	189	6.3[3.3-10.8]	2430	12	4.94[2.80-8.69]	6.97
	285	2.1[0.78-4.5]	3504	6	1.71[0.77-3.81]	11.03
on						
ianity	371	3.5[1.9-5.9]	4611	13	2.82[1.64-4.85]	13.61
	96	4.2[1.1-10.3]	1269	4	3.15[1.18-8.40]	4.22
	7	**14.2[0.36-57.9]**	54	1	**18.52[2.61-131.46]**	0.17
try						
	38	18.4[7.7-34.3]	545	7	12.84[6.12-26.94]	2.08
	436	2.5[1.3-4.5]	5389	11	2.04[1.13-3.68]	15.92

iosis (ICD-10 Chapter)						
enital Malformations	393	3.3[1.8-5.6]	4902	13	2.65[1.54-4.57]	14.48
atory system es	37	5.4[0.7-18.2]	380	2	5.26[1.32-21.04]	1.14
ratory system es	4	50.0[6.8-93.2]	71	2	**28.17[7.04-112.63]**	0.51
rnal clinical and lab. igs and Others	40	2.5[0.06-13.2]	581	1	1.72[0.24-12.22]	1.87
ment Type						
al	15	6.7[0.2-31.9]	71	1	**14.08[1.98-99.99]**	0.29
al	459	3.7[2.2-5.9]	5863	17	2.90[1.80-4.66]	17.71
	99	6.1[2.3-12.7]	1328	6	4.52[2.03-10.06]	4.34
	86	3.5[0.7-9.9]	1054	3	2.85[0.92-8.82]	3.03
	84	3.6[0.7-10.1]	929	3	3.23[1.04-10.01]	2.84
	119	2.5[0.5-7.2]	1452	3	2.07[0.67-6.41]	4.48
	86	3.5[0.7-9.9]	1171	3	2.56[0.83-7.94]	3.32

NOTE: P-value notation; *p-value≤0.05, **p-value≤0.01, ***p-value≤0.001

Mortality outcome for above 15 years old was also assessed and presented in Table 4.4 below. The analysis showed that the cumulative mortality incidence ranged from 5.9%(95%CI=4.1 to 8.7) in 2018 to 15.2%(95%CI=12.1 to 18.8) in 2016. Mortality in 2018 was approximately 8 deaths/1000 persons at risk compared with 22 deaths/1000 in 2016. Also, by age groupings, mortality increased as age increases with a significant expected event difference (p-value≤0.001). Tellingly, patients aged 60 and above years were expected to have high event expected days (108.9 days), overall sex differential here also showed that the ratio of male : female mortality rate was approximately 1:1 per 1000 person-days at risk among the cohorts studied with an insignificant difference in expected events days at risk (p-value>0.05). For rural-urban, the cumulative incidence was 9.5%(95%CI=7.2 to 12.2) and 9.2%(95%CI=7.9 to 10.6) with mortality of 12.04 deaths/1000 and 12.9 deaths/1000 persons in rural and urban respectively. Furthermore, diagnosis by ICD-10 Chapter had a statistically significantly associated with treatment outcome cumulative incidence of 5.1%(95%CI=2.1 to 10.3) and 10.1%(95%CI=7.2 to 13.6) with mortality of 4.2 death/1000 and 13.8 death/1000 persons for

Congenital Malformations and Abnormal clinical and lab. Findings and Others respectively while the expected difference of event days was significant statistically (p-value<0.01).

Also, the difference in expected events days was not statistically significantly associated with; marital status, residence, religion, country of origin, and Diastolic blood pressure (p-value>0.05). There was a high mortality rate of 15.8 death/1000 person-days at risk among patients who were medically treated and were statistically significant (p<0.0001).

Table 4.4: Demographic and clinical characteristics by cumulative incidence rate, mortality, and event expected days among patients above 15 at the National Cardiothoracic Centre, 2015-2019

ociodemographic haracteristics	Absolute Nos.	Cum. Incidence per 100[95% CI]	Person day at risk	No. of death	Rate per 1000 person-days at risk[95%CI]	Events Expected	
ge							17.
5-29	206	7.3[4.1-11.7]	2058	15	7.29[4.39-12.09]	24.56	
)-39	214	5.6[2.9-9.6]	1897	12	6.32[3.59-11.14]	23.08	
)-49	295	7.5[4.7-11.1]	2278	22	9.66[6.36-14.67]	28.7	
)-59	448	9.2[6.6-12.2]	3103	41	13.21[9.73-17.94]	39.73	
)+	1266	10.7[9.0-12.5]	8416	135	16.04[13.55-18.99]	108.94	
ex							
lale	1394	8.6[7.2-10.2]	9967	120	12.04[10.07-14.39]	127.02	
:male	1035	10.1[8.4-12.1]	7785	105	13.49[11.14-16.33]	97.98	
larital Status							
ingle	371	6.2[4.0-9.2]	3237	23	7.10[4.72-10.69]	39.27	8
larried	1808	9.7[8.4-11.2]	12783	176	13.77[11.88-15.96]	163.33	
ther	250	10.4[6.9-14.9]	1732	26	15.01[10.22-22.05]	22.4	
esidence							
ural	569	9.5[7.2-12.2]	4485	54	12.04[9.22-15.72]	56.69	0
rban	1860	9.2[7.9-10.6]	13267	171	12.89[11.09-14.97]	168.31	
eligion							
hristianity	2130	9.0[7.8-10.3]	15403	191	12.40[10.76-14.29]	195.74	5
lam	268	10.4[7.1-14.7]	2162	28	12.95[8.94-18.76]	26.84	
thers	31	19.3[7.5-37.4]	187	6	32.08[14.41-71.42]	2.42	
ountry							
ther	145	12.4[7.5-18.9]	1096	18	16.42[10.35-26.07]	13.64	1
hana	2284	9.1[7.9-10.3]	16656	207	12.43[10.84-14.24]	211.36	
iagnosis (ICD-10 Chapter)							
							12.

ongenital alformations	136	5.1[2.1-10.3]	1675	7	4.18[1.99-8.77]	19.35
irculatory system seases	1677	9.5[8.2-11.0]	11107	160	14.40[12.34-16.82]	143.65
espiratory system seases	230	8.3[5.0-12.6]	2134	19	8.90[5.68-13.96]	25.8
bnormal clinical id lab. Findings						
id Others	386	10.1[7.2-13.6]	2836	39	13.75[10.05-18.82]	36.21
reatment Type						
edical	1547	10.6[9.1-12.2]	10393	164	15.78[13.54-18.39]	133.96
rgical	882	6.9[5.3-8.8]	7359	61	8.29[6.45-10.65]	91.04
stolic BP						
ormal	446	5.4[3.5-7.9]	3654	24	6.57[4.40-9.80]	45.32
evated	761	7.5[5.7-9.6]	5574	57	10.23[7.89-13.26]	70.72
igh	1044	11.9[10.0-14.0]	7347	124	16.88[14.15-20.12]	93.80
risis	177	11.3[7.0-16.9]	1164	20	17.18[11.08-26.63]	15.16
iastolic BP						
ormal	514	7.2[5.1-9.8]	3761	37	9.84[7.13-13.58]	47.64
evated	908	8.9[7.1-11.0]	6839	81	11.84[9.53-14.72]	86.43
igh	952	10.4[8.5-12.5]	6657	99	14.87[12.21-18.11]	84.77
risis	54	14.8[6.6-27.1]	482	8	16.60[8.30-33.19]	6.16
ear						
015	450	12.2[9.3-15.6]	3314	55	16.60[12.74-21.62]	41.9
016	460	15.2[12.1-18.8]	3205	70	21.84[17.28-27.61]	40.89
017	513	7.8[5.6-10.5]	3525	40	11.35[8.32-15.47]	45.12
018	559	5.9[4.1-8.7]	4273	33	7.72[5.49-10.86]	54.05
019	447	6.0[4.0-8.7]	3435	27	7.86[5.39-11.46]	43.04

NOTE: P-value notation; **p-value≤0.01, ***p-value≤0.001, ****p-value≤0.0001

In terms of residence, urban dwellers have a higher survival chance for the below 15 age group while both urban and rural residents have about equal survival for the age group above 15

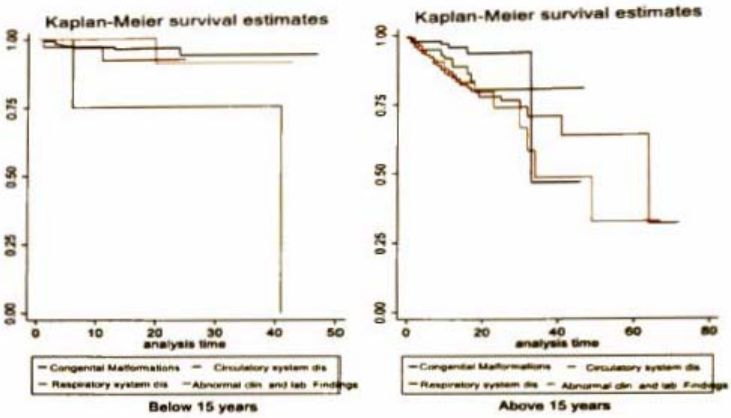

Figure 4.1: Survival graph for diagnosis

From the Kaplan Meier graph above diagnosis of respiratory system diseases in the below 15 years group have a better survival chance as compared with the same diagnosis for the above 15 years group whiles circulatory system diseases have a better survival chance in the group of above 15 years than that of the below 15 years.

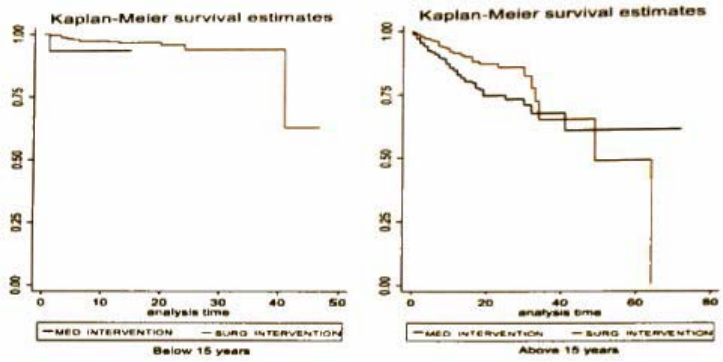

Figure 4.2: Survival graph for treatment type

For both age groups, the surgical intervention appears to give a better survival chance than medical intervention in terms of treatment given.

Table 4.5: Demographic and clinical characteristics of the patient above 15years for the determinant of survival outcomes of cardiothoracic conditions

Sociodemographic	cHR[95% CI]p-value	aHR[95% CI]p-value
Age		
15-29	Ref	Ref
30-39	0.85[0.40-1.82]	0.69[0.31-1.56]
40-49	1.26[0.65-2.43]	0.80[0.38-1.70]
50-59	1.70[0.94-3.08]	0.98[0.48-1.97]
60+	2.05[1.20-3.50]**	1.25[0.65-2.40]
Sex		
Male	Ref	
Female	1.13[0.87-1.47]	
Marital Status		
Single	Ref	Ref
Married	1.84[1.19-2.85]**	1.29[0.76-2.18]
Other	1.99[1.13-3.49]*	1.44[0.76-2.74]
Residence		
Rural	Ref	
Urban	1.07[0.78-1.45]	
Religion		
Other	Ref	Ref
Christianity	0.39[0.17-0.89]*	0.26[0.11-0.59]**
Islam	0.42[0.17-1.02]	0.27[0.11-0.67]**
Country		
Other	Ref	
Ghana	0.74[0.46-1.20]	
Diagnosis (ICD-10 Chapter)		
Congenital Malformations	Ref	Ref
Circulatory system diseases	3.13[1.46-6068]**	2.38[1.10-5.15]*
Respiratory system diseases	2.05[0.86-4.89]	1.56[0.65-3.77]
Abnormal clinical and lab. Findings and Others	3.02[1.35-6.77]**	2.41[1.06-5.46]*
Treatment Type		
Medical	Ref	
Surgical	0.54[0.40-0.73***	
Systolic BP		
Normal	Ref	Ref
Elevated	1.53[0.95-.2.46]	1.42[0.87-2.30]
High	2.50[1.62-3.87]***	2.26[1.44-3.54]***
Crisis	2.50[1.38-4.53]**	2.30[1.25-5.23]**
Diastolic BP		
Normal	Ref	
Elevated	1.21[0.82-1.78]	
High	1.50[1.03-2.19]*	
Crisis	1.67[0.77-3.62]	

Year		
2015	Ref	Ref
2016	1.31[0.92-1.86]	1.19[0.83-1.71]
2017	0.67[0.45-1.02]	0.61[0.40-0.92]*
2018	0.46[0.30-0.71]***	0.41[0.27-0.64]***
2019	0.48[0.30-0.75]**	0.38[0.24-0.61]***

NOTE: P-value notation; *p-value≤0.05, **p-value≤0.01, ***p-value≤0.001

From the above analysis for 15 years and above, age is a predictor of treatment outcome from cardiothoracic cases with 60 years and above having a hazard ratio of about two (2) fold 2.05 compared with that of age group 15 to 29 years with a hazard ratio of 0.85 and it is significant. Furthermore, being female increases your risk by 1.13-fold but not significant, the marital status of a person also significantly predicts treatment outcomes of cardiothoracic cases with another marital status such as divorce, widowed, or separated having about 1.99 hazards compared with married persons with hazards ratio of 1.84. being diagnosed with a circulatory system disease increases your hazards ratio by 3.13 as compared with being diagnosed with respiratory system diseases with hazards of 2.05 and it is significant, meanwhile, a unit increase in systolic blood pressure increases risk with high and crisis systolic group by 2.5-fold as compared with a high systolic group of 1.53 and it is significant.

Table 4.6: Demographic and clinical characteristics of the patient below 15years for the determinant of survival outcomes of cardiothoracic conditions

Sociodemographic Characteristics	cHR[95% CI]p-value	aHR[95% CI]p-value
Age		
Below 5	Ref	Ref
5-14	0.21[0.06-0.71]*	0.16[0.04-0.68]*
Sex		
Male	Ref	
Female	1.17[0.46-2.97]	
Residence		
Rural	Ref	Ref
Urban	0.29[0.10-0.82]*	0.25[0.08-0.73]*
Religion		
Others	Ref	
Christianity	0.16[0.02-1.21]	
Islam	0.15[0.02-1.43]	
Country		
Other	Ref	Ref
Ghana	0.16[0.06-0.44]***	0.17[0.06-0.49]**
Diagnosis (ICD-10 Chapter)		
Congenital Malformations	Ref	Ref
Circulatory system diseases	1.93[0.43-8.56]	5.78[1.05-31.69]*
Respiratory system diseases	7.42[1.25-43.92]*	3.88[0.47-32.32]
Abnormal clinical and lab. Findings and Others	0.66[0.09-5.12]	0.78[0.10-6.22]
Treatment Type		
Medical	Ref	
Surgical	0.27[0.04-2.08]	
Year		
2015	Ref	
2016	0.70[0.17-2.88]	
2017	0.75[0.18-3.07]	
2018	0.48[0.12-1.93]	
2019	0.64[0.16-2.63]	

NOTE: P-value notation; *p-value≤0.05, **p-value≤0.01, ***p-value≤0.001

For the age category of below 15 years, age is a predictor of treatment outcome of cardiothoracic cases with a hazard ratio of 0.21 for the 5 to 14 age groups. Furthermore, being diagnosed with respiratory system diseases has a three-fold risk as compared with children diagnosed with abnormal clinical and laboratory findings and others with below 1 hazard ratio.

CHAPTER FIVE

DISCUSSION

5.0: Discussion

Cardiovascular conditions are important health risk conditions globally and have gained public health attention. This study was conducted with the hypothetical idea of establishing the trend of cardiovascular cases admitted at the NCTC, a national referral centre in Ghana, and sub-countries in the West African region and further assessed the mortality treatment outcome from 2015-2019.

The overall age of the study cohorts ranged from as low as 1-month to a high of 102 years and the mean of age (49.4±25.5 years) was relatively lower compared with a similar study conducted to assess the pattern of cardiovascular deaths retrospectively within 5 years by Adegoke and colleagues who observed 65.2 years (Adegoke et al., 2018).

5.1 Percentage Incidence of cardiovascular cases at the National Cardiothoracic Centre, 2015-2019

The percentage incidence of new cases as the study established depicts that, there was a slightly increasing trend in the reported cases with the peak occurring in 2018 (23.4%). The trend of cardiovascular percentage incidence cases as observed in this current study was significantly lower compared with the similar 5 years trend established in Nigeria, a neighbouring country (Adedapo, 2017). Adedapo also established an increased case of cardiovascular conditions with the same peak in the fourth year (40.5%). The significant differences observed as compared with Adedapo could be explained by the different participants and the various years involved in the study. Adedapo involved only female sex with cardiovascular condition retrospectively from 1997-2001 whiles this current study involved both sexes from 2015-2019.

In Ghana, Cardiovascular conditions are a growing public health issue in which this study establishing an increasing trend. However, the observed declining rate of the cases from 2018 to 2019 could be explained by the fact that there was a cardiovascular intervention in the country from 2018 due to the rise from 2015-2018. Thanks, to the Ghana Heart Initiative which was launched in 2018 to improve risk assessment and management of cardiovascular diseases in public hospitals in the Greater Accra region of Ghana (Ghanaian Society of Cardiology, 2019).

For clinical diagnosis within the period understudied, the commonest reported health conditions were; circulatory system diseases (including cerebrovascular diseases, diseases of veins, lymphatic vessels, and lymph nodes, hypertensive diseases, ischemic heart diseases, other forms of heart disease, pulmonary heart disease, and diseases of pulmonary circulation); congenital malformations (including Congenital malformations of the circulatory system, Other congenital malformations of the digestive system, and amongst others); abnormal clinical and laboratory findings and others (abnormal findings of the blood, diabetes mellitus, diseases of the esophagus, stomach, and duodenum, general symptoms and signs, in situ neoplasms, malignant neoplasms of respiratory and intrathoracic organs, surgical and medical complications and symptoms and signs involving the circulatory and respiratory systems); and finally respiratory system diseases (chronic lower respiratory disease, influenza, and pneumonia other acute upper respiratory infections, other and unspecified disorders of the circulatory system, other diseases of the pleura, suppurative and necrotic conditions of the lower respiratory tract and amongst others) (Appendix 4).

5.2 Mortality treatment outcome

The results from this study established that patients were either treated with medical procedures or surgical procedures. From the analysis, most patients were medically treated occurring among over half of the patients both overall and within the study period. The major medical conditions involved

were Ischemic heart diseases, Hypertensive diseases, Cerebrovascular diseases (Stroke), Pulmonary heart disease, and diseases of pulmonary circulation, Other forms of heart disease and surgical conditions include; Congenital malformations of the circulatory system, Diseases of arteries, arterioles, and capillaries, Diseases of Esophagus, Stomach, and Duodenum, Surgical and medical complications

It was quite interesting that the treatment method employed by the Centre significantly decreased the incidence of mortality rate. The study observed an overall 8.4% mortality cases with the highest peak occurring in 2016 (13.4%). The overall mortality rate per 1000 person-days at risk decreased by approximately 62% from 17.1 per 1000 in 2016 to 6.5 per 1000 in 2019. The rate of change of the observed decreased in mortality is almost 50% higher compared with what was established in Hungary by Virág and colleagues (2018). The two friends observed a decreased rate of approximately 40% of all cardiovascular diseases from 1984-2013 (Virág & Nyári, 2018b). Also, this current declining rate of CVD mortalities was over 3-folds compared with a study to assess mortality from CVD in the Americas in 2015. The study established a decrease of 21% of CVD among patients in the period 2000–2010 (Ordunez et al., 2015).

It was interesting to establish that, as age increases, the risk of cardiothoracic mortality also increases significantly. By age groupings, the pattern showed that the incidence of mortality increased by approximately 81%. The rate of increase was between 3 per 1000 persons aged below 15 years to 16 per 1000 persons aged 60 years and above. When the hazard ratio was examined, the risk of experiencing death among patients aged 60 years and above was significantly over 2-folds compared with their counterparts who were aged below 15 years. Increasing age as a risk factor of cardiothoracic mortality outcome is not surprising because age is associated with cardiovascular diseases and that, aging causes changes in the heart and blood vessels that may predispose a person to cardiovascular disease (NIH, 2018). Also, the probable reason could be that, older adults are more susceptible to

risky lifestyle behavior like smoking, alcohol, less exercising which predispose them to high body mass index, unhealthy diet, and amongst others which are the most important risk factors of CVD globally (Barnes, 2013; Mathers et al., 2015; Mirzaei et al., 2020; Yusuf et al., 2020).

This study is consistent with a previous study where older adults in developed countries have a higher risk of CVD mortality (Lloyd-Sherlock et al., 2019). Notwithstanding the analysis by Mathers et al. (2015) mortality report stipulates that in LMICs the reduction in CVD mortality among older adults was one of the most important factors to the increase in life expectancy among older adults from 1980 and 2010 (Mathers et al., 2015).

The overall differences in mortality rate among sex differences were observed in this to be statistically not different from each other even though the risk of experiencing death outcome was higher among females compared with females. This finding is not different compared with a similar study conducted to assess the sex disparity of CVD mortality. The study established that the number of CVD mortality cases among female sex was higher compared with males (Mosca et al., 2011).

For clinically diagnosed conditions, the highest mortality rate was significantly higher among patients diagnosed with circulatory system diseases (approximately 14 per 1000 persons at risk). Circulatory conditions involving; cerebrovascular diseases, diseases of veins, lymphatic vessels, and lymph nodes, hypertensive diseases, ischemic heart diseases, other forms of heart disease, pulmonary heart disease, and diseases of pulmonary circulation were most diagnosed in this study. These aforementioned conditions are heart and blood vessel diseases that affect how heart or blood vessels pump blood can cause complications to patients. The high-rate mortality of circulatory conditions as found in this study is lower compared with a study conducted to estimate all-cause mortality and cause-specific mortality among patients' proton pump inhibitors (PPIs). The study showed that the mortality outcomes were 17.47 per 1000 patients taking PPIs (Xie et al., 2019). The differences as

found compared with this study could be the method of study design adopted as Xie and colleagues adopted a longitudinal design compared with this retrospective design.

Mortality among medically treated patients was approximately 3-folds significant (15.7 deaths per 1000 persons) compared with patients treated with a surgical procedure (5.9%) and the difference in expected event days was statistically significant. The NCTC has two treatment interventions i.e., surgical and medical. The surgically treated conditions are localized intervention such as congenital conditions including; Congenital malformations of the circulatory system and Diseases of Esophagus, Stomach, and Duodenum which prevent severe cases while medical condition involves the pharmaceutical approach to the treatment of conditions. The probable explanation could be that medical treatment is usually exploratory since it involves a combination of different medication and procedures which either leads to successful treatment or failure, conversely surgical treatment which is usually with strict protocol to correct the defect.

Patients from the rural areas have with mortality of 9.5 deaths/1000 and 10.5 deaths/1000 persons in rural and urban respectively. The expected difference of event days between rural and urban was statistically not significant.

CHAPTER SIX

6.0: CONCLUSION AND RECOMMENDATION

6.1: Conclusion

There has been a steady trend of reported cardiovascular conditions at the national cardiothoracic centre except for the spike in reported cases in 2018. There is a high mortality rate for medical treatment as against surgical treatment, as also for the patients 60 years and above. Cardiovascular disease incidence increases age increases. We recommend that there should be a well-drafted protocol for the treatment of medical cases just like in the protocols in place for surgical cases to reduce the need for trial and hope treatment among medical cases to reduce the mortality rate among such cases.

6.2: Recommendation

The Ghana national aging policy must consider the cardiothoracic conditions among the aged to create a good picture of aging and to promote the health and wellbeing of the aged. Also, we recommend that to ascertain the true incidence, pattern, and mortality outcomes of cardiothoracic conditions, a nation-wide facility study be conducted to help policymakers plan and stem the tides of future catastrophes from cardiothoracic conditions.

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Appendix 4: Disease classification of diagnosis based on ICD 10 block

Disease classification ICD 10 Block	ICD-10 Code	Freque
Circulatory system diseases	**Chapter IX**	**1714**
Acute rheumatic fever	I00-I02	1
Cerebrovascular diseases (Stroke)	I60-I69	60
Chronic rheumatic heart diseases	I05-I09	18
Congenital malformations of the circulatory system	Q20-Q28	1
Diseases of arteries, arterioles and capillaries	I70-I79	29
Diseases of veins, lymphatic vessels and lymph nodes	I80-I89	49
Hypertensive diseases	I10-I15	113
Ischemic heart diseases	I20-I25	429
Other and unspecified disorders of the circulatory system	I95-I99	3
Other diseases of the pleura	J90-J94	2
Other forms of heart disease	I30-I52	855
Pulmonary heart disease and diseases of pulmonary circulation	I26-I28	154
Congenital Malformations	**Chapter XVII**	529
Congenital malformations and deformations of the musculoskeletal system	Q65-Q79	2
Congenital malformations of the circulatory system	Q20-Q28	483
Congenital malformations of the respiratory system	Q30-Q34	2
Other congenital malformations of the digestive system	Q38-Q45	40
Other forms of heart disease	I30-I52	2
Respiratory system diseases	**Chapter X**	**234**
Acute upper respiratory infections	J00-J06	1
Chronic lower respiratory disease	J40-J47	13
Influenza and pneumonia	J09-J18	51
Other acute upper respiratory infections	J00-J06	23
Other and unspecified disorders of the circulatory system	I95-I99	1
Other diseases of the pleura	J90-J94	127
Other diseases of the respiratory system	J95-J99	2
Other respiratory diseases principally affecting the interstitium	J80-J84	4
Suppurative and necrotic conditions of the lower respiratory tract	J85-J86	12
Abnormal clinical, laboratory Findings and other diseases	**Chapter XVIII**	**426**
Abnormal findings of blood	R70-R79	10
Abnormal findings on diagnostic imaging	R90-R94	6
Aplastic and other anemias and other bone marrow failure syndromes	D60-D64	1
Aplastic, anemias and bone marrow failure	D60-D64	9
Benign neoplasms	D10-D36	1
Diabetes mellitus	E10-E14	21
Diseases of Esophagus, Stomach and Duodenum	K20-K31	60

Diseases of the inner ear	H80-H83	4
Diseases of myoneural junction and muscle	G70-G73	1
Diseases of the oral cavity and salivary glands	K00-K14	1
Disorders of the immune mechanism	D80-D89	5
Dorsopathies	M40-M54	1
Episodic and paroxysmal disorders	G40-G47	2
General symptoms and signs	R50-R69	14
Glucose regulation and pancreatic internal secretion	E15-E16	2
Health hazards related to personal disease history	Z20-Z29	45
Hemolytic anemias	D55-D59	1
Hernia	K40-K46	2
In situ neoplasms	D00-D09	67
Injuries to the head	S00-S09	1
Injuries to the thorax	S20-S29	7
Malignant neoplasms	C00-C14	1
Malignant neoplasms of lymphoid, hematopoietic and related tissue	C00-C75	4
Malignant neoplasms of respiratory and intrathoracic organs	C30-C39	16
Metabolic disorders	E70-E90	7
Muscle disorder	M60-M63	1
Other bacterial diseases	A30-A49	3
Other diseases of the digestive system	K90-K93	2
Puerperium complication	O85-O92	3
Renal Failure	N17-N19	15
Surgical and medical complications	T80-T88	71
Symptoms and signs involving the circulatory and respiratory systems	R00-R09	25
Symptoms and signs involving the digestive system and abdomen	R10-R19	6
Symptoms and signs involving the skin and subcutaneous tissue	R20-R23	8
Tuberculosis	A15-A19	3

Appendix 2: Budget

Item Category	Unit cost(GhC)	Number	Total Cost (GhC)
IRB review	200	1	200
Printing and Photocopy	30	8	240
Research assistant	500	2	1000
Stationary	100		100
Subtotal			1540
Miscellaneous			200
Total (GhC)			1740

Appendix 3: Work plan

ACTIVITY	Feb 2020	March 2020	Apr-May, 2020	June
Proposal development				
Submission to Ethical Review Committee				
Collection of Data				
Data Analysis and report writing				

Appendix 4: Questionnaire

A. Socio-demographic characteristics

1. Age:
2. Gender: Male ☐ Female ☐
3. Marital status: Single ☐ Married ☐ Others ☐
4. Place of residence: rural ☐ urban ☐
5. Religion: Christian ☐ Islam ☐ Others ☐
6. Nationality: .....
7. Date of admission __/__/____

Evaluation findings

8. Systolic Blood Pressure: ..... mmHg
9. Diastolic Blood Pressure: ..... mmHg
10. Weight: ..... kg
11. Height: ..... cm
12. Pulse: ..... bpm

B. Diagnoses

i. Final CVD diagnosis: .....
ii. Treatment Received: .....
iii. Date of discharge: __/__/____
iv. Days Spent: .....
v. Year of Admission: .....

C. Outcome: .....