



Addis Ababa University
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Incidence and associated risk factors of major cardiovascular diseases among patients who visited Felege Hiwot Referral Hospital in Bahir Dar, Ethiopia, between 2014 and 2017

A thesis submitted to school of graduate studies of Addis Ababa University in partial fulfillment of the requirements for the degree of master science in biology

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This is to certify that the Thesis prepared by Enguday Bimalid Mulu entitled: Incidence and Associated risk factors of major cardiovascular diseases among patients who visited Felege Hiwot referral hospital in Bahir Dar, Ethiopia between 2014 and 2017 and Submitted in partial fulfillment of the requirements for the Degree of Master of Science in Biology complies with the regulations of the University and meets the accepted standards with respect to originality and quality.

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ACRONYMS AND ABBREVIATION

ACS	Acute Coronary Syndrome
AF	Atrial Fibrillation
AH	Arterial hypertension
ANRS	Amhara National Regional State
BMI	Body Mass Index
CAD	Coronary Heart Disease
CHF	Congestive Heart Failure
CVA	Cerebro Vascular Accident
CVD	Cardio Vascular Disease
DRIS	Dietary Reference Intake.
HCM	Hypertension Cardiomyopathy.
HAL	High Density Lip proteins
HF	Heart Failure
HIV/AIDS	Human Immune Deficiency Virus/Acquired Immune Deficiency Syndrome
LDL	Low Density Lipoproteins
LV	Left Ventricular
NCD	Non Communicable Disease
NHLB	National Heart ,Lung and Blood Institute

NIH	National Institute of Health
RHD	Rheumatic Heart Disease
SAN	Sino atrial Node
SCD	Statistics on Cardio vascular Disease+
SNP	Single Nucleotide polymorphisms
SSA	Sub Saharan Africa
SVT	Supra Ventricular Tachycardia
TIA	Transient Ischemic Attack
UN	United Nations
VF	Ventricular Fibrillation
WHO	World Health Organization

Abstract

The aim of this research was to assess the incidence of three common cardiovascular diseases (hypertension, heart disease, and stroke) and their risk factors among patients who visited Felege Hiwot Referral Hospital (FHRH) in Bahir Dar, Ethiopia. Patient records available between 2014 and 2017 were used as sources to get the required data on incidence among sex, age and residential (urban and rural) groups. In addition, data on annual trends of incidence and patients' background related to potential risk factors were extracted from the medical records. Supplementary data were obtained by interviewing selected patients and members of the medical staff including Medical doctors and nurses. The data were collected from December 2017 to April 2018. Out of 2435 hypertension patients, 1097 (45.1%) and 1338 (54.9%) had Stage 1 and Stage 2 Hypertension respectively. The highest incidence of hypertension was recorded in the >65 age group while there were no hypertension cases recorded in the <15 age group. Incidence of hypertension was significantly higher in males than females ($p=0.00$). Hypertension incidence showed continuous increase between 2014 and 2015. The hypertension incidence was also significantly higher in urban residents than rural ones ($p=0.00$). Five types of heart diseases were recorded, of which valvular and rheumatic heart diseases were the most common. Unlike hypertension, heart disease was observed in all age groups. There was no significant difference in the incidence of heart diseases between males and females ($p=0.347$). The annual trend of heart disease showed continuous increases between 2014 and 2017. There was no significant variation in the incidence of heart disease between urban and rural residents ($p=0.07$). Stroke was recorded in all age groups except <5 years. Both Ischemic and hemorrhagic stroke patients were not recorded under five years. Ischemic stroke was significantly more common than hemorrhagic stroke ($p=0.03$). On the other hand, stroke incidence did not show significant difference between males and females ($p=0.117$) and urban and rural residents ($p=0.644$). Unhealthy dietary habit was a contributing factor more to hypertension and heart diseases than stroke while smoking contributed more to heart diseases than hypertension and stroke. Lack of proper use of prescribed drugs specially for hypertension, and the arrival of patients late after suffering from stroke were stated by the medical staff as the major challenges in the treatment of cardiovascular diseases at FHRH.

*Conclusion:*The finding revealed that, CVDs are common in the population of Bahir Dar and the surrounding area who visited the hospital . The data also suggests that prevalence could increase in the nearby future.

Keywords: Hypertension, heart disease, stroke, cardiovascular, risk factors, Bahir Dar.

1. INTRODUCTION

1.1 Background

Cardiovascular diseases (CVD) can be defined as the development of pathology that occur in the vascular system. CVD is associated with one or more characteristics of an individual that increases the likelihood of developing a disease (Kramer *et al.*, 2008). Of the 56.9 million deaths worldwide in 2016, more than half (54%) were due to the top 10 causes. Ischaemic heart disease and stroke are the world's biggest killers, accounting for a combined 15.2 million deaths in 2016 (WHO,2018). Worldwide, the primary risk factors (hypertension, obesity, physical inactivity, poor diet, alcohol and smoking) are increasing as a result of urbanization (Mendis *et al.*, 2011). The African Union has identified CVDs as one of the continent's biggest health challenges after HIV AIDS (UNAIDS, 2011).

Cardiovascular diseases most of which are due to atherosclerosis (mainly heart attack and stroke) and often related to arterial hypertension, are responsible for nearly 20% of all deaths worldwide (nearly 10 million) (Fernando.S, Antezana,2013). They are the principal causes of death in all developed countries accounting for 50% of all deaths and are also emerging as a prominent public health problem in developing countries, ranking third with nearly 16% of all deaths. They have already become the first cause of death in countries such as Argentina, Chile, Cuba, Singapore, Sri Lanka and Uruguay (Fernando, 2013).

The latest estimate from the World Health Organization (WHO,2011) shows of the 57 million deaths that occurred in the world in 2008, 36 million (63%) were the result of non-communicable diseases. Four-fifth of these deaths were in low and middle-income countries, and 29% were in people under 60 years of age compared with 13% in high-income countries. Without intervention, deaths from non-communicable diseases are set to increase by 15% between 2010 and 2020, according to WHO predictions, with the biggest increases occurring in the African, Eastern Mediterranean, and South East Asian regions (Richard *et al.*, 2012).

Hypertension has become in recent times of growing public health concern in developing countries. Remarkable successes achieved in under nutrition and infectious disease control within the last century has produced a sharp decline in infant mortality, as a result of which

expectancies have increased considerably. However, non-communicable diseases replaced infectious diseases as the major causes of morbidity (Perpetua, 2003).

Ethiopia's population pyramid shows that of most developing countries with very low proportion of aged persons: proportion of the young population under age 15 has declined from 49.82% in 1984 to 45.0% in 2007. Conversely, proportion of the population in the working age group 15-64 has increased from 50.2 % in 1984 to 51.9 % in 1994. Furthermore, 16% of its 73.9 million people live in urban areas (CSA, 2007).

Little is known about the incidence and risk factors of CVDs among residents of Bahir Dar town and the surrounding area. However, recent surveys indicate that hypertension and stroke are increasing partly because of the increase in risk factors including smoking, obesity, and use of alcohol and lack of exercise (Awoke Misganaw *et al*, 2014). This study aimed to assess the incidence and potential risk factors of cardiovascular diseases among patients who visited Felege Hiwot Referral Hospital (FHRH), Bahir Dar from September 2014 to June 2017 for better understanding of the extent of the disease in this part of the country.

1.2. Research questions

- What are the extent of CVD incidence in Felege Hiwot Referral Hospital between 2014 and 2017?
- Is there sex, age and residences variation in incidence of CVDs?
- What are the potential causes and risk factors of CVDs in the studied sample group?
- What are the available treatment options and challenges at FHRH?

2. OBJECTIVES

2.1 General Objective

- To assess the incidence of CVDs and risk factors among patients who visited in FHRH between 2014 and 2017.

2.2 Specific Objectives

- To determine the incidence of hypertension, heart disease and stroke in the last four consecutive years.
- To identify variations in incidence of CVDs among the age and sex groups.
- To identify variations in incidence of CVDs among urban and rural residents.
- To identify potential risk factors associated with CVDs.
- To document the treatment options and challenges in the Hospital.

3. LITERATURE REVIEW

3.1 Overview of cardiovascular diseases

Cardio-Vascular Diseases (CVDs) are one of the main causes of mortality among the non-communicable diseases. Of an estimated 58 million deaths globally from all causes in 2005, cardiovascular disease (CVD) accounted for 30%. This proportion is equal to that due to infectious diseases, nutritional deficiencies, and maternal and perinatal conditions combined (WHO,2005). It is important to recognize that a substantial proportion of these deaths (46%) were of people under 70 years of age, in the more productive period of life; in addition, 79% of the disease burden attributed to cardiovascular disease is in this age group (WHO,2002}

Between 2006 and 2015, deaths due to noncommunicable diseases (half of which will be due to cardiovascular disease) are expected to increase by 17%, while deaths from infectious diseases, nutritional deficiencies, and maternal and perinatal conditions combined are projected to decline by 3% (WHO ,2002). Almost half the disease burden in low- and middle-income countries is already due to noncommunicable diseases (Lopez. AD et al ., 2006).

3.2 Types of cardiovascular diseases

Cardiovascular diseases are a class of diseases that involve the heart or blood vessels. CVD include all diseases of the heart and blood vessels which are classified according to the International Classification of Diseases as Chronic rheumatic heart disease; Hypertension and Hypertensive heart disease; Ischemic heart disease; and other forms of heart diseases such as cardiomyopathies, arrhythmias, valvular heart diseases (Iung *et al.*, 2003). Below the three types of CVDs (hypertension, heart disease and stroke) that are the focuses of this study are described.

3.2.1 Hypertension

Hypertension is a public health problem and a term used to describe high blood pressure. It is a condition that occurs as a result of repeatedly elevated blood pressure exceeding 140 / 90 mmHg, (systolic/ diastolic). Normal blood pressure is below 120/80; readings between 120/80 and 139/89 are called pre-hypertension. Systolic blood pressure is the pressure in the arteries as the heart contracts and pumps blood forward into the arteries whereas diastolic represents pressure as a result to relaxing of the arteries after contraction (Zareian, 2004; Cunha, 2011). Hypertension has been called a silent killer as it is usually without symptoms. Hypertension takes a long time before diagnosed thereby causing major health problems as stroke and other

cardiovascular diseases. Damage to organs including the brain, heart, kidneys and eye and so on are the long term effects of high blood pressure (Cunha and Makx, 2011).

Blood pressure is usually measured with a device called sphygmomanometer. This consist of an inflatable rubber cuff, an air pump and a column of mercury or a digital readout reflecting pressure in an air column as well as electronic blood pressure machines. The readings are widely expressed in millimeters of mercury or mmHg. Diagnosis of high blood pressure is not based on a single reading except when it is extremely high (above 170-180/105-110).

Causes of Hypertension

Hypertension is grouped into two main categories as primary and secondary hypertension.

Stage1 (primary Hypertension) is condition that patients with systolic blood pressure 140-159mmHg or diastolic pressure 90-99mmHg (140//90-159//99mmHg). It can result from multiple factors, including blood plasma volume and activity of the hormones that regulate blood volume and pressure. It is also influenced by environmental factors, such as stress and lack of exercise.

Stage 2 (Secondary Hypertension) is condition that patients with systolic pressure greater than 160mmHg or diastolic blood pressure greater than 100 mmHg (160//100 -180/110mmHg). It has known specific causes and is a complication of another problem. This includes:-

- diabetes, nerve damage and kidney disease,
- congenital adrenal hyperplasia, a disorder of the cortisol-secreting adrenal glands,
- hyperthyroidism or an overactive thyroid gland and
- pregnancy, sleep apnea, obesity, aging, excessive alcohol consuming as well as genetic factors (Cunha, 2011).

A study has showed the presence of high blood pressure mostly amongst adults aged 20-79 (Keaney *et al.*, 2004). Less activity as a result of ageing also causes high blood pressure. Impaired ability of the arteries to expand when blood is pumped can be attributed to hardening of the structural changes in the arteries. Hormonal changes as a result of ageing can as well cause high blood pressure. Changes as decrease in estrogen production, underactive and overactive thyroid can as well influence the rise in blood pressure (Young, 2011). It is known that high

blood pressure usually develops in elderly women after menopause due to hormonal changes (Schofield *et al.*, 1999). However, the occurrence is not a routine part of aging since there are other factors that influence the occurrence (Young, 2011).

Salt is not a major cause of HBP. However, it is a contributing factor especially among salt sensitive persons. Excessive intake of salt accounts greatly to the occurrence of HBP and other cardiovascular diseases. Several studies conducted over the years recommend reduction of salt intake as the key to prevention and control of high blood pressure. A study conducted by (Sacks *et al.*; 2001) confirmed the substantial fall of blood pressure in the Finnish population for the past thirty years due to the decrease of salt intake.

According to a recent study sodium consumption should be 1500mg per day; equivalent to a teaspoon. The maximum level researched not to pose risk for consumption is 2500 mg per day (U.S Department of Health and Human Services, 2005). However, research estimates daily consumption on the average westernized meal as 3000 to 4500mg. This figure accounts twofold of the maximum recommendation (Sacks *et al.*, 2001). New salt labeling regulations were passed by the Ministry of Trade and Industry in conjunction with the Ministry of Social Affairs and Health (STM). This legislation affected all item categories that contributed high salt intake to the average Finnish meal. These included; bread, cheese, butter, sauces and so on. The full implementation of this legislation since 1 June, 1993 contributed remarkably to decreasing high blood pressure. Even though obesity and alcohol consumption have increased, the decrease has contributed to other cardiovascular diseases as well (Statistics on Cardiovascular Diseases, 2003).

Sedentary lifestyle is a medical term used to describe lifestyle with little or no physical activity. Sedentary lifestyle is dangerous to health as smoking. This is due to the fact that it contributes to most deaths as a result from heart diseases. The high growing rate of sedentary lifestyle could be attributed to economic growth, modernization, urbanization as well as globalization treat of unhealthy diet (Puska *et al.*, 2003).

Advances in technology have also reduced level of mobility at work. Most jobs demand sitting behind the desks for long hours during the day. This is followed by long hours of watching

television or playing video games at leisure time. As a result diseases such as HBP are becoming most common (Puska *et al.*; 2003; STM, 2010).

Obesity is one of the causative factors of high blood pressure. Even though genes can put individuals at risk of gaining weight, the balance of energy intake and exercise is an important determinant. It is a major global public health challenge of our times. The prevalence of overweight and obesity has increased significantly over the past three decades and concerns about the health risks associated with obesity have become nearly universal (Fleming *et al.*.,2014).

Obesity was categorized according to World Health Organization cutoff criteria as : underweight (BMI <18.5 kg m⁻²), normal weight (18.5–24.9 kg m⁻²), overweight (25–29.9 kg m⁻²) and obese (30–34.9 kg m⁻²) (WHO, 2000).

Blood pressure is affected by various activities of the body throughout the day. The heart reacts differently to basic activities of the day such as eating and drinking. High consumption of alcohol has been related to the rise of blood pressure over the years (Mittal and Singh, 2010). This is due to the fact that, the kidney and liver work extra hard in getting rid of waste from the blood stream therefore, more pressure is exerted on the arteries. Excessive alcohol intake can also increase the chance of other medical issues as obesity that may lead to an increase in blood pressure (Bakx *et al.*, 1999).

Arterial Hypertension (AH) is the most common cardiovascular disease and is a major public health problem in both developed and developing countries. Arterial hypertension produces a marked effect on patients, relatives and society, either because of hypertension through its complications (stroke, heart attack, ischemic heart disease, renal dysfunction and heart failure) which can produce premature death or permanent disability. The risk of developing a cardiovascular complication is higher when the individual combines hypertension with other risk factors such as hypercholesterolemia/dyslipidemia or smoking. It is known that more than 95% of hypertensive patients in the community are of essential or idiopathic/unknown origin and only a small percentage have an identifiable cause (secondary hypertension). Epidemiological evidence shows that there are several factors which play an important role in the development, evolution and prognosis of arterial hypertension, some of them non-modifiable, such as age, sex,

ethnicity and heredity, and others modifiable, such as body weight, alcohol intake and sedentary life style (Fernando, 2013).

It has been suggested that the prevalence of cardiovascular diseases and hypertension was increasing rapidly in sub-Saharan Africa. The current prevalence in many developing countries, particularly in urban societies, was said to be already as high as those seen in developed countries (Juliet *et al.*, 2007).

Hypertension gradually increases during adult life and gets highest in old age populations. A study in Skaraborg (Sweden) showed that the prevalence of hypertension was 20% in both men and women with a steep increase by age (Janet *et al.*, 2010). Some studies have reported degrees of sex variation in the prevalence of hypertension. A Study conducted in Vietnam showed men were often more hypertensive than women (Van *et al.*, 2006).

Data from different national and regional surveys showed that hypertension is common in developing countries, particularly in urban areas, and awareness, treatment, and control are low. Several hypertension risk factors seem to be more common in developing countries than in developed regions. Findings from surveys show an increasing prevalence of hypertension in developing countries, possibly caused by urbanization, ageing of population, changes in dietary habits, and social stress. High illiteracy rates, poor access to health facilities, bad dietary habits, poverty, and high costs of drugs contribute to poor blood pressure control, (Mohsen and Albertino, 2012).

3.2.2 Heart disease

The term 'heart disease' is often used interchangeably with the term 'cardiovascular disease'. Cardiovascular disease generally refers to conditions that involve narrowed or block blood vessel that can lead to heart attack, chest pain (angina) or strokes. Many forms of heart disease can be prevented or treated with healthy lifestyle. There are different forms of heart diseases such as coronary heart disease, valvular heart disease, arrhythmia, cardiomyopathy, rheumatic heart disease which lead to heart failure. Heart failure is one of the most common complications of heart disease. It is a chronic disease characterized by the inability of the heart to pump an adequate amount of blood to achieve the demand of the different organ systems (American Heart Association, 2006).

Heart failure is not a disease in itself but a syndrome with an underlying cause. It has been defined as a syndrome in which the patients should have the following features, typically shortness of breath at rest or during exertion, and/or fatigue; signs of fluid retention such as pulmonary congestion or ankle swelling, and objective evidence of an abnormality of the structure or function of the heart at rest (Dickstein et al., 2008).

Heart failure is a major public health problem worldwide. The available data suggest that while the morbidity due to heart failure is great in many parts of the world, the etiologies differ, (Khatibzadeh *et al.*, 2012). The most common underlying cause of heart failure in high-income countries is coronary artery disease (Schocken *et al.*, 2008). In sub-Saharan Africa, the predominant causes have traditionally been ascribed to rheumatic heart disease, hypertensive heart disease and cardiomyopathy (Amoah and Kallen, 2000). The prevalence of heart failure is estimated at 2%-3% of the adult population and increases with age. Over 26 million people suffer from heart failure around the world and over 3.5 million people are newly diagnosed with heart failure every year in Europe alone. The long-term prognosis associated with heart failure is worse than that associated with the majority of cancers, with 50% mortality after 4 years. Patients suffer disabling symptoms that often become refractory to treatment and need hospitalization, having the greatest negative impact on quality of life compared with other chronic conditions. The cost of medical care in billions of dollars (José, 2011). Recent data from the sub-Saharan African Survey of Heart Failure underscore the significant contribution of hypertension (Damasceno *et al.*, 2012).

The origin of heart failure in the majority of patients is ischemic heart disease which includes pectoral (chest muscle and breast muscle pain) (Mosterd, and Hoes, 2007). Other major causes of heart diseases are hypertension, valve disease, high alcohol intake and arrhythmias. Coronary heart disease. For some patients the etiology of their heart failure remains unknown the prevalence of heart failure is from 1-2 % in developed countries with higher numbers with age. The prevalence of heart failure is reaching about 10% in patients over 70 years of age (Agvall *et al.*, 2005; Stålhammar *et al.*, 2012). The two common types of heart failure:-

Diastolic heart failure: contractility of the cardiac muscle is intact or increased, however, the relaxing phase of the cardiac cycle is impaired. The prevalence of diastolic heart failure

increases with age. Diastolic heart failure may be seen in 40 to 80 % of older patients with heart failure and is almost twice as frequent in women as men. The patho-physiology is primarily attributed to left ventricular (LV) diastolic dysfunction (a leftward and upward shifted end diastolic pressure-volume relationship), in which left ventricular diastolic chamber size is normal or reduced despite elevated filling pressure resulting in decreased stroke volume and cardiac output (Iung et al., 2003).

Systolic heart failure: describes the decrease in the heart muscle's ability to contract and pump blood against the systemic vascular resistance, which usually is increased. Coronary artery disease (CAD) is the predominant cause of heart failure in general and systolic dysfunction, in particular, accounting for 60 to 75% of all cases in industrialized countries (Wang TJ, *et al.*, 2003). Other etiologies include non-ischemic idiopathic cardiomyopathy, valvular heart disease, myocarditis, alcohol, and drugs. Rheumatic fever remains a leading cause of heart failure in Africa and Asia, particularly in the young population (Wang TJ, *et al.*, 2003).

The relation of systolic to diastolic heart failure is clearly shifted towards diastolic heart failure in elderly patients, especially in women. Mortality is increased with systolic dysfunction in elderly patients compared to younger heart failure patients. Mortality is less with diastolic dysfunction, but still higher compared to elderly without heart failure. In addition, morbidity is increased both with diastolic and systolic heart failure in elderly patients (Ali .Mohamed, 2015).

The treatment and prevention of heart failure has become increasing public health problem reaching epidemic levels especially for the elderly population. There are more than 20 million people affected worldwide and has a prevalence of 2% in developed countries (Yamani and Massie, 1990). According to the American Heart Association, 5.3 million Americans have congestive heart failure (CHF), 660,000 new cases are diagnosed yearly, with aminoacids approaching 10 per 1000 population among persons older than 65 years of age (Center for Disease Control and Prevention, 2004).

Valvular heart disease (NHD) is type of heart valve diseases continue to be an important cause of morbidity and mortality across the globe with an increasing number of elderly patients being affected by degenerative valvular disease. Although there are no recent population-based data regarding the prevalence of valvular heart diseases. Aortic stenosis and ischemic mitral regurgitation are the most common valvular disorders in the elderly, (Kanel and Belanger, 1991; Munt et al., 1998; Tribouilloy et al, 1998). In contrast to the developed nations, where valvular disease is largely degenerative in origin, in Africa it is almost always the result of infectious diseases, either directly as in infective endocarditis, or indirectly as in rheumatic heart diseases (Otto et al.,1996).

Rheumatic heart disease (RHD) is heart disease continues to be relatively common in many parts of Africa, predominantly affecting young people. However, most elderly grow with relative insignificance in RHD acquired during childhood. Various autopsy studies have demonstrated a 2.5%-5.0% incidence of rheumatic mitral valve involvement in older patients (Schneider and Guralink,1990). About two-third of patients with rheumatic mitral disease have regurgitation. Combination of regurgitation and stenosis is fairly common, along with approximately 75% prevalence of pulmonary hypertension. This pattern is particularly common in women (Schneider and Guralink, 1990).

Coronary heart disease (CHD) is disease of blood vessels supplying the heart muscle. Coronary heart disease is the leading killer of older people in developed countries (Murray, 1996). The prevalence and severity of atherosclerotic CHD increases with age in men and women (Murray, 1996).

It is associated with increased short-term and long-term mortality (Passik, 1987). In sub-Saharan Africa, the prevalence of coronary heart disease is steadily increasing although there are variations in reported prevalence rates within the different regions. Patients are more likely to have adverse outcomes associated with acute coronary syndrome (ACS). When compared to younger patients with acute heart disease, elderly patients are more likely to have medical and cardiac co-morbidities and atypical symptoms complicating initial diagnosis (Passik, 1987).

Arrhythmias are irregular heartbeats that cause significant mortality and impairment of quality of life in humans. The prevalence of cardiac arrhythmias and disorders of impulse formation and conduction increase with age (Dare et al., 1993). Common arrhythmias including atrial fibrillation (AF), sinoatrial node (SAN) dysfunction, atrial flutter, and ventricular fibrillation (VF) continue affect growth (Julias et al., 1997). In clinical practice, the most frequent arrhythmia is atrial fibrillation. It is the most common sustained cardiac arrhythmia and increases in prevalence with age (Orejarena et al., 1998).

Other types of arrhythmia are supraventricular, atrial-ventricular modulate -entry tachycardia and paroxysmal supra-ventricular tachycardia which are the commonest arrhythmias in the elderly (Kannel *et al.*, 1982). Among patients who present with supra-ventricular tachycardia (SVT), approximately 10% will have atrial flutter. Ventricular arrhythmias are common in healthy elderly people but are not of clinical importance or adversely prognostic (Baine *et al.*, 2001).

Cardiomyopathies are diseases of heart muscle. In 1995 WHO/International Society and Federation of Cardiology (ISFC) Task Force defined and classified cardiomyopathies into dilated cardiomyopathy, hypertrophic cardiomyopathy (HCM), restrictive cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy and unclassified cardiomyopathies (Granada et al., 2004).

Hypertrophic cardiomyopathy (HCM) is a familial cardiac disease. It is recognized in Africans and other populations as an autosomal dominant disorder that is caused by mutations in at least 11 different genes that code for sarcomere proteins. Most HCM-causing mutations have arisen independently in most families studied, suggesting that the majority occurred relatively recently as new mutations (Lindroos *et al.*, 1993). This finding predicts that HCM is likely to be evenly distributed among different populations worldwide.

3.2.3 Stroke

Stroke is a condition that can generally be understood as a form of “brain attack” in which continuous supply of blood to an area of the brain is interrupted. As a result, brain cells are deprived of oxygen and begin to die, affecting the functions controlled by that part of the brain such as memory and muscle control that could be severely impaired. The effect of stroke to a person may be of varying degrees depending on the area of the brain where the stroke has occurred and the magnitude of the brain damage caused. For example, someone who has merely suffered a minor stroke may only experience temporary weakness of the arm or leg, whereas, people who have suffered a major stroke may be permanently paralyzed on one side of their body or lose their ability to speak. While it is possible to completely recover from stroke, it has been observed that more than two third of stroke survivors end up with a certain form of disability (WHO, 2014).

Stroke can be classified into two types: Ischemic stroke and Hemorrhagic stroke. Ischemic stroke occurs when a vessel carrying blood to the brain is blocked due to a blood clot (thrombosis or embolism). When blood flow to the brain is stopped temporarily, patients may begin to experience stroke like symptoms which are medically referred to as Transient Ischemic Attack (TIA). Depending on the severity of the ischemia, infarction cellular death is likely to occur within minutes, causing irreversible damage even after blood flow is restored. This is called the “core” of the infarction. Surrounding the core is tissue that is affected functionally due to diminished circulation but may recover if blood flow is restored. This is called “ischemic penumbra”. It is estimated that 50-70% of survivors of ischemic stroke may recover functional independence three months after onset, yet 20% may require institutional care (National Stroke Association, 2017; Mozaffarian *et al.*, 2015).

Ischaemic stroke can be further subcategorized as atherosclerotic ischaemic stroke and embolic ischemic stroke. Atherosclerotic ischemic stroke is common among elderly persons, in which 80% of cases occur without warning. Embolic ischemic stroke, on the other hand, is more frequent in patients with atrial fibrillation, myocardial infarction, prosthetic valves, rheumatic heart diseases and large artery atheroma (Mozaffarian *et al.* 2013; National Stroke Association, 2017).

Hemorrhagic stroke occurs when hemorrhage with arteries in the brain or a weakened blood vessel leak (hemorrhage) occurs in the brain. Hemorrhagic stroke may be of two types, one resulting from intra cerebral hemorrhage secondary to hypertension, cerebral amyloid angiopathy, or degenerative artery disease. The other type may be secondary to subarachnoid hemorrhages caused by rupture of an aneurysm. Most intra cerebral hemorrhagic stroke may develop within 30-90 minutes with varied symptoms depending on the extent and location of the hemorrhage. These symptoms may include vomiting, aggressive, and headache. Large hemorrhages may cause stupor or coma. Other occasional symptoms may include paralysis of limb, difficulty in speaking, visual impairment or sudden unexplained headaches (National Stroke Association, 2013).

The effects of a stroke depend on which part of the brain is injured and how severely it is affected. Stroke survivors are often confronted with adaption challenges long after discharge from the hospital or rehabilitation wards. Suddenly, individuals become aware of the significant impact of stroke in their lives, both physical and psychological. (Simeone *et al.*, 2015).

Depending on the site and size of the lesion, stroke may cause hemiplegia, weakness, perceptual dysfunction, disturbance of vision and/or speech, and loss of control of the bowel and bladder. It may also result in personality and intellectual challenges, ranging from difficulty in controlling emotions and lack of self-confidence. The severity of the disabilities, stress, depression, cognitive impairment and reduced quality of life as an aftermath of stroke remains a main day to day challenge in the life of many stroke survivors (Feigin, V.L., Lawes, C.M and Bennett, D.A., 2009).

3.3. Epidemiology of cardiovascular diseases

Cardiovascular diseases are the most frequently diagnosed and the leading causes of death in both men and women especially in old age (Mbewu, 1998). CVD pathologies such as hypertension, cardiomyopathies, coronary artery disease, arrhythmia, and heart failure, increase in incidence with increasing age. Globally, mortality due to CVDs (mainly coronary heart disease, stroke, and rheumatic heart disease) was projected to increase from 14.4 million in 1990 to 17.5 million in 2005 and to about 20 million (30% of global deaths) by 2015 (WHO, 2005). It is anticipated that by 2030, non-communicable diseases will contribute more than 75 % of deaths

worldwide and CVDs alone will account for more deaths in low-resource countries than infectious diseases.

Cardio vascular disease mortality rates are estimated to be higher in low and middle income countries compared to developed countries. For example, age-standardized mortality rates for CVDs are over 500 per 100,000 in Russia and Egypt; between 400 and 450 for South Africa, India and Saudi Arabia, in contrast it is between 100 and 200 per 100,000 for Australia, Japan, France and the USA (WHO, 2009). It has been reported that CVDs are the second leading causes of disability among Americans during old age. More than 80 % of all deaths attributable to cardiovascular diseases occur in people older than 65 years with approximately 60 % of deaths in patients older than 75 years (CDC, 2003). A study done in Kenya by (Ludenyio *et al.*, 1991), at Kenyatta National Hospital found that 202 patients over 60 years of age were admitted in medical wards because of cardiovascular problems. This formed 7% of the total medical admissions. One hundred and forty six (73%) were between 60 and 75 years of age with only 26 (13%) being over 85 years (Ludenyio and Mcligeyoso, 1997).

3.4. Risk factors for cardiovascular diseases

There are several risk factors for CVDs: age, gender, tobacco use, physical inactivity, excessive alcohol consumption, unhealthy diet, obesity, genetic predisposition and family history of CVDs, and raised blood pressure (hypertension), raised blood sugar (diabetes mellitus), raised blood cholesterol (hyperlipidemia), undiagnosed celiac disease, psychosocial factors, poverty and low educational status, and air pollution, (José, 2011 and Ali *et al.*, 2015). While the individual contribution of each risk factor varies between different communities or ethnic groups the overall contribution of these risk factors is very consistent (Khatibzadeh *et al.*, 2018). Some of these risk factors, such as age, gender or family history/genetic predisposition, are unmodifiable; however, many important cardiovascular risk factors are modifiable by lifestyle change, social change, drug treatment (for example control of hypertension, hyperlipidemia, and diabetes) (Schocken *et al.*, 2008). People with obesity are at increased risk of atherosclerosis of the coronary arteries (Amoah and Kallen, 2000).

3.4.1. Genetics, age and sex

Genetic factors influence the development of CVDs. Cardiovascular disease in a person's parent's increases their risk by 3 fold (Damasceno, 2012). Multiple single nucleotide polymorphisms (SNP) have been found to be associated with CVDs in genetic association studies (Rich and Mensah, 2009) but usually their individual influence is small, and genetic contributions to cardiovascular diseases are poorly understood (CDC, 2003). *e*

Age is by far the most important risk factor in developing CVDs, with approximately a tripling of risk with each decade of life (Schocken *et al.*, 2008). Coronary fatty streaks can begin to form in adolescence. It is estimated that 82 % of people who die of coronary heart disease are 65 years and older. At the same time, the risk of stroke doubles every decade after age 55 (Hall and Frances, 2001).

Multiple explanations have been proposed to explain why age increases the risk of CVDs. One of them is related to serum cholesterol level (Ni, 2003). In most populations, the serum total cholesterol level increases as age increases. In men, this increase levels off around age 45 to 50 years. In women, the increase continues sharply until age 60 to 65 years. It is also associated with changes in the mechanical and structural properties of the vascular wall, which leads to the loss of arterial elasticity and reduced arterial compliance and may subsequently lead to coronary artery disease (NHLB, 1996).

Men are at greater risk of CVDs than pre-menopausal Women. (Zile and Brutsaert, 2003). Once past menopause, it has been argued that a woman's risk is similar to a man's, although more recent data from the WHO and UN disputes this (Iung *et al.*, 2003). If a female has diabetes, she is more likely to develop heart disease than a male with diabetes (Ni, 2003). Among men and women, there are notable differences in body weight, height, body fat distribution, heart rate, stroke volume, and arterial compliance (Zile and Brutsaert, 2003). In the elderly, age-related large artery pulsatility and stiffness is more pronounced among women than men. This may be caused by women's smaller body size and arterial dimensions which are independent of menopause (Zile and Brutsaert, 2003).

In a study done by the WHO, sex contributes to approximately 40% of the variation in sex ratios of coronary heart disease mortality (Aronow and Kronzon, 2007). Another study reports similar results showing that gender differences explain nearly half the risk associated with cardiovascular diseases. One of the proposed explanations for gender differences in cardiovascular diseases is hormonal difference (NHLB, 1996). Among women, estrogen is the predominant sex hormone. Estrogen may have protective effects on glucose metabolism and hemostatic system, and may have direct effect in improving endothelial cell function. The production of estrogen decreases after menopause, and this may change the female lipid metabolism toward a more atherogenic form by decreasing the High –density lipoprotein (HDL) cholesterol level while increasing low-density lipoprotein(LDL) and total cholesterol levels (NHLB, 1996).

3.4.2. Tobacco, physical inactivity and diet

Cigarette is the major form of smoked tobacco. Risks to health from tobacco use result not only from direct consumption of tobacco, but also from exposure to second-hand smoke. Approximately 10% of CVDS are attributed to smoking; however, people who quit smoking by age 30 have almost as low a risk of death as never smokers (Munt, 1999).

Insufficient physical activity (defined as less than 5 x 30 minutes of moderate activity per week, or less than 3 x 20 minutes of vigorous activity per week) is currently the fourth leading risk factor for mortality worldwide (Richard *et al.*, 2012). In 2008, 31.3% of adults aged 15 or older (28.2% men and 34.4% women) were insufficiently physically active. The risk of ischemic heart disease and diabetes mellitus is reduced by almost a third in adults who participate in 150 minutes of moderate physical activity each week or equivalent (Kanel and Belanger, 1991). In addition, physical activity assists weight loss and improves blood glucose control, blood pressure, and lipid profile and insulin sensitivity. These effects may, at least in part, explain its cardiovascular benefits (Richard *et al.*, 2012).

High dietary intakes of saturated fat, trans-fats and salt, and low intake of fruits, vegetables and fish are linked to cardiovascular risk, although whether all these associations are a cause is disputed. The WHO attributes approximately 1.7 million deaths worldwide to low fruit and vegetable consumption (Richard *et al.*, 2012). The amount of dietary salt consumed is also an

important determinant of blood pressure levels and overall cardiovascular risk. Frequent consumption of high-energy foods, such as processed foods that are high in fats and sugars, promotes obesity and may increase cardiovascular risk (Richard *et al.*, 2012). A coherence review found that replacing saturated fat with polyunsaturated fat (plant based oils) reduced CVD risk. Cutting down on saturated fat reduced risk of cardiovascular disease by 17% including heart disease and stroke. High cholesterol intake has adverse effects on blood lipids and circulating inflammatory markers and elimination of trans-fat from diets has been widely advocated (Schneider and Guralink, 1990). There is evidence that higher consumption of sugar is associated with higher blood pressure and unfavorable blood lipids, and sugar intake also increases the risk of diabetes mellitus (Otto, 1980). High consumption of processed meats is associated with an increased risk of CVDs, possibly in part due to increased dietary salt intake (Dare *et al.*, 1993).

The relationship between alcohol consumption and CVDs are complex, and may depend on the amount of alcohol consumed. There is a direct relationship between high levels of alcohol consumption and risk of CVDs (Julias, 1997). Drinking at low levels without episodes of heavy drinking may be associated with a reduced risk of CVDs. Overall alcohol consumption at the population level is associated with multiple health risks that exceed any potential benefits (Clarke, 1996). There are beneficial relationships with Coronary heart disease, stroke and diabetes mellitus, provided low-to moderate average volume of consumption is combined with non-binge patterns of drinking (WHO, 2002). Worldwide, alcohol causes 3.2% of deaths (1.8 million). This proportion is much higher in males (5.6% of deaths) than females (0.6%).

3.5. Other Determinants of CVDs

Socio-economic status of individuals indirectly influences cardiovascular health as well as health in general. These determinants shape a set of socioeconomic positions within hierarchies of power, prestige and access to resources. Several structural mechanisms are responsible for creating the differential social positions of individuals, including governance, education systems, labor market structures and the presence or absence of these can affect individual's health status as well as CVD outcomes by impacting behavioral and metabolic cardiovascular risk factors, psychosocial status, living conditions and the health system (WHO, 2010).

CVDs are also driven by the negative effects of unregulated globalization and unplanned urbanization (Mathenge *et al.*, 2010 and Vorster, 2002). For example, irresponsible marketing supported by multinational food co-operations are targeting children and adolescents to promote consumption of “junk” food with high levels of energy, fat and salt.(WHO/ FAO,2002).

3.6. Challenges of Cardiovascular Disease Prevention

The clinical condition of major CVDs are often different. For example, the signs of an infraction are severe chest pain in a young person while the elderly experience stomach ache, nausea and vomiting. A typical chest pain is more common in elderly compared to young (Sliwa *et al.*, 2005). Similarly Shortness of breath is more common in the elderly than young patients (Lewis and Maron, 1994).While CVD mortality in many richer countries has substantially decreased over the last few decades, CVD death rates in poorer countries are already higher and are rising (Feigin *et al.*, 2009). CVD modeling from developed countries suggests that great reductions in mortality resulted from improving the cardiovascular disease rheumatic fever (CVDRF) distribution in the population or enabling higher proportions of the population to receive evidence-based treatments (Ford *et al.*, 2011). The actual benefits would double if all eligible CVDRF patients could receive appropriate therapies at the right time (Capewell *et al.*, 2009).

Favorable changes in CVD such as smoking cessation and aggressive treatment of metabolic CVD almost halved mortality, separately from earlier diagnosis and lifesaving treatment (Ford *et al.*, 2000). Three very cost-effective interventions in primary care are tobacco control, salt reduction and a multidrug strategy to treat people who are at high CVD risk (Malan *et al.*, 2008). Recently, more evidence emphasized the importance and effectiveness of interventions to tackle unhealthy diets, physical inactivity and obesity as well as policy-level solutions to create favorable healthy environments (Leeman, 2012).

Lessons and successful experiences from chronic HIV/AIDS epidemics can be usefully applied to the prevention and control of CVDs (Narayan *et al.*, 2011). Good surveillance systems for CVD is crucial for measuring the magnitude and costs of proteins and, identifying vulnerable groups, and evaluating intervention effects (Narayan *et al.*, 2011). Low-cost detection approaches should be linked to cost-effective prevention and treatment that efficiently integrate behavioral and biomedical approaches or public health and health care resources (Narayan *et al.*, 2011; Rabkin *et al.*, 2011). As in HIV/AIDS, besides the individual behavioral interventions and

societal policies for healthier lifestyles, which mainly affected the most motivated adopters, it is critical to integrate low-cost biomedical interventions into CVDs prevention as a complementary part of a holistic approach (Narayan *et al.*, 2011; Dabhadkar *et al.*, 2011).

In many low and middle income countries, the existing healthcare systems are challenged by the lack of resources, the low priority of CVDs in systems geared towards acute and infectious care, and the lack of an integrated infrastructure involving communities, health services and local institutions (Julian, 1983).

4. MATERIALS AND METHODS

4.1 Description of the study area

The study was conducted at Felege Hiwot Referral Hospital in Bahir Dar City, which is the capital City of Amhara National Regional State (ANRS) .

Bahir Dar is located 578 km far away from Addis Ababa (11°36' N and 37°23' E) and has an elevation of 1840 m above sea level. The area of the city is about 160 km² and according to population and housing census conducted by the Central Statistical Agency of Ethiopia, the city has a total population of 256,999 (CAS, 2011).

4.2. Data Collection

Secondary data will be collected from medical records of patients for the period of September 2014 - June 2017. Information on sex, age, residence (urban or rural), types of CVDs, potential risk factors such as substance abuse, stress, diet, physical inactive of patients was extracted from the medical records. A total of 4140 medical records of CVD cases (hypertension, heart disease and stroke) were examined for this purpose. However, information on smoking, consumption of excess alcohol, unhealthy diet and stress was available only for 2491 patients.

Oral interview will be conducted with a medical doctor, Dr Zemenay Bitew and two nurses , Sintayehu Mekonen and Agumas Dagneu to get information on the general treatment options and challenges. The data collection was carried between December 2017 and April 2018.

Permission to access medical records of patients was obtained from the Research Center of FH RH. Data extraction from the medical records were conducted with the help of three assistants from the record staff.

4.3. Data analysis

The compiled data will be coded, entered in to computer and analyzed using SPSS software version 20. The descriptive data was analyzed by standard techniques such as frequency distribution, Proportion and percentage. Result will be calculated based on 95% confidence Interval (p=0.05). Chi-square (χ^2) test was performed to verify the possible association between cardiovascular diseases (hypertension, heart disease and stroke) with variation of sex, age, gender, resident of patients' and associated risk factors in four consecutive. Values were considered as significant when p-value is less than or equal to 0.05. Results were presented in tables, graphs and interpretations of findings made as possible

5. RESULTS

5.1. overall incidence of cardiovascular diseases

Cardiovascular diseases are a huge public health problem in terms of burden on health care facilities, accounting to the increasing percentage of outpatient consultation in most health facilities in different regions in Ethiopia . As mentioned in the table below, the secondary data collected from Felege hiwot referral hospital showed that the overall prevalence of CVD was 11,662 (7.9%) between 2014 to 2017 in relation to other diseases. Based on this data CVD was becoming highly incidence from year to year, the reason may be the life standard of the people that is feeding habit, lack of doing physical exercise, smoking cigarette .

Among 11,662 cases of CVDS patients , 4140 (35.5%) cases of CVD only (hypertension,heart disease and stroke) were recorded, of which 2435 (20.9%%) were hypertension ,heart disease 1019 (8.7%) and 686 (5.9 %) were stroke patients between 2014 to 2017 (Table 1).

Diseases/Years E.C.	2006	2007	2008	2009
Hypertension	284	601	732	818
Heart failure	140	214	291	375
Stroke	87	118	196	282
Total	511	933	1219	1475

Table 1 Overall prevalence of some of the cardiovascular diseases in four consecutive years (2014- 2017) at Felegehiwot referral hospital, Bahir Dar.

5.1.1. Incidence of hypertension by age

A total of 2435 case hypertension diseases are a huge public health problem in terms of burden on health care facilities, accounting to the increasing percentage of outpatient consultation in most health facilities in different regions in Ethiopia.. Based on this data CVD was becoming highly prevalent from year to year, the reason may be the life standard of the of hypertension were recorded, of which 1338 (54.9%) were Stage 2 hypertension and 1097 (45.1%) were stage 1 hypertension. Among the age groups, patients older than 65 years constituted the highest numbers (n=1342; 55 %) followed by the 46-65 age group (n=818; 33.6%). The variation in the number of Stage 1 and Stage 2 hypertension cases was statistically significant (p =0.002) (Table 2).

Table 2 Incidence of stages of hypertension among different age groups at FHRH (2014 - 2017).

Age groups	Stage 1 hypertension (%)*	Stage 2 hypertension (%) **	Total
<5 years	None	None	None
6-15 years	None	None	None
16-45 years	189 (7.8%)	86 (3.5%)	275 (11.3%)
46-65 years	496 (20.4%)	322 (13.2%)	818 (33.6 %)
>65 years	412 (16.9%)	930 (38.2%)	1342(55.1%)
Total	1097 (45.1%)	1338 (54.9%)	2435(100%)

* Systolic blood pressure of 140-159 mmHg or diastolic pressure 90-99 mmHg (140/90-159/99 mmHg) after three consecutive measurements of stroke volume

** Systolic pressure greater than 160 mmHg or diastolic blood pressure greater than 100 mmHg (160/100 -180/110 mmHg).

5.1.2. Gender-wise incidence of hypertension

Out of 2435 cases of hypertension, 1375 (56.5) were males while 1060 (43.5%) were females (Table 2). The difference was statistically significant (p=0.000) (Table 3).

Table 3. Gender-wise incidence of hypertension at FHRH (2014-2017)

Sex	Number of patients
Male	1375 (56.5%)
Female	1060 (43.5%)
Total	2435

5.1.3. Annual trends of incidence hypertension (2014-2017)

The hypertension incidence showed continuous increase from 2014 to 2017 from 344 cases in 2014 to 903 in 2017. The annual difference in the number of hypertension cases was statistically significant ($p=0.021$) (Fig 1).

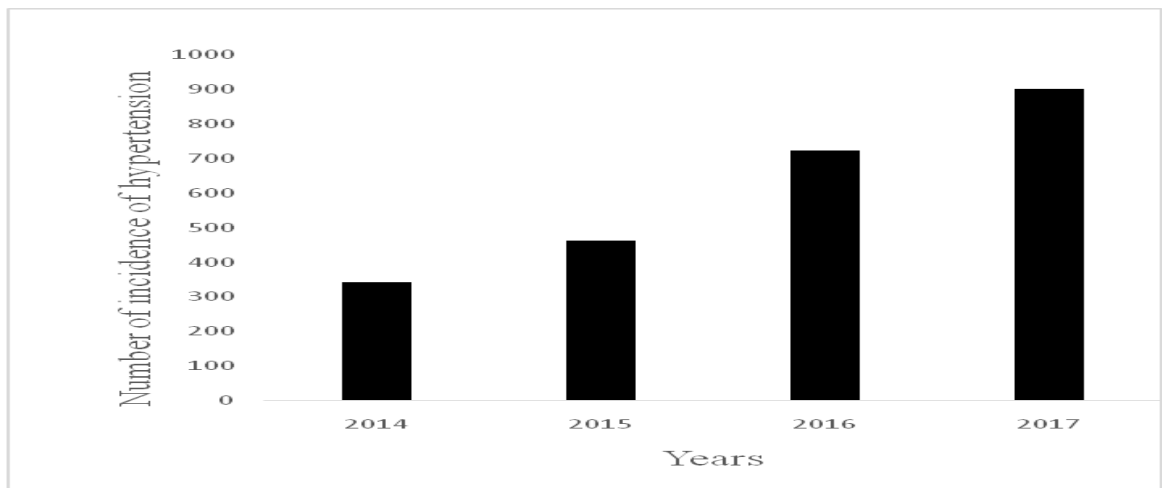


Figure 1. Incidences of hypertension in four consecutive years at FHRH (2014 -2017)

5.1.4. Variation of incidence among urban and rural inhabitants

The majority of hypertension cases were recorded among urban inhabitants ($n=1867$; 76.7%). (Table 4). And the difference was statistically significant ($p=0.000$).

Table 4 Variation of incidence of hypertension among urban and rural inhabitants at FHRH (2014-2017)

Locality	Incidence				Total
	2014	2015	2016	2017	
Rural	98 (4.02%)	136 (5.6%)	154 (6.3%)	180 (7.4%)	568 (23.3%)
Urban	281 (11.5%)	362 (14.9%)	504 (20.7%)	720 (29.6%)	1867 (76.7%)
Total	379 (15.5%)	498 (20.5%)	658 (27%)	900 (37%)	2435

5.2. Heart Disease

5.2.1. Incidence by age groups and types of heart disease

A total of 1019 (8.7 %) cases of heart diseases were recorded. Valvular heart disease (n=267; 26.2%), rheumatic heart diseases (n=241; 23.7%) and arrhythmia (n=227; 22.3%) were the three most common types of heart diseases recorded (Table 4). The variation in incidence of the five types of heart diseases observed at FHRH was statistically significant (p=0.013) (Table 4) All types of heart diseases were observed in each age category except rheumatic heart diseases which was not recorded in the age group of <5 years (Table 4). The highest number of heart disease cases were observed in the oldest age group (>65 years; n=464; 45.5%) followed by 46-65 years of age (n=302; 29.6%). Only 0.9% (n=10) of the cases were observed in the <5 years age category. There were statistically significant difference between age groups (p=0.032). Valvular heart disease was the common diseases among older age groups (>65 years) while arrhythmia was more incidence in the 6-15 years age group (Table 5).

Table 5 Incidence of heart diseases among different age groups at Felege hiwot referral hospital (2014 -2017)

Age group	Rheumatic heart disease	Cardio Myopathy	Arrhythmias	Coronary heart disease	Valvular heart disease	Total
<5 Years	None	3 (0.3%)	3 (0.3%)	2 (0.2%)	2 (0.2%)	10 (0.9%)
6-15 Years	11 (1.1%)	13 (1.3%)	22 (2.2%)	19 (1.9%)	7 (7%)	72 (7.1%)
16-45 years	33 (3.2%)	31 (3.0%)	37 (3.6%)	24 (2.4%)	46 (4.5%)	171(16.8%)
46-65 years	79 (7.8%)	42 (4.1%)	59 (5.8%)	34 (3.3%)	88 (8.6%)	302 (29.6%)
>65 Years	118 (11.6%)	50 (4.9%)	106 (10.4%)	66 (6.5%)	124 (12.2%)	464 (45.5%)
Total	241 (23.7%)	139 (13.6)	227 (22.3)	145 (14.2)	267 (26.2)	1019

5.2.2. Gender wise incidence of heart disease

The number of male and female heart patients was nearly the same and the statistical analysis showed no significant difference ($p=0.347$) between males and females (Table 6).

Table 6 .Incidence of heart diseases among males and females at FHRH

Sex	Number of patients
M	506 (49.7%)
F	513 (50.3%)
Total	1019

5.2.3. Incidence of heart diseases in the four consecutive years (2014 -2017)

Similar to hypertension, incidence of heart diseases also showed continuous increase between 2014 and 2017 from 148 to 420 cases with a statistically significant difference ($p=0.04$). The increase was observed for all types of heart diseases. However, arrhythmias showed a decrease between 2014 and 2016 before increasing in 2017 (Fig.2).

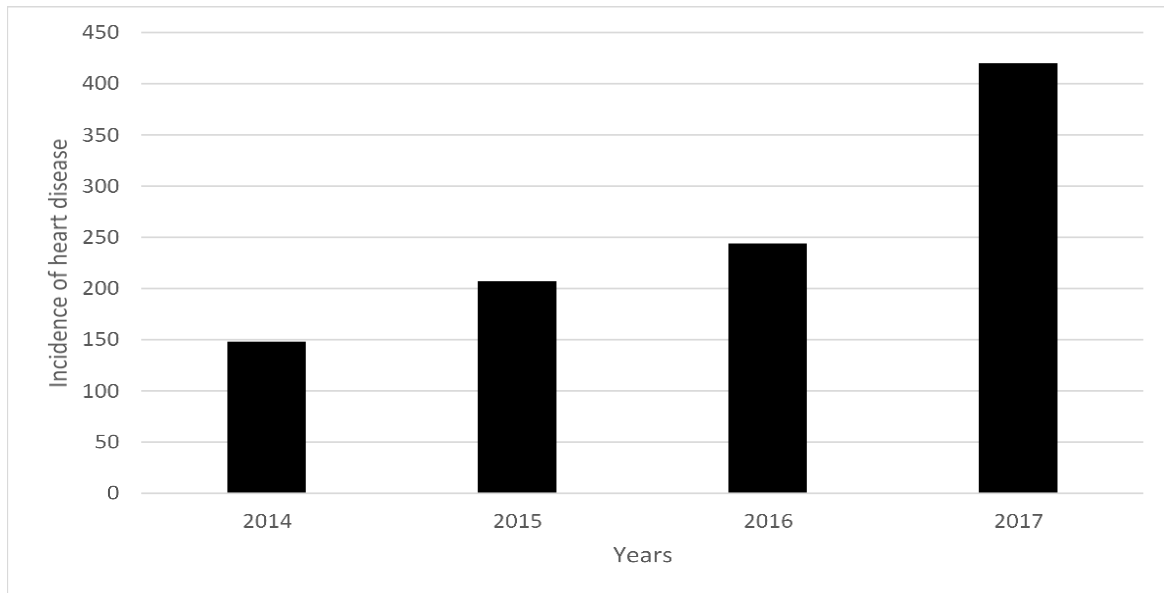


Figure 2 Annual trends of incidence heart disease (2014 to 2017)

5.2.4. Variation of incidence among urban and rural inhabitants

The majority of the heart disease patients were urban residents ($n=668$; 65.6%). However, the difference in the incidence of heart disease in urban and rural residents was not statistically significant ($p=0.07$) (Table 7).

Table 7. Variation of incidence of heart diseases among urban and rural residents who visited FHRH (2014 -2017)

Residence	Incidence				Total
	2014	2015	2016	2017	
Urban	81 (7.9%)	131(12.9%)	159 (15.6%)	297 (29.1%)	668 (65.6%)
Rural	56 (5.5%)	85 (8.3%)	89 (8.7%)	121 (11.9%)	351(34.4%)
Total	137 (13.4)	216 (21.2)	248 (24.4)	418 (41%)	1019

5.3. Stroke

5.3.1. Incidence

The total number of recorded stroke cases were 686 (5.9 %). Stroke incidence showed similar pattern as hypertension and heart disease with higher numbers among older people. No incidence of stroke was observed in the age group <5 years in FHRH.. In addition, only ischemic stroke was observed in the age group 6-15 years. Most of the observed stroke was that of the ischemic type (n=547; 79.7%) compared to hemorrhagic stroke (n=139; 20.3%) and this was statistically significant (p=0.03) (Table 8).

Table 8 Incidence of stroke among different age groups at FHRH (2014 -2017)

Age group	Ischemic stroke (%)	Hemorrhagic stroke (%)	Total
<5 years	None	None	None
6-15 years	6 (9%)	None	6 (0.9%)
16-45 years	41 (5.9%)	3 (0.4%)	44(6.4%)
46-65 years	184 (26.8%)	28 (4.1%)	212 (30.9%)
>65 years	316 (46.1%)	108 (15.7%)	424 (61.8%)
Total	547 (79.7)	139 (20.3)	686

5.3.2. Gender-wise variation of stroke

The stroke incidence between males and females was quite similar and there was no statistically significant difference (p=0.117) (Table 9).

Table 9 . Gender-wise incidence of stroke at FHRH (2014-2017)

Sex	Number of patients
M	346 (50.4%)
F	340 (49.6%)
Total	686

5.3.3. Annual trends of incidence stroke (2014-2017)

The incidence of stroke also showed continuous increase between 2014 and 2017 from 91 cases in 2014 to 248 cases in 2017. The statistical analysis showed significant difference between 2014 and 2017 ($p=0.001$) (Fig 3).

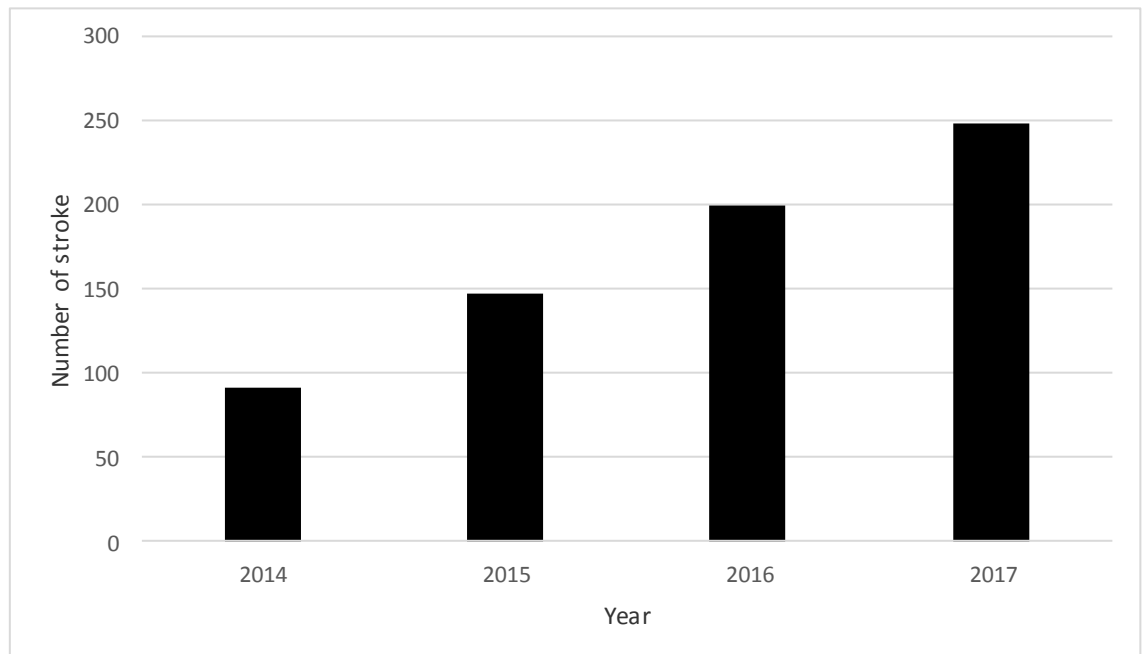


Figure 3. Incidences of stroke in four consecutive years at FHRH (2014--2017)

5.3.4. Variation of incidence among urban and rural inhabitants

The stroke incidence was also more common in urban residents ($n=444$; 64.7%) compared to rural ones ($n=242$; 35.3%). However, this difference was not statistically significant ($p=0.644$) (Table 10).

Table 10. Variation of stroke incidence among urban and rural inhabitants at FHRH (2014-2017)

Locality	Incidence				Total
	2014	2015	2016	2017	
Rural	29 (4.2%)	54 (7.9%)	68 (9.9%)	91(13.3%)	242 (35.3%)
Urban	62 (9.0%)	93 (13.6%)	132 (19.2)	157 (22.9%)	444 (64.7%)
Total	91(13.3)	147 (21.4%)	200 (29.2)	248 (36.2)	686

5.4. Association of incidence with patients' background

5.4.1. Risk Factors and the presences of Hypertension, Heart disease and Stroke Hypertension

Most of the hypertension patients were alcoholic (n=449; 44.6%). Similarly, for heart diseases and stroke, the number of alcoholic patients was higher than those categorized under other risk factors (Table 11). The data showed that unhealthy dietary habit was a contributing factor more to hypertension and heart diseases than stroke. On the other hand, stress contributed more to stroke than hypertension and heart diseases. Smoking contributed more to heart disease compared to hypertension and stroke. The contribution of each of the four risk factors (smoking, alcoholism, unhealthy diet and stress) was statistically significant for hypertension (p=0.00) but not for heart diseases (p=0.053) and stroke (0.174) (Table 11).

Table 11 Associations between potential risk factors and the presences of hypertension, heart disease and stroke at FHRH (n=2491)

Characteristics	Total	Smoking (%)	Alcoholism (%)	Unhealthy diet (%)	Stress (%)
Hypertension	1007	161 (16%)	449 (44.6)	294 (29.2)	103 (10.2%)
Heart disease	811	227 (28%)	252 (31%)	221 (27.3%)	111 (13.7%)
Stroke	673	143 (21.2%)	264 (39.2)	34 (5.1%)	232 (34.5%)
Total	2491	531(21.1%)	965(38.7%)	549 (22%)	446 (17.9%)

5.5. Results from interview of doctors and nurses

5.5.1. Treatment of hypertension

According to information obtained from the medical doctors and nurses the stage 1 (primary) hypertension was treated by changing lifestyle and behavior of patients. The patients treated themselves by taking balanced diet, avoiding intake of excess alcohol, lowering salt intake, doing regular exercise and loss of weight for those who are overweight or obese.

The medical doctors replied, first they carry out some blood and urine tests, and ask questions about the patients' health to determine patients' risk of other problems such as diabetes, and kidney diseases. Whether medication is recommended depends on blood pressure reading and risk of developing problems such as heart attacks or strokes.

- If the patient's blood pressure is consistently above 140/90mmHg and the risk of other problems is low, the medical doctors only gave advice to make some changes to patients' lifestyle.
- If patients' blood pressure is consistently above 140/90mmHg and patients risk of other problems is high, the doctors prescribe medication to lower the blood pressure, in addition to lifestyle changes.
- If patients' blood pressure is consistently above 160/100mmHg, medication is prescribed to lower the blood pressure.

Types of medication for hypertension: According to information obtained from the medical doctor and nurses, hypertensive patients were prescribed anti-hypertension drugs (diuretics) to remove excess water and sodium (salt) from the body in the form of urine and control blood pressure. They said that, there are two groups of diuretic drugs which are used in combination with additional prescription therapies.

- **Thiazide diuretics:** chlorthalidone, chlorothiazide, hydrochlorothiazide, metolazone etc.
- **Potassium-sparing diuretics:** amiloride hydrochloride, spironolactone triamterene etc In addition to removing excess water and salt and these drugs also control the level of potassium in the body fluid (blood).

5.5.2 Heart disease treatment

According to information obtained from doctors and nurses, the first hand treatment of any type of heart disease is changing of patients' life style and control the potential risk factors of heart diseases.

They gave medical advice to patients to:-

- Modify daily activities and get enough rest to avoid stressing the heart
- Eat a heart-healthy diet that is low in sodium and fat.
- Avoid smoke and avoid exposure to second-hand smoke
- Limit intake of alcohol and salt.
- Lose weight
- Avoid or limit caffeine intake
- Get regular exercise and reduce stress.

When they faced serious form of heart disease like heart failure, they prescribed different medications for the patients. Most heart disease patients take more than one drugs.

Medications may be prescribed to:

- Dilate blood vessels
- Strengthen the heart's pumping action
- Reduce water and sodium in the body to lessen the heart's workload.

Heart disease medicines: The main types of heart disease medicines prescribed at FHRH are:

- ACE (angiotensin-converting enzyme) inhibitors.
- Beta blockers.
- Aldosterone antagonists.
- Digoxin and Diuretic.

5.5.3 Stroke treatment

The medical doctors said 80% of strokes are preventable if the patients reached at the hospitals at early stage of the diseases when initial signs such as sudden weakness of the face, arm or leg, most often on one side of the body are manifested.

The medical doctors said limiting brain damage is the primary treatment goal for hemorrhagic stroke. Monitoring blood pressure and draining blood from the brain to reduce swelling and prevent damage are two priorities.

According the information from the medical doctors, most patients were cured completely and they can restart many of their usual activities once they go home from the hospital. But some of them who have strokes were partially paralyzed and they continue to need help with some tasks; others become completely paralyzed or lose the ability to speak, and lose their vision.

Medications of stroke: According to information obtained from doctors and nurses, the main challenge of treatment of stroke at FHRH was that the patients could not come to the hospital as soon as they feel the sign of the disease. Most of the time they reach the hospital after they get into a coma.

6. DISCUSSION

The present study assessed the incidence of the three major CVDs (hypertension, heart disease, and stroke) and associated risk factors in four consecutive years from 2014 to 2017 at FHRH. The study showed a continuous annual increase in the incidence of hypertension, heart disease and stroke. This might be due to intakes of saturated fat, high salt and low intake of fruits, vegetables and fish (Richard et al.,2012).

From 4140 CVD patients, 2435 (20.9%) were cases of hypertension, 1019 (8.7%) heart disease and the rest 686 (5.9%) were stroke cases. In contrast, a study in the capital city; Addis Ababa adults an estimated 25 % of all household deaths between 2006 and 2009 and 11 % prevalence of CVDs all hospital deaths between 2002 and 2010 (WHO,2001).

. In the current study, the proportion of elderly patients was the highest which was also supported by a study conducted in Kenya (Richard, 2012).

In the present study, urban community hypertension incidence was higher compared to the rural incidences. The same result was reported by in Harrer Ras Tefferi Hospital (Blahos and Kubastova, 1993). In a rural community with sampled outpatient visits, an estimated 0.5% hypertension prevalence was found among adults aged 15 years and above in Oromia Region (Pauletto *et al.*,1994). In Addis Ababa, hypertension prevalence ranged from 4.1% among adult workers in 1984 to 30% among a sampled population in 2009 (Fikiru Tesfaye and Byass, 2009). In the regions, hypertension prevalence accounted for about 10% in the Southern Nations, Nationalities, and Peoples Region (SNNPR) in 2011, and 1.8% in the rural Amhara populations in the mid-1980s. This implies that cardiovascular diseases become highly increased.

The incidence of hypertension in this study population is low (20.9%) compared to a community-based study conducted in Gondar with the prevalence of 28.3 % (Akilew Awoke *et al.*, 2012). In a study conducted at Gilgel Gibe Field Research Center,it was reported that the specific observed hypertension prevalence was 2.6% (Ayalew Tegegne, 2012). A study in Eritrea reported that the prevalence of hypertension in the general population was 16% (Mufunda *et al.*, 2006).

Regarding to sex the incidence of hypertension is higher in males (56.5%) than females (43.5%). There was statistically significant difference of hypertension incidence between males and

females in the study area. This is consistent with some reports from many studies on hypertension in different parts of the world, like study done in Vietnam (Pauletto *et al.*, 1994) and Tanzania (Njelekela *et al.*, 2009). On the other hand, in Kenya prevalence of hypertension was reported to be significantly higher in women than in men (21.2% vs. 17.4%) (Steven, 2010).

The association of age with hypertension is visible in all studies. A significant increase in the incidence of hypertension with age for both male and female was observed in this study. The result that is shown in Table 1, indicates that the highest incidence of hypertension particularly that of Type 2 was observed among older people than younger ones. This result is similar with the study conducted by Martins *et al.* (2001). Similarly, the current study was in line with the study conducted in Sub sabaharan African slum (Agyemang *et al.*, 2006; Damasceno *et al.*, 2009; Njelekela *et al.*, 2009). This implies, age is a strong cardiovascular risk factor for hypertension.

In case of residence, the community from urban 1867 (76.7%) areas were more susceptible to hypertension than rural 568 (23.3%). Similar result was reported in South Africa by Mayosi and coworkers (2009).

Challenges that were faced during treatment of hypertension at FHRH include: medical doctors said that even though anti hypertension drugs are widely available, the patients don't take their medications according to the prescribed doses due to a variety of factors such as negligence and concerns of side effects such as hypotension (low blood pressure).

In the current study, the major determinants of cardiovascular diseases were alcohol abuse, smoking ,unhealthy diet and stress. Similar with the study conducted in steel Factors in Akaki,Addis Ababa (Birhane Guchiye, 2014).

Poor access and utilization of health services together with absence of health insurance scheme is a challenge for hypertension prevention and control in both rural and urban Ethiopia.

The current study reveals that the occurrence of heart disease among male and female was almost equal. Heart disease incidence also increased with age. This implies that no significant difference between sex but significant increase with age. The occurrence of heart disease among male and female with 36.7% and 63.3% were reported in Addis Ababa respectively (Sonia Tole,

2015). On the other hand, the present study was different from the study conducted in South Africa Seweto for heart failure; 22% for females and the rest 78% for males (Howard and Shireman, 2005).

Regarding to age, all age groups were affected. But ages above 45 were the most affected group. Similar result was reported in Cameroon at St. Elizabeth Catholic General Hospital where case were above 65 years (Howard and Shireman, 2005). Study in the US showed 80% of men and 70% of women under age 65 were diagnosed with heart failure (Krumholz *et al.*, 1997). On the other hand, various observation compared to studies from other parts of the world; heart failure in Africa tends to occur at a much younger age. This might be due to in a sedentary life style and chronic disease inappropriate early treatment and prevention of predisposing factors in developing country (Steyn and Damasceno,2006).

In present study valvular stenosis, rheumatic heart disease and arrhythmic heart disease were the most dominant types of heart disease in the study area. Cardiomyopathy was the least observed type of heart disease.

Concerning residence, 668 (65.6%) of the heart patients were from urban area whereas the rest 351(34.4%) were from rural community. This was similar to what was reported by Leslie and coworkers(2012) where more than 55% of the patients were urban residents.

In the case of stroke incidence, there was similarity in males 346 (50.4%) and females 340 (49.6%). Older people were more affected than young ones. The present study was also in line with the study conducted in Cuba (Otma and Co workers, 2016). Most patients had Ischemic stroke (79%) and the rest (21%) had the Hemorrhage type.

In the current study the percentage of patients who smoked cigarettes (16%) among the hypertension patients recorded was much lower than reported in Mauritius (35.9%) (Ministry of Health and Quality of Life, 2006) and Nepal (Bunna Bahndari *et al.*, 2014). The differences may partly be due to different age groups of the participants in the surveys. The current study participants included all age groups. In contrast study conducted in Akaki steel factory excluded those younger than 18 years (Birhane Guchiye, 2014). .

7. CONCLUSION AND RECOMMENDATION

7.1 CONCLUSION

The finding revealed that, CVDs are common in the population of Bahir Dar and the surrounding area who visited the hospital. The data also suggests that prevalence could increase in the nearby future. The study showed incidence of CVDs was significantly high among older people than the young. Gender wise; males have higher rates of susceptibility to hypertension than females but heart disease and stroke were almost similar in both sexes. Age is observed to be the strongest determinant of CVD prevalence. Incidence of hypertension and heart diseases was higher among the urban residents who visited the hospital of Bahir Dar than rural communities. But stroke is nearly the same in both communities. The present study showed, smoking, drinking alcohol, unhealthy diet and stress as the potential risk factors for the occurrence of hypertension and heart diseases but might be small contributors for stroke. In FHRH, stress was main risk factor of stroke.

7.2. RECOMMENDATION

Based on the results of this study the following recommendations are suggested: In the present study, the main challenges in the treatment of CVDs were patients' complacency in properly taking their prescribed medications and the delayance in the arrival of patients who suffered stroke. In addition, several controllable risk factors such as smoking, drinking, and unhealthy diet were observed in the patients admitted for CVD treatment. Thus, strong community education programs on these and related subjects should be conducted by concerned parties, governmental and non governmental healthcares as well as emergency services specially ambulance should be available to help those who suffer sudden stroke or heart attacks.

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Appendix. 1. Checklist of semistructured oral interview items for Felege Hiwot Referral Hospital Doctor and Nurses.

Oral interview prepared to collect information about General option of treatment, challenge, types and side effect of drugs of cardiovascular diseases of the patients who visited at Felege hiwot referral hospital. This research is done in partial fulfillment of the requirements for the degree of masters of Science in Biology, Addis Ababa University.

Dear respondents, the main purpose of this study is to identify the option of treatment, Challenge of treatment and side effects of drugs of major cardiovascular diseases among the patients who visited Felege hiwot referral hospital .Therefore, I kindly request you to give genuine response for each question.

1. What are the factors for the occurrence of hypertension?
2. What do you advise to the community to treat hypertension?
3. What do you prescribe drugs for Hypertension patients?
 - a) Stage 1 hypertension
 - b) Stage 2 hypertension
4. What are the different causes of heart disease?
5. What do you advise for people to prevent heart disease?
6. What do you prescribe for heart disease medicines?
7. What are the diagnostic techniques for heart failure?
8. What do you advise to our community to prevent stroke?
9. What are the treatment option and diagnosis techniques for stroke disease?
10. What do you prescribe drugs for Stroke patients?
 - a) Ischemic types of stroke
 - b) Hemorrhagic type of stroke
11. What is the most effective proven medical approaches to stroke prevention?
12. What are challenges of treatment of CVDs

Declaration

I undersigned; declare that the thesis comprises my own work. In compliance with initially accepted practices, I have duly acknowledge and referenced all materials used in this work. I understand the non-adherence to the principle of academic honesty and integrity. Misrepresentation /fabrication of any data/ date/ fact/ source will constitute sufficient ground for disciplinary action by the university and can also evoke penal action from the source which have not been cited or acknowledge.

This work has been done under my supervision

Name...

Signature-----

Date-----

Name: -----

signature-----

date-----