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TRENDS OF CARDIOVASCULAR DISEASE MORTALITY IN GHANA: A CASE STUDY OF MORTALITY CASES AT KORLE BU TEACHING HOSPITAL

BY

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ACCEPTANCE

Accepted by the Faculty of Social Science, University of Ghana, Legon, in partial fulfillment of the requirements for the degree of MPHIL (Population Studies).

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DECLARATION

I, Olutobi Adekunle Sanuade, hereby declare that this work is the result of my own research undertaken under supervision except for references made to other people's work and which have been duly acknowledged. Also, this work has neither in part nor whole been presented for another degree elsewhere.

Signed……

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Date …….

DEDICATION

This thesis is dedicated to all the members of my family who have always been there for me.

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ABSTRACT

Globally, more people die from cardiovascular diseases (CVDs) annually than from any other cause (WHO, 2011). In Ghana, CVDs accounted for one of the top three causes of death in 2010 after diarrhoeal and HIV/AIDS. Despite this, Ghana has no effective surveillance system in place to monitor the disease. Although hospital data may partly help in monitoring the mortality from the disease, most of these data are not analysed and interpreted. The goal of the study was to examine the trend in CVD mortality among autopsy cases from Korle Bu Teaching Hospital (KBTH), from 2006 to 2010. All cardiovascular deaths diagnosed at autopsy in the 5-year period from the beginning of January 2006 to the end of December 2010 located in the autopsy logbooks of the Department of Pathology, KBTH, were analysed for this study. The study showed that a total of 20,706 autopsy cases were done at KBTH within the five-year period. Out of this, 1,417 cases were incomplete and hence, a total of 19,289 cases were used in the analysis. The results showed that CVDs constituted about one-fifth of all causes of deaths from autopsy cases at KBTH within the 5-year period. Also, the findings show that females had higher odds of death from CVDs compared to males. Congestive heart failure was a major cause of CVDs deaths and it had the highest contribution to the years of potential life lost (YPLL) to CVDs. Therefore, there is need for population-based surveillance system put in place to monitor CVDs mortality and effort should be made at ensuring that developing policies for the disease is not based on mere extrapolations but on actual data.

Key words: Cardiovascular diseases, Autopsy, KBTH, Years of potential life lost, Surveillance

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

The global burden of cardiovascular diseases (CVDs) both in developed and developing countries has been increasing overtime. At the beginning of the 20th century, CVDs accounted for less than 10 percent of all deaths worldwide. By the start of the 21st century, it was responsible for about 30 percent of all deaths globally while more than 80 percent occurred in low- and middle- income countries (Gaziano, et al., 2005). Just as CVDs has been the leading cause of death in the developed countries since the mid-1900s, it is also fast becoming the leading cause of death in developing countries. This is coupled with the fact that death from infectious diseases is still significant in these countries thereby causing this part of the world to experience a double burden of infectious and chronic diseases.

In the past four decades, Africa has witnessed increasing urbanization and changing lifestyles and this has been associated with an increase in the incidence and prevalence of cardiovascular diseases. Studies have shown that the global burden of the disease occurs in developing countries with sub-Saharan Africa being seriously hard-hit due to social disintegration and inequality that is compounded by the dwindling economy in the region. Cardiovascular disease was believed to be the disease of the wealthy (developed countries) but sub-Saharan Africa is now recently seen to be living with the disease of the wealthy without the wealth (Gaziano et al., 2005). Also, medical experts have shown that most of these diseases are preventable if people adopt appropriate behaviours like healthy diets, physical activities, non-use of tobacco, low salt, sugar

and fat in-takes, etc. However, the increased rate of urbanization and globalization in the region has predisposed people in many of the countries in the region to adopting unhealthy lifestyles.

Ghana is said to have gone through epidemiological and nutritional transitions since the colonial period up to the post adjustment period with each period marked by changing phase of disease. According to Agyei-Mensah et al (2010), there was a co-existence of infectious and non-communicable diseases during the colonial period (1877-1957). They contend that the coexistence of infectious communicable diseases and chronic non-communicable diseases had been recorded at Korle Bu as early as the 1920s with stroke cases assuming importance as causes of disability and death. At this period, medical doctors also observed the interrelationship between infections and chronic diseases by linking chronic heart disease to common infections. Records on causes of death in the 1950s showed the co-existence of both infectious diseases and chronic non-communicable diseases as causes of death (Pobee, 2006; Agyei-Mensah et al., 2010).

Furthermore, in the post-colonial period (1957-1982), Ghana inherited the colonial health infrastructure that was mainly curative and a public health approach that was limited to control of major outbreaks of epidemic diseases such as smallpox and yellow fever (Addae, 1996; Agye-Mensah et al., 2010). In this period, the public health concern was still limited to prevention of communicable diseases while little or no attention was given to chronic non-communicable diseases. During the post-adjustment period (1983-2007), the country had become more urbanized with an accompanying increase in urban poverty. This, in addition to the effect of globalization, increased out-of-home meals which led to structurally mediated and sedentary

lifestyle shift that has in turn escalated the rising prevalence of lifestyle diseases such as hypertension, diabetes and obesity (De-Graft., 2007; Agyei-Mensah et al., 2010). Currently, the interplay of these factors in the country has made CVDs one of the top three causes of death in the country (WHO, 2010).

It is amazing that despite the increase in the prevalence of CVDs in Ghana, there is no effective population-based surveillance system put in place to monitor the disease. Also, the Ghana Demographic and Health Survey (GDHS) gather data on infectious diseases without much provision for CVD and its risk factors. However, without epidemiologic surveillance of the CVDs, making meaningful policies in addressing the diseases becomes difficult. Since there is no effective national surveillance of CVDs mortality in Ghana, estimating the hospital trends of the disease mortality becomes very important because it will give a fair estimate of what is probably going on in the population in terms of mortality. Using autopsy cases at Korle Bu Teaching Hospital, this study is therefore set out to examine the trend in CVDs mortality from 2006 to 2010.

1.2 Problem Statement

Globally, more people die from cardiovascular diseases annually than from any other cause (WHO, 2011). In other words, cardiovascular disease is a major chronic disease and it is the number one killer in the world. In 2002, there was a total death of 16.7 million deaths due to cardiovascular diseases worldwide and these accounted for about one-third (30.3 percent) of all deaths worldwide. Also, more than half of these deaths occurred in developing countries (WHO, 2002). In 2008, an estimated 17.3 million people died of CVDs representing 30% of all global

deaths. Of these deaths, 7.3 million were due to coronary heart disease and 6.2 million were due to stroke. Also, by 2020, studies indicate that mortality by CVDs is expected to increase by 120% for women and 137% for men while by 2030, almost 23.6 million people will die from CVDs, mainly from heart disease and stroke (Yach et al., 2004; BeLue et al., 2009; WHO, 2011).

Cardiovascular diseases contribute to disability, diminished quality of life and greatly increases health care cost (WHO, 2002). For instance, the number of disability adjusted life years (DALYs) lost to CVDs in sub-Saharan Africa rose from 5.3 million for men and 6.3 million for women in 1990 to 6.5 million and 6.9 million in 2000 for men and women respectively (Kadiri, 2005). Although CVDs used to be seen as the disease of the aged and a disease in which one is expected to live with for a long time, the age at which people die of the disease has been coming down and this has serious implications on the active population (Leeder et al., 2004). This indicates that if serious attention is not given to the disease, by the time most of the under fifteen population (which constitutes about 43% of the sub-Saharan Africa's population) move to the working population, the burden of the disease will seriously hit them. This, in the long-run may lower the Gross National Income (GNI) of these nations and their health care budget. This is partly because people that are supposed to work to contribute to health care budget in these nations are being affected by this disease. It is even surprising that despite the burden of the disease in Ghana, there is no provision for it in the millennium development goals (MDGs).

Although both the developed and the developing countries are faced with the problem of CVDs, the burden seems to be higher in the latter due to ineffective health system, lack of adequate

knowledge of the disease's risk factors, irregular screening exercise, spiritual causal theories, poverty, weak government policies, e. t. c (De-Graft et al., 2010). Many people are dying of CVDs; yet, considerable attention has not been paid to monitoring the burden of the disease in the developing countries. More so, although the gross national income (GNI) of developed countries is 25-fold that of developing countries, they devote twice as much of their GNI to health care compared to developing countries (Gaziano et al., 2005). In Africa, considerable efforts have not been put in place to ensure effective health care systems for CVDs (WHO, 2007). In 2007, the WHO developed the health system framework in terms of six core building blocks in order to access the quality of health. These building blocks cover areas of finances, health workforce, information, governance, medical products and technologies, and service delivery. However, assessing African countries by these building blocks, studies show that they are not faring well at all (WHO, 2007).

In Accra, CVDs rose from being the seventh and tenth cause of death in 1953 and 1966 respectively, to number one cause of death in 1991 and 2001 and has been the major cause of mortality in the country since then (Agyemang et al., 2011). Despite all these problems, Ghana has no national policy on CVDs' plan and no effective surveillance system put in place to monitor the disease mortality. More so, the dominant assumption among lay communities and experts in Ghana is that CVDs are rare or do not pose serious public health challenges (de-Graft 2007). Secondly, Ghana's health system is not only structured to address acute communicable diseases, but it is also crippled by inadequate finances and human resources (de-Graft 2007). Also, although the government established the Non-communicable Disease Programme (NCDP) in 1992, charged with developing research and intervention for conditions of public health

significance such as CVDs and other chronic diseases, this programme has been crippled by lack of funds and few biomedical staffs. These problems consequently undermine the ability to address the double burden of communicable and chronic non-communicable diseases in the country. This creates a deep concern on government's commitment to minimize the incidence and the prevalence of the disease in the country if there is no effective surveillance system to monitor the disease. Although hospital records can also help in monitoring the disease, most of the data are not properly documented, analysed or interpreted. From the foregoing, this study intends to address the following questions:

1. What is the pattern of mortality at KBTH from 2006 to 2010?
2. What is the trend in CVDs proportionate mortality ratio (PMR) at Korle Bu Teaching Hospital from 2006 and 2010?
3. What is the pattern of CVDs mortality categories at Korle Bu Teaching Hospital from 2006 to 2010?
4. How many years of potential life are lost due to CVDs from 2006 to 2010 at Korle Bu Teaching Hospital?

1.3 Rationale

Developing effective policy intervention for disease prevention is important in enhancing the health status of any nation. One of the ways of developing appropriate primary, secondary and tertiary preventions is by clear understanding of the health transition taking place in the country. It is important to note that transition is not just any change; it is a change that follows an identifiable pattern which occurs over a relatively long time (Frenk et al., 1991). Health transition thereby refers to an identifiable change in the patterns of the health of the society,

which is noticeable over a relatively long time. This implies that in order to monitor the epidemiologic transition that has taken place in the pattern of a disease, it is necessary to look at the trend of the disease mortality. The process by which an epidemiologic transition can be determined is through a concept called “epidemiological surveillance” which looks at the cause-specific ratio of a disease, the age and sex structure of the people mostly affected in the epidemiologic situation (Frenk et al., 1991). In other words, without epidemiologic surveillance, no effective intervention can take place.

Epidemiologic surveillance has been seen as very important in monitoring the burden of diseases in the population. Although population-based data is mostly suitable for this surveillance, this is not available in sub-Saharan Africa. In Ghana, there are no population-based data available for CVDs mortality patterns due to the absence of a population-based CVDs registry anywhere in the country. Population-based data is mostly suitable for epidemiologic surveillance because it gives a representativeness of the burden of CVDs in a particular country; however, in the absence of this kind of data, hospital records have been seen as one of the ways of monitoring CVDs (Gordis, 2009). The Centers for Disease Control and Prevention (CDC) defined epidemiologic surveillance as the "ongoing systematic collection, analysis, and interpretation of health data essential to the planning, implementation, and evaluation of public health practice closely integrated with the timely dissemination of these data to those who need to know” (Thacker et al., 1988; Gordis, 2009). This indicates that monitoring the trend of a particular disease for appropriate dissemination is a range of process which involves ongoing systematic collection, analysis and interpretation of the data. Without the completion of these processes, developing effective intervention for the disease seems impossible.

Although there have been ongoing collection of mortality cases at Korle Bu Teaching Hospital, there has been no systematic analysis and interpretation of these data. Without analysis and interpretation of these data, no effective policies can be put in place because the government will not know the kind of disease people are dying from. This study intends to fill this gap by analysing and interpreting the causes of death from CVDs using autopsy cases from Korle Bu Teaching Hospital (KBTH) from 2006 to 2010 with the aim of triggering effective primary, secondary and tertiary interventions. In terms of primary prevention, by showing what people are dying of with the age-sex variations, the various stake-holders like Ghana Health Service, Ghana Statistical Service, NGOs, and academics can appropriately direct their interventions on reducing the risk factors of CVDs in Ghana. More so, analysis and interpretation in this study will also help in developing screening exercises on the disease (Secondary prevention).

In relation to the tertiary prevention, the emergence or the growing trend of CVDs normally aggravates pressure on more complex services such as hospitals. This study will help to direct the efforts of medical personnel on the appropriate technologies needed for diagnosis and prolonging the life expectancies of people who are already living with the disease at the hospital. Finally, it is hoped that this study will facilitate systemic analysis of data on CVDs mortality at KBTH and triggers further researches on the disease.

1.4 Objectives

The general objective of this study is to examine the trend of CVDs mortality among autopsy cases at Korle Bu Teaching Hospital (KBTH) from 2006 to 2010.

1.4.1 Specific Objectives

1. To describe the mortality pattern at KBTH (2006 - 2010) by age, sex, and locality.
2. To examine the Proportionate Mortality Ratio (PMR) of CVDs at KBTH from 2006 to 2010.
3. To describe the trend in the categories of CVDs mortality at KBTH from 2006 to 2010.
4. To estimate Years of Potential Life Lost (YPLL) due to CVDs KBTH from 2006 to 2010.

1.5 LITERATURE REVIEW

Cardiovascular diseases are basically referred to as a group of disorders of the heart and blood vessels. There are various types of CVDs and these include: coronary artery disease, heart attack (myocardial infarction), heart failure (congestive heart failure), cerebrovascular disease (stroke), peripheral arterial disease, rheumatic heart disease, congenital heart disease, deep vein thrombosis, pulmonary embolism, etc. Coronary artery disease is a disease of the blood vessels supplying the heart muscle; cerebrovascular disease is a disease of blood vessels supplying the brains; peripheral arterial disease constitutes a disease of blood vessels supplying the arms and legs; rheumatic heart disease causes damage to the heart muscle and heart valves from rheumatic fever, caused by streptococcal bacteria; congenital heart disease basically cause malformations of heart structure existing at birth while deep vein thrombosis and pulmonary embolism cause blood clots in the leg veins which can dislodge and move to the heart and lungs (WHO, 2011).

Out of these categories, cardiomyopathy has been seen as the most prevalent in Africa (Sliwa et al., 2005).

1.5.1 History of Cardiovascular Diseases in Ghana

Before the plague of 1908 and the publication of the Simpson Report, some attention had been paid to public health and medical services. At this period, pipe borne water was one of the colonial government's major contributions to public health in Accra. In 1904, the construction of the Accra waterworks began at Weija (15 km west of Accra) and was completed in 1914. Prior to this time, people had depended on rainwater from rooftop storage tanks or on water from polluted wells as their main sources of drinking water. The introduction of pipe-borne water in 1914 helped reduce the incidence of many water-borne diseases such as guinea worm, typhoid fever, and dysentery which were major causes of death in Ghana at that period (Agyei-Mensah et al., 2010). This implies that the major causes of death in Ghana before the second decade of the 20th century were infectious diseases.

At the beginning of the second decade of the 20th century, Ghana started to witness the co-morbidity of infectious and chronic non communicable diseases. The co-existence of infectious communicable diseases and chronic non-communicable diseases was recorded at Korle Bu as early as the 1920s with stroke cases assuming importance as causes of disability and death. Medical doctors also observed the interrelationship between infections and chronic diseases during this period. For example, chronic heart disease was linked to common infections. More so, records on causes of death in the 1950s showed the co-existence of both infectious

communicable diseases and chronic non-communicable diseases as causes of death in Ghana (Pobee, 2006; Agyei-Mensah et al., 2010).

Furthermore, hospital-based and community-based studies on chronic non-communicable diseases in Ghana increased during the 1950s and 1960s. In the 1960s, thirty-five percent of morbidity cases at the Korle Bu Hospital were due to hypertension. Between 1960 and 1968, strokes accounted for 8 percent of medical admissions and 6 to 10 percent of adult deaths at Korle Bu; hypertension, diabetes, and obesity constituted important associated factors (Agyei-Mensah et al., 2010). By 1972, strokes constituted 10.4 percent of all medical admissions and 21.4 percent of all deaths. Female admissions and deaths (8.6 percent and 24.6 percent respectively) far outnumbered male admissions and deaths (1.8 percent and 20 percent respectively). Cancer cases presented at the hospital especially breast and cervical cancer also increased during this period.

A World Health Organization community-based study begun at Mamprobi, a suburb of Accra, in the 1970s provided the first documented evidence on community-based, cardiovascular diseases' prevalence rates and predisposing factors. The study researchers recorded hypertension prevalence of 13 percent in the community. Two further important trends were recorded: Infections were a common cause of death in the younger age group, while non-communicable chronic diseases were commoner in the older age group. Infections were twice more likely to cause death in low-income groups than in the middle and high-income groups. Also, non-communicable chronic diseases were four times more likely to cause death in the middle and high-income groups compared to the low-income groups at this period (Pobee, 2006).

Between 1987 and 1993, outpatient statistics for Accra show that malaria, diarrhea, parasitic infections, and respiratory infections were among the top ten conditions presented at health centers. Communicable diseases like measles, whooping cough, and tetanus were not among the top ten causes of outpatient morbidity. Possible reasons have been linked to the successful immunization services introduced in the late post-colonial period that had led to considerable reduction in these conditions. The major causes of death in post-adjustment Accra were no longer parasitic and infectious diseases as was the case in the 1950s and 1960s. At the beginning of the 1990s, circulatory diseases became the major causes of death. Twenty-six percent of all male deaths and 24 percent of all female deaths were due to circulatory diseases. Specifically, poor communities were mostly affected by both communicable and circulatory diseases. This reflects the regional evidence of "the double jeopardy of infectious and chronic diseases" experienced by poor communities and supports the "epidemiological polarization" element of the protracted polarized model (Frenk et al., 1991; Agyei-Mensah et al., 2010).

Since the 1970s, researches have shown that wealthy populations face higher risks of chronic diseases and poor communities face higher risks of infectious diseases as well as the double burden of infectious and chronic diseases. In the twenty-first century, cardiovascular disease has become one of the leading causes of morbidity and mortality in Ghana. The trend that has also been seen is that the prevalence and the incidence of the disease cut across the different socio-economic groups as against the situation in the twentieth century. However, the poor are more affected because of their inability to access the health facilities, coupled with the fact that Ghana has no national health policy on chronic disease.

1.5.2 Categories of Cardiovascular Diseases

a. Cerebrovascular diseases/Stroke

Stroke basically takes place in the brain. In other words, if the blood flow to the brain is interrupted, the brain loses its supply of oxygen and nutrients. One of the major reasons for the interruption may be due to the build-up of fatty deposits on the inner walls of the blood vessels which supply the brain. This therefore makes the blood vessels narrower and less flexible (sometimes called 'hardening of the arteries or atherosclerosis) and which make them more likely to get blocked by blood clots. Hence, when this happens, the blood vessels cannot supply blood to the brain and this cause damage to the brain tissue thereby leading to stroke (WHO, 2005). Stroke may technically be referred to as cerebrovascular disease, transient ischemic attack, cerebral haemorrhage or cerebral thrombosis.

According to Murray (1996), stroke constitutes the second leading cause of death in adults worldwide and it contributes significantly to disability and reduced quality of life. For instance, in 2005, an estimated 16 million first-time strokes was reported and 5.8 million stroke deaths which accounted for about 10 percent of all deaths worldwide, that is, about one out of ten deaths in the world are caused by stroke (Strong et al., 2007; Truelsen et al., 2007). In sub-Saharan Africa, community–based studies have shown that stroke is the cause of 5 to 10% of all deaths (Kahn et al., 1999; Walker et al., 2000; Van et al., 2001). In Accra, about 69% of stroke deaths in 2001 occurred in less than 24 hours after the onset of the disease but in Kumasi, about 13% of deaths occurred within 24 hours while most of the deaths occur within 1-7 days (Wiredu et al., 2001; Agyeman et al., 2011). This shows the weak nature of both the primary and secondary prevention mechanism in the country.

According to Agyei-Mensah (2005), there has been widely held misconceptions that stroke is predominantly a disease of the old in high income countries. This is not entirely true. This is because data showed that in 2005, about four out of ten (40%) stroke victims were younger than 70 years and high income countries contributed only 13% of stroke deaths in people of all ages while 6% of the deaths occurred among those that are younger than 70 years (Strong et al., 2007; Truelsen et al., 2007). In addition, the burden of the disease is projected to be greater by the year 2030 unless preventive measures are taken to control the risk factors of the disease. For instance, it is estimated that the stroke burden will increase to 18 million first-ever strokes and 6.5 million deaths in 2015 and to 23 million first-ever strokes and 7.8 million deaths by 2030. This is quite pathetic because stroke is a disease that can be prevented if healthy lifestyle is adopted. Despite all these projections, there are no population-based data in most of the sub-Saharan African countries to monitor the disease and its risk factors. This is why it is important to examine the hospital base mortality of the disease in order to make appropriate interventions. Although, the hospital-based cases may not be externally valid, they will at least give a fair estimate of the disease trend.

In the first study on mortality from cardiovascular diseases in Ghana (The Gold Coast) from 1921 to 1953, seventy three deaths out of 3,645 autopsied cases (2%) were due to stroke (Edington, 1954). More recent data suggest that stroke has become a major cause of morbidity and mortality (Nyame et al., 1994). In a study by Amin in 1984 in a series of 10,720 non-traumatic deaths in Accra from 1972 to 1981, he found the overall incidence of stroke as a cause of death to be 11%. Several studies of the pattern of stroke in Accra have shown that 60% to 90% of strokes are haemorrhagic (Binder, 1961; Nyame, 1998).

b. Myocardial Infarction/Heart Attack

With every heartbeat, the heart pumps blood and it carries oxygen and nutrient to different part of the body. The heart gets oxygen and nutrients through blood vessels called "coronary arteries". However, when the blood that flows to the heart is cut off, there will be decrease in the supply of oxygen and nutrients which can cause a lasting damage to this vital organ. Hence, when the blockage is sudden, this is what is called a heart attack (WHO, 2005). Also, if the blockage is partial while the blood flow to the heart is decreased, this can cause chest pain which is technically called "angina". According to WHO report in 2005, angina may not cause lasting damage to the heart muscle but it is a 'warning sign that a person could develop a major heart attack.

c. Coronary Artery Disease

Since 1990, more people have died from coronary heart disease than from any other cause worldwide (WHO, 2002). The mortality rates from heart attack have variations in different countries in the major risk factors like blood pressure, blood cholesterol, smoking, physical inactivity and unhealthy diet. Although genetic factors also play a part in the cause of the disease, most of the causes of the disease worldwide are due to lifestyles.

The impact of coronary heart disease on the population cannot be over emphasized. According to the WHO report on the 'global burden of coronary heart disease (2002)', disability-adjusted life years (DALYs) lost can be thought of as "healthy years of life lost"-they indicate the total burden of a disease (morbidity), as opposed to simply the resulting deaths (mortality). This shows that this disease triggers morbidity and mortality in the population. Coronary heart disease burden is

projected to rise from around 47 million DALYs globally in 1990 to 82 million DALYs in 2020. Currently, about 3.8 million men and 3.4 million women worldwide die each year from coronary heart disease.

For example, it was reported that in USA, about 1 in 4 men and 1 in 3 women still die within a year of a recognized first heart attack despite increase in the life expectancy (WHO, 2002). However, coronary heart disease is decreasing in many developed countries, but is increasing in developing and transitional countries, partly as a result of increasing longevity, urbanization, and lifestyle changes (WHO, 2002). More than 60% of the global burden of coronary heart disease is said to occur in developing countries. For instance, death rates from coronary heart disease have decreased in North America and many western European countries. This decline has been due to improved prevention, diagnosis, and treatment, in particular reduced cigarette smoking among adults, and lower average levels of blood pressure and blood cholesterol. This implies that primary prevention, secondary prevention and epidemiological surveillance have been effective in developed countries but not in developing countries.

Developing countries lack adequate effort in promoting knowledge on how people can adopt a healthy lifestyle due to factors ranging from economic, social, and cultural to political. This provides a plausible reason why the incidence of the disease has continued to escalate day in day out in this part of the world. Also, due to the weak nature of their health systems, it becomes difficult to provide adequate care for people living with this condition, coupled with both the direct and indirect cost of treating the disease, a lot of mortality still results in low and middle income countries due to coronary heart disease. It is expected that 82% of the future increase in

coronary heart disease mortality will occur in developing countries. More so, of all coronary heart disease patients who die within 28 days after the onset of symptoms, about two-thirds die before reaching the hospital. This highlights, not only the need for early recognition of the warning signs of a heart attack, but also the need for prevention which is in the long run more cost- effective than secondary prevention.

Migration has also been seen as one of the major events responsible for increasing the risk factors of coronary heart disease. In other words, risk of heart attack can change when people migrate to another country. For instance, Japan has a low rate of coronary heart disease, but after moving to the USA, Japanese people have been found to have a gradually increasing risk. This eventually approaches that of people born in the USA. Further work on the effect of migration on the increase in CVD risk factors among Ghanaians is ongoing in a study called "Research on Diabetes among Migrants" (Agyemang, 2012- RODAM STUDY)

d. Rheumatic heart disease (RHD)

This is damage to the heart muscle and heart valves from rheumatic fever, caused by streptococcal bacteria. According to the 2001 estimates, rheumatic heart disease accounts for 338,000 deaths per year and two-third of them occur in Southeast Asia and Western Pacific (WHO, 2002). About 12 million people in developing countries, most of them children, suffer from RHD (WHO 1995). A review of developing countries suggests that rheumatic heart disease prevalence in children is between 0.7 and 14 per 1,000, with the highest rates in Asia. Rheumatic heart disease is seen as one of the most common causes of cardiac disease among children in

developing countries and accounts for almost 10 percent of sudden cardiac deaths (Bradshaw et al., 2003; Gaziano et al., 2005).

e. Congenital heart disease and other cardiovascular diseases

Malformations of heart structures existing at birth may be caused by genetic factors or by adverse exposures during gestation. Examples are holes in the heart, abnormal valves, and abnormal heart chambers. The risk factors are maternal alcohol use, medicines (for example thalidomide, warfarin) used by the expectant mother, maternal infections such as rubella, poor maternal nutrition (low intake of folate), close blood relationship between parents (consanguinity). Tumours of the heart, vascular tumours of the brain, disorders of heart muscle (cardiomyopathy), heart valve diseases, and disorders of the lining of the heart killed about 2.4 million globally in 2002 (WHO, 2002).

f. Deep Vein Thrombosis

A deep vein thrombosis (DVT) is a blood clot in a deep vein. It mainly occurs in the legs and may have no symptoms. The various signs may include pain, swelling, redness, warmness and engorged superficial veins in the leg (National Institute of Health, 2011). Also, studies have shown that approximately half of the people with deep vein thrombosis have no symptoms. This means that signs and symptoms cannot be used to diagnose the disease. Although the risk factors are useful in determining the likelihood of deep vein thrombosis, most of those suspected do not have the disease (Bates et al., 2012). DVT is majorly caused by slow of blood flow in the veins, usually the legs or abnormality in the process by which blood forms clots (Martinelli, 2010; Mitchell, 2007). The strongest risk factor for DVT is age, that is, after aging, blood composition favours clotting. Also, the risk factors do not predict all DVTs because some of the people with

the disease have no risk factor present and many with multiple risk factors never have one (Lijfering et al., 2010).

g. Hypertensive heart disease

Hypertensive heart disease is the cause of death associated with high blood pressure. Basically, it refers to a group of disorders that includes an excessive thickening of the heart muscle. The signs of the disease include: high blood pressure, enlarged heart and irregular heartbeat, fluid in the lungs or lower extremities and unusual heart sounds.

h. Pulmonary Heart disease

Pulmonary heart disease is a heart disease which results from a lung disorder. In other words, it develops when the blood that flows into the lung is slowed or blocked and as a result, this causes an increase in lung pressure. The disease usually arises from the lower extremity deep venous system, but it may also arise from the renal veins, pelvic veins, upper extremities as well as from the right heart. Depending on the size of the embolus (i.e, the size of the blood clots that block the blood vessels), and the site at which it lodges, the clinical consequences may range from minimal to massive saddle embolism with sudden death (Tapson, 2003). The symptoms of the disease include: shortness of breath, shortness of breath on exertion, chest pain, fatigue, weight loss, etc.

1.5.3 Regional Patterns of Cardiovascular Disease Mortality

According to WHO (2007), CVDs constitute the leading cause of death in high, medium and low income countries in 2002 (WHO fact sheet, 2007). This indeed shows that the burden of the disease is great and it is fast becoming an epidemic in the world. In 2002, it was estimated that 16.7 million deaths (29 percent) were due to CVDs and 43 percent of global morbidity and

mortality which is measured in disability-adjusted life years (DALYs) was caused by CVDs (WHO, 2002; Mbewu et al., 2006). More so, about 78 percent of mortality and 86 percent of morbidity from CVDs occurs in developing countries. By 2020, studies have shown that CVDs will account for 73 percent of total global mortality and 56 percent of total morbidity and it will be the leading cause of global health concern (Murray et al., 1996; Reddy et al., 2004; Mbewu et al., 2006). By 2030, it is projected that with the ongoing prevalence of the disease, almost 23.6 million people will die from CVDs (WHO, 2011). As at 2011, the New WHO report Global atlas on cardiovascular disease prevention and control reported that CVDs are the leading cause of death and disability in the world (WHO, 2011). According to the report, although a large proportion of CVDs is preventable, they continue to rise mainly because preventive measures are inadequate.

For instance, since 1940, CVDs has been the number one killer in both the United States and West Virginia (Levy et al., 1998). In the country, CVDs (atherosclerosis and heart failure) is the leading cause of mortality and it accounts for over 40 percent of deaths in those aged 65 years and above (Lakatta, 2002). Also, over 80 percent of all CVDs deaths occur in the same age group. This indicates that age is a major risk factor for CVDs in the United States. As are most chronic illnesses, cardiovascular disease is primarily a disease of aging. It has been projected that the elderly population in the U.S. will increase by 2.6% annually after the baby boomers begin to turn 65years in 2010; by 2020, one in five Americans will be 60 years of age or older. "Disease Incidence and Prevalence in the US," a report published by Medical Data International, estimates a minimum increase in heart disease of 3.4% per year as a result of the graying of America. This

fact in itself is alarming, but even more disturbing is the recent increase in heart mortality among young persons.

According to the results of a study conducted by the U. S. Centers for Disease Control and Prevention (CDC), deaths from cardiac arrest among persons under the age of 35 years increased from 2,710 to 3,000 between 1989 and 1996. More so, of particular concern to researchers are the disparities revealed by the study: the cardiac arrest death rate rose from 19% among African Americans compared to 14% among whites and three times faster among young women than among young men. This increase parallels the increased prevalence of many of the cardiovascular disease risk factors, e.g., smoking, high cholesterol levels, and obesity, among youth as well as adults (Aubert et al., 1998).

Although the United States has witnessed an overall 20 percent decrease in CVDs deaths during the past decade, CVDs still remains the leading cause of death and disability among both males and females and also among all races. This consequently creates enormous cost to everyone. In 2001, the economic cost (i.e., health expenditures and lost productivity) of CVDs in the United States was estimated to be $298.2 billion. More so, in America and West Virginia, coronary heart disease and stroke which are the two main categories of cardiovascular disease are the first and third leading causes of death respectively in the state and nation. They accounted for about one-third (37.8 percent) of total deaths in the United States in 1998 and 39.5 percent of total deaths in West Virginia in 1999.

In 1998, there were 8,088 cardiovascular disease deaths among West Virginia residents, 6,839 due to heart disease and 1,249 to cerebrovascular disease (stroke). Heart disease and stroke together accounted for 39.0 percent of total deaths in the state in that year. About forty-one

percent (40.7%) of deaths among women were due to cardiovascular disease, compared to 37.1% of deaths among men indicating higher deaths among women compared to men in this state. Nationwide, heart disease and stroke were responsible for 37.7% of all deaths in 1998.

Each year, over 1,100,000 Americans have a new or recurrent heart attack and it is estimated that approximately 400,000 will die (Aubert et al.,, 1998). Coronary heart disease (CHD) accounts for approximately half of cardiovascular diseases' deaths and nearly one-fourth (23%) of deaths from all causes. More so, clinical CVD usually manifests in middle or old age; however, atherosclerosis, the underlying process that results in CVD, begins much earlier, often as early as childhood. Atherosclerosis is the gradual build-up of plaque, or fatty deposits, on the inner walls of the arteries, causing the arteries to slowly thicken and restrict blood flow. In addition to narrowing the arteries, these plaques can rupture and form blood clots that can break off and clog a vessel leading to the heart or the brain, resulting in a heart or brain attack. The major advantage enjoyed by people living with CVD in this nation is the good health system that has been put in place which enables those suffering from the disease live longer.

In addition, Gersh et al (2010) reported that autopsy data from Olmsted County, MN, USA, suggest that the mortality trends of CVD are mirrored by adverse trends in the prevalence of risk factors which demonstrate a reversal of the progress made in the 1970s and 80s. A different perspective is provided by the recent experience in Russia which perhaps illustrates the deleterious effects of social upheaval and economic instability upon mortality. Prior to the dissolution of the Soviet Union, longevity in Russian males and females steadily increased, but this was followed by a steep fall in the late 1980s. The explanations are multifactorial, but it is estimated that heart disease and stroke accounted for approximately 65% of the decline in life

expectancy with little change in death rates due to cancer. Incriminating factors include alcohol and tobacco abuse, violence, accidents, and the less tangible effects of psychosocial stress and destabilization. More so, during the 1980s and the 1990s, increases in mortality in St Petersburg Russia were primarily among those with lower levels of education with little change in individuals who had had a university education (Gersh et al., 2010). This indicates that in St Petersburg Russia, level of education may play a significant role in CVD mortality.

Furthermore, cardiovascular disease is an 'equal opportunity attacker' which strike people from different demographic and socio-economic characteristics. However, some groups may be disproportionately affected. For instance, while some may have the wherewithal to manage the disease, others may not. In America, African Americans are significantly more likely to die from cardiovascular disease than whites. Nationally, the heart disease death rate for African American men is 1½ times that for African American women and over twice that for their white male peers, while the death rate for stroke is almost twice as high for African American men as white men and 77% higher in African American women than white women.

In Latin America and the Caribbean, the impact of CVD is also very great. In 2001, CVD accounted for close to one-third (31 percent) of all deaths in region. Also, the figure is expected to rise to about 38 percent by 2020 (Murray et al., 1996). One of the reasons for the increase in the burden of CVD in the region is due to the nutritional transition which has taken place in the region. The region has experienced a switch from vegetables as a source of protein to animal protein and has also seen an increase in fat intake as a percentage of energy. These factors are seen as potential predictors of CVD.

In Australia, according to the Australia Institute of Health and Welfare (2011), despite the fact that cardiovascular disease mortality has been going down in the region since 1960s, it still remains the largest cause of mortality in the country. This in a way shows that CVD still constitute a major threat to the peace of people in this country. In 2000, CVD accounted for about 39% of all deaths (ABS, 2002) and it is one of the largest causes of premature deaths in the country (AIHW & DHAC, 1999; CATI Technical Reference Group, 2003). The two leading causes of death from CVD are ischaemic heart disease and cerebrovascular disease (stroke). In 2000, ischaemic heart disease accounted for 59 percent of men's deaths and 48 percent of women's deaths from CVD. Since 1968, stroke has been the second most common cause of CVD death , accounting for 21% of men's and 28% of women's deaths from CVD in 2000 (ABS 2002). More so, in terms of hospitalization, the Australian Institute of Health and Welfare (AIHW) reported that those hospitalised for stroke have the highest in-hospital mortality (11% of stroke hospitalization). Heart failure (9%) had the next highest rate, followed by peripheral vascular disease (8%), coronary heart disease (3%) and rheumatic fever and rheumatic heart disease (2%) (AIHW 2001a).

In terms of morbidity, in 1998-99, cardiovascular disease was the principal diagnosis for 437,717 hospitalisations in Australia. More than a third (36%) of hospitalisations was attributable to coronary heart disease, 12% to stroke and 10% to heart failure. The average length of stay in hospital for cardiovascular disease has declined since 1993-94 from 7.6 days to 5.5 days in 1998 99 (AIHW 2001a). This variable increases with age and is higher for females (5.8 days) than males, (5.3 days). Furthermore, the number of same-day patients has increased, particularly for coronary heart disease (67%) (AIHW, 2000). Furthermore, the National Health Priority Area (NHPA) 1998 report showed that around 2 percent of Australians are disabled by heart, stroke

and vascular disease. According to the report, among all the cardiovascular conditions, stroke was identified as the most prominent cause of disability in terms of the effect on a person's functioning. More so, stroke was found to disable approximately one-third of all the people living with the condition with some degree of paralysis on one side of the body, difficulty in communicating or a range of other problems that have the potential to affect a person's quality of life and ability to function in society. According to the 1998 ABS Survey of Disability, Ageing and Carers, the rate of disability due to stroke is influenced considerably by age. This is because about 1 percent of the Australian population aged forty-five and over who were classified as disabled with stroke (as primary cause of disability) compared with approximately 6 percent of the population aged 85 and over. From the foregoing, data from selected developed countries indicate that heart failure, stroke and coronary heart disease are the leading causes of deaths in this part of the world.

Although CVD is a threat to both developed and developing countries but it seems the burden of the disease is mostly borne by the developing countries due to many factors ranging from their poor health system to their poverty status. For instance, in the developed countries (high income countries), CVD mortality occur mostly among the aged whereas in the low and middle income countries, it occurs mostly among the middle-aged people and this is why the DALYs will be mostly felt in these regions (Mbewu et al., 2006; WHO, 2007). Furthermore, the burden will be particularly felt in Africa because of the double burden of communicable and chronic non-communicable diseases ravaging the region.

According to Mbewu et al (2006), African predicament will worsen because majority of her populations are under 35 years of age and the predictors of CVD are already prevalent and increasing within this age group. This consequently suggests potential threats to the future working life of individual adult in this region and also to the macro economy of nations within this region. For instance, in Ghana, where cerebral hemorrhage is a leading cause of death, the average age at which people die from this disease is 55 years. In the long run, the public health system will greatly suffer from this because people who are supposed to work to strengthen the health system are being incapacitated by CVDs. This may make a lot of people living with the disease be denied adequate treatment and which may eventually escalate the mortality resulting from this disease. Also, another great concern in sub-Saharan Africa is that recent finding by Lawlor et at (2002) has shown that poor socio-economic conditions in childhood determine CVD in middle age as strongly as do CVD risk factors in middle age in the same individuals (Lawlor et al., 2002; Mbewu et al., 2006). Also, the current impoverishment in the region may result in an epidemic of CVD in middle age for those who survive the ravages of poverty-related communicable diseases such as HIV/AIDS, tuberculosis, pneumonia and malaria.

Furthermore, CVD is responsible for 10% of DALYs lost in low- and middle-income countries and 18% in high income countries. It is a growing threat to health in Africa, accounting for 9.2% of deaths in 2001, principally due to hypertension, stroke, cardiomyopathy, and rheumatic valve disease (Kadiri, 2005; Opie et al., 2005). More so, CVD has a higher mortality rate in developing countries and affects younger people and women disproportionately. For instance, peripartum cardiomyopathy is a major cause of heart failure in Africa. In some parts of Nigeria, heart failure in women is reported to occur after childbirth as often as once in every 100 births (Sliwa et al.,

2005). On the other hand, ischemic heart disease is relatively uncommon in Africa whereas, rheumatic valvular disease remains a commonly encountered cause of disability and death, and pericardial disease may be the first manifestation of HIV infection in its early stages. Aneurysms can also be associated with HIV. Worldwide surveys have found that congenital heart disease may occur in 12 to 15 of 1,000 live births and that it is often associated with high infant mortality rates. CVD morbidity and mortality therefore varies from country to country and there is also wide variation even within a country.

In South Asia, a lot of nutritional transitions have also taken place with different countries in different phase of the transition while the impact of CVD in this region is very great. For instance, India has been experiencing an increase in heart disease and the causal factors been changes in lifestyles and diets, rapid urbanization and an underlying genetic component. The major proximal factor in this country is diabetes which has become a major health issue. About 31.6 million people in India are diabetics and the number is expected to reach 57.2 million by 2025 (Ghaffar et al., 2004). Also, the WHO estimates that by 2010, about six out of ten (60 percent) of the world's cardiac patients will be in India. In terms of the age distribution, about half (50 percent) of CVD-related deaths occur among people who are below 70 years compared with about 22 percent in the West. More so, between 2000 and 2030, about one-third (35 percent) of all CVD deaths in India will occur among those age 35 to 64 years compared with only 12% in the United States and 22% in China (Leeder et al., 2004). This disparity between the West and South Asia may probably be because of the good health system and also because CVD has occupied a top priority in the health agenda of the western countries compare with other parts of the world.

In the Middle East and North Africa, there has been an increase in economic wealth and this has been characteristically accompanied by urbanization. As a result, the rate of CVD has been increasing rapidly to the extent that it has become the leading cause of death and it accounts for about 25% to 45% of total deaths. In most countries in the region, the daily rate of per capital fat consumption has increased and this ranges from 13.6 percent increase in Sudan to 143.3 percent increase in Saudi Arabia (Musaiger 2002). In this region, Ischemic heart disease (IHD) is the predominant cause of CVD with about three ischemic heart disease deaths for every stroke death. Also, Rheumatic heart disease (RHD) remains a major cause of morbidity and mortality although the number of hospitalizations for RHD is gradually declining.

In sub-Saharan Africa, deaths from CVDs are expected to more than double between 1990 and 2020. Presently, HIV/AIDS is the leading over-all cause of deaths in the region while CVDs is the second-leading cause of deaths and it is also the first among those over the age of 30 years. This has serious implication for the future working life of people and also the economic growth and development of nations in this region. Stroke is the dominant form of CVDs in sub-Saharan Africa. Due to increasing urbanization, the level of daily physical activity has reduced and rate of smoking has been increasing. Also, hypertension, one of the major risk factors of CVDs, has become a major health concern on the region. According to Bertrand (1999), hypertension accounts for the dominance of stroke, rheumatic heart disease and cardiomyopathies. This explains why CVDs will continue to be a major menace in the region for many years if serious measures are not taken to combat the incidence and the prevalence of the disease.

For instance, in east Africa, CVD also accounts for large proportion of mortality and morbidity. In an autopsy study carried out by Ogeng et al (2011) where 134 autopsy cases were examined at the department of Human anatomy, University of Nairobi, Kenya, they described the spectrum of cardiovascular causes of death in Kenya. The study showed that cardiovascular causes comprised 13.2 percent of all autopsy cases and myocardial infarction was the most common. The conditions of CVD that are prevalent in the country include myocardial infarction (18.7 percent), cardiomyopathy (14.2 percent), subarachnoid hemorrhage (15.7 percent), pulmonary thromboembolism (14.2 percent), ruptured aortic aneurysm (11.2 percent) and hypertensive heart disease (9.0 percent). The mean age of cardiovascular diseases was 50.4 years, peaking at 40-60 years and more than half (56.7 percent) aged 50 years and younger and the male-female ratio is 2.7 : 1. This contradicts the occurrence in United States and Australia in which more of the CVD mortality occur at later age (65 years and over), although this may be because the data from America and Australia are nationally representative compared to that of Kenya which is an autopsy cases.

1.5.4 Causes of cardiovascular diseases

Studies have shown that sub-Saharan African countries have experienced both epidemiological and nutritional transition which have exposed people to the risk of chronic Non-communicable disease most especially cardiovascular disease. Epidemiological transition involves a shift in the pattern of mortality and disease which is associated with development (BeLue et al., 2009). In other words, it is often characterized by a shift in communicable diseases and nutritional deficiencies to chronic non-communicable diseases due to urbanization and changing lifestyles. However, sub-Saharan Africa tends to be experiencing a double burden of both infectious and chronic non-communicable diseases which are responsible for a larger percentage of mortality in

this region. In addition, the epidemiological transition provides a useful framework for understanding changes in the patterns of disease as a result of socioeconomic and demographic developments (Gersh et al., 2010). The epidemiologic transition consists of four basic stages.

Stage 1 is called “the age of pestilence and famine”. This has characterized much of human development throughout the course of history with cardiac disease (rheumatic and nutritional) accounting for less than 10% of total deaths (Gersh et al., 2010). According to Omran (1971), the age of pestilence and famine is characterized by the prevalence of malnutrition and infectious disease and also by scarcity of CVDs In regions such as the USA and Europe, the transition into the next phase (Stage 2) occurred in the late 18th and throughout the 19th century, but in many developing countries infectious and post-infectious circulatory disorders continue to exact a major toll and are neglected in the overall global agenda for the research and control of CVD. (Gersh et al., 2010).

The second age (receding pandemics) is characterized by increase in wealth and which increases food security, improved sanitation and access to vaccines and antibiotics and life expectancy (Omran, 1971; Gersh et al., 2010). As a result of these changes, incidences of infections and malnutrition, and the emergence of hypertension, stroke, and coronary disease and rheumatic heart disease were prevalent. In this phase, stroke is primarily haemorrhagic, presumably due to uncontrolled hypertension (Gersh et al., 2010). Examples of this phase are the USA in the early part of the 20th century and parts of China and India today.

The age of degenerative man-made (stage 3) is marked by changes in risk factors including increased fat and caloric intake, tobacco use, and reduced levels of exercise leading to hypertension, obesity which led to the emergence of atherosclerosis. Although the life expectancy increased at this period (beyond 50 years), mortality from CVD and other noncommunicable diseases exceeds mortality from malnutrition and infectious disease. Cardiovascular deaths account for 35–65% of all deaths, and exceed death rates due to infections and malnutrition (Gersh et al., 2010).

At this age, mortality from coronary heart disease (CHD) exceeds mortality from ischemic stroke but ischemic stroke was still a significant cause of morbidity and mortality (Omran, 1971; Gaziano et al., 2005). Furthermore, in the age of degenerative and man-made diseases, due to introduction of primary and secondary prevention, the age-adjusted CVD mortality was reduced; however, congestive heart failure prevalence increases due to the improvement in the survival status of those with ischemic stroke. This improvement in survival status may not extend to developing countries because of the increased or sustained mortality from CVD which are often supposed to be lived with for a long period of time. One of the main reasons for this compression of morbidity may be due to health systems in this part of the world which are already being over-burdened with infectious diseases which in a sense incapacitate the treatment of CVD.

According to Gersh et al (2010), examples of Phase 3 are the USA during 1930 to 1965, Western Europe approximately 10 years later, and many parts of China, India, the Middle East, Eastern Europe, and Latin America today. Interestingly, the emergence of cardiovascular and ischaemic heart disease during Phase 3 is primarily seen among the better educated and more affluent as

shown in the INTERHEART study of a relatively small number of black Africans with myocardial infarction. In contrast, among whites and coloureds, myocardial infarction was more commonly associated with lower socioeconomic status.

Stage 4, which is the age of delayed degenerative diseases, is currently the situation in most high income and highly industrialized nations of the world. Life expectancy is greater than 70 years; leading causes of mortality are CVD and cancer, and the dominant forms of cardiovascular death are ischaemic heart disease, ischaemic stroke, and more recently congestive heart failure. In this phase of the transition, premature coronary artery disease tends to occur in patients of lower socioeconomic status since the benefits of risk factor reduction, secondary prevention, and access to evidence-based therapies and new technologies tend to be more widely implemented among the socially advantaged. Among the higher socioeconomic classes, coronary artery disease is predominately a disease of the elderly. Examples of this are provided by data from the Women's Heart Study in which higher levels of education and income among apparently healthy female professionals were associated with a lower rate of cardiovascular events over a 10-year period. Similarly, in a high-income country such as Canada, which also has universal healthcare, CVD mortality rates are lowest among the most affluent with evidence of an announced gradient based upon income.

More so, the last four decades have witnessed a gratifying fall in the USA of 2% per year in the age-adjusted coronary heart disease mortality and 3% per year in stroke mortality. This is attributable mainly to control of risk factors and to a lesser extent upon new therapeutic advances. Nonetheless, in the wake of increasing prosperity and urbanization the epidemic of

obesity, diabetes, and hypertension is now a world-wide phenomenon. In addition, the decline in smoking rates is leveling off in some countries, and rates of detection and treatment of hypertension have not increased. A crucial question is whether therapeutic advances will offset the impact of an adverse trend in risk factors, and of concern in this respect are the data suggesting that men and women age 35–44 years in the USA, the annual decline in mortality from coronary heart disease has lessened and might be trending upward.

According to Gaziano et al (2005), there are new trends which suggest that many developed countries a 'yet-unnamed' phase of the epidemiological transition, characterized by an epidemic of obesity and diabetes prevalence. However, it has been shown that this trend also extends to developing countries because of the effect of globalization and urbanization which have brought about changes in lifestyles. According to World Health Organization, more than 1 billion adults worldwide are overweight while 300 million are clinically obese and which leads to increase in diabetes and hypertension which are major risk factors of CVD. Also, increase in childhood obesity has been observed globally. The major difference between the developed countries and the developing countries is the ability of the former to manage the incidence of the disease because of their technology while the former still face a competing share of the health resources between infectious and chronic noncommunicable diseases (NCD).

Nutritional transition entails a shift from a low caloric content diet to a higher caloric content and/ or reduction of physical activity (Popkin, 2003). Basically, advancement in technology, urbanization and globalization has increased unhealthy diets, physical inactivity, smoking and alcohol consumption which can cause high blood pressure (hypertension), high blood sugar

(diabetes) and high lipid level (dyslipidemia). These are major risk factors of cardiovascular disease which will be classified into: modifiable, non-modifiable and proximal risk factors.

1.5.5 Modifiable Risk Factors of Cardiovascular Diseases

a. Smoking

Smoking has been seen as one of the modifiable causes of cardiovascular diseases (CVDs). In other words, the globalization of tobacco use represents a major threat to worldwide public health (Yach et al., 2000; Pampel, 2008). Tobacco smoke is full of substances that damage the lungs, blood vessels and heart. They take the place of the oxygen in the blood that the heart and brain need to work properly. Tobacco use greatly increases the chance of having a heart attack or stroke (WHO, 2005). A substantial number of deaths from CVDs have been attributed to tobacco smoking which increases the risk of dying from coronary heart disease and cerebrovascular disease about 2-3 fold (WHO, 2011). The risk is said to increase with age and also greater for women than for men. Also, the report of WHO (2011) on 'cardiovascular disease prevention and control: missed opportunities' shows that quitting smoking can reduce the risk of CVDs. For instance, the report shows that cardiac events fall about 50% in people who stop smoking and acute myocardial infarction, stroke and peripheral vascular disease decreases significantly over the first two years after stopping smoking. More so, for those who are already suffering from CVD, continuous smoking after myocardial infarction or coronary revascularization can pose serious clinical consequences. For instance, for eight years after myocardial infarction, the deaths from post-myocardial infarction patients who does not stop smoking doubles that of 'quitters' (WHO, 2011).

More so, the toxin in the blood from smoking cigarettes contribute to the development of atherosclerosis which hardens the arteries caused by the deposit of fatty plaques and the scarring and thickening of the artery wall. The inflammation of the artery wall and the development of blood clots can obstruct blood flow and which can lead to heart attack (Martin, 2009). In America, an estimated 1.1 million had a new or recurrent coronary attack and cigarette smoking has been associated with sudden cardiac death of all types in both men and women.

Furthermore, helping people to stop smoking even after they have been diagnosed of CVD can be a very challenging task. One often wonders why people will continue to smoke even after they know that it is hazardous to their health. For instance, it is usually stated in various advertisements on smoking that tobacco smoking is dangerous to health, yet, the rate of smoking has not reduced. The Global smoking statistics in 2007 shows that smoking related-diseases kill one in ten adults globally and by 2030, it is projected that if the current trends of smoking continues, it will kill about one in six people. Presently, at least one person dies of tobacco use every eight seconds (Martin, 2007). One can begin to see why serious attention has to be paid to this issue because of the serious implications on the human society. Despite these serious consequences, the rate of smoking is on the rise in the developing countries but falling in developed nations (Martin, 2007). For instance, among the Americans, smoking rates reduced by about half in three decades (from the mid-1960s to mid-1990s), which falls to 23 percent of adults by 1997. Conversely, tobacco consumption in the developing countries rises by 3.4% per year (Martin, 2007; Pampel, 2008). From 1970 to 2000, per capita cigarette consumption fell by 14% in developed countries and rose by 46% in developing counties (Guindon et al., 2003).

The burden of Cardiovascular diseases in developing countries is so great because these countries are also the ones who do not have effective health systems which can help people live with CVD for a long time thereby shortening their life expectancies, yet, their consumption of tobacco has not gone down. Strategies have been put in place to combat the use of tobacco. Global public efforts have aimed to provide consistent anti-smoking policies across the world and one of the strategies is the creation of an international treaty which has led to the WHO Framework Convention on Tobacco Control (WHO, 2005; Pompey, 2008). Other strategies include surveillance of smoking which can aid in developing locally grounded actions for tobacco control but lack of standardized and comparable data on tobacco smoking has been identified by researchers, policymakers and anti-tobacco advocates as factors that handicap this achievement in developing countries.

As a result of this, the mission of WHO Cardiovascular Diseases Program is to provide global leadership in the prevention and control of CVDs, and to assist member States reduce the toll of morbidity, disability and premature mortality due to CVDs (WHO, 2011). WHO has therefore suggested that Government levy high tax on tobacco industries so as to discourage production and consumption. But the challenge may be that if heavy taxes are levied on these industries, there will be increase in the cost of production which may discourage consumption. This may eventually leads to lay-off of the staffs in these tobacco industries. These sudden lay-offs may cause psychological trauma for these people and which predisposes them to the risk of high blood pressure and consequently heart disease. This has been the argument of the industries that produced tobacco. But the fact is that keeping a healthy population is in the long-run more cost effective than people losing their jobs in these industries.

Studies have shown that even though doctors are knowledgeable about the risks of CVDs associated with tobacco smoking, they find it difficult to help the patients stop smoking because the patients do not follow the counseling given by these physicians (WHO, 2011). On one hand, this implies that individuals have a lot to do in terms of behavioural change most especially on issue that affects their health. On the other hand, this suggests that behaviour change transcends having knowledge alone but it involve complexities of social, psychological, economic and cultural factors. In essence, there is therefore no doubt that smoking is one of the leading causes of preventable death and it has negative health impacts on people at all stages and it harms unborn babies, infants, children, adolescents, adults and aged (Martin, 2009). This is why serious efforts should be directed at reducing the rate of tobacco smoking worldwide.

b. Unhealthy Diet

Dietary patterns play a major role in enhancing the well-being of individuals. The Traditional African diets are said to be healthy and reduce the risk of CVDs. However, the rate of urbanization and the impact of globalization have brought about changes in the traditional eating pattern, forms of cooking and sources of food intake in Africa. Samuel et al in 2008 document the common features of traditional African diets and their nutritional values. According to them, traditional African diet is high in complex carbohydrates, pulses and vegetables; low in sugar and saturated fat, all of which lower the risk of obesity. Also, grain is said to be common in traditional African food which helps to limit the risk of metabolic syndrome development and heart disease. This is because grain foods are naturally low in fat and the soluble fiber helps in

maintaining blood sugar levels and prolong digestion of minerals. According to them, grain also promotes healthy weight maintenance.

More so, the consumption of leafy vegetables and nutritional plants was also common in traditional African diet. These vegetables produce a high total phenol content and antioxidant activity which has health benefits. The existence of the abundance and variety of fruits in Africa also connotes available of healthy diet but it is unfortunate that consumption of these fruits is usually low (Oniang' o et al., 2003; Samuel et al., 2008) in the continent. Scientific evidence has however shown that fruits and vegetables contain flavonoids which help in preventing CVDs. The main thing is that the nutritional value of traditional African diets helps to protect against the risk of obesity, overweight and CVDs. But due to the rate of urbanization and globalization in Africa, the importance of these diets have been downplayed and a lot of people, most especially in the urban areas, take foods which are rich in fats, salt and sugar which predispose them to the risk of CVDs. This is also partly because taking these unhealthy diets is seen as a 'sign of good living' and anyone not taking them may be seen as poor. It is therefore important to educate people on falling back to the traditional African foods which can contribute significantly to reducing the risk of CVDs. Rather than trying to appear modern (civilized) by taking these junk foods, a situation which has a serious health implication, it is better to stay with the African diet which can eventually reduce both the direct and indirect cost of CVD in the continent.

In a study carried out by Hamada et al in 2009 among 97 healthy men living in Mwanza, Tanzania, they demonstrate the importance of eating fish in reducing the risk of Metabolic Syndrome and CVD. The study assessed the biological markers of diet by using a 24-hour urine (24U) because this method is seen as more reliable foe dietary habit assessment than questionnaire. According to them, the excretion of Tau, sodium (Na) and potassium (K) in 24U

correlated with dietary fish, salt and vegetable intakes which are link with MS risk. Tau is found in many foods but it is mostly abundant in sea food. More so, epidemiological studies and animal experiments have shown that a high-fish diet or intake of Tau prevent MS risks (Yamori, 1994; Hamada, 2009). The study shows that there is a lower eating level of sea food in young adults than in the middle-aged among the respondents and one plausible explanation for this was the habitual assimilation of non-traditional foods (westernized foods) like donuts and ice cream by the young adults.

Generally, the study found out that high level of Tau excretion in 24U reduces the risk of CVD. On the other hand, in Japan, Tau excretion showed a significant inverse correlation with ischemic heart disease in men and women and a positive correlation between fish intake and CVD in the country (Yamori et al., 2009; Hamada et al., 2009). This shows that while fish intake is inversely related to the risk of MS/CVD in Nwanza, Tanzania, it is positively correlated with CVD in Japan. The reason for this remains inconclusive. In addition, the study by Hamada et al., (2009) found out that there is no significant correlation between the eating of the unhealthy foods and socio-economic status. This implies that eating of unhealthy foods (or low eating of sea foods) cut across different socio-economic status and which indicates that everybody is at risk of Metabolic Syndrome (MS) and CVD.

Furthermore, increase in salt intake characterized the nutritional transition in both developed and developing countries. According to WHO (2009), the large increase in dietary salt is associated with multiple adverse health issue most especially increase in blood pressure which is one of the major causes of CVDs. In America, high salt intake is estimated to be the seventh leading risk for premature death and the second leading risk in Chile (Danaei et al., 2009; Legetic et al., 2011). It is also estimated that reduction of salt intake by 15% will save 8.5 million premature

death in 10 years at low cost in low and middle income countries (Legetic et al., 2011). In view of this WHO has recommended that salt consumption should be less than 5 grams per day (WHO, 2008).

c. Physical Inactivity

Physical inactivity has been identified as one of the risk factors of cardiovascular diseases. It is used to identify people who do not get enough regular exercises. It also helps to prevent the development of diabetes, helps maintain weight loss, reduces hypertension which is a proximate cause of cardiovascular diseases. The level of physical inactivity most especially in urban areas has reduced drastically because of the sedentary lifestyles and lack of space for those in the urban poor communities. According to Thompson et al., (2003), regular physical exercise like walking, running or swimming produces cardiovascular adaptations which increase exercise capacity, endurance and skeletal muscle strength. Also, it prevents the development of coronary artery disease (CAD) and reduces symptoms in patients with established cardiovascular disease. Evidence has also shown that regular physical activity reduces the risk of other chronic diseases like type 2 diabetes, osteoporosis, obesity, depression and cancer of the breast.

Physical activity is basically defined as any bodily movement produced by skeletal muscles that result in energy expenditure beyond resting expenditure. Exercise is a subset of physical activity and it is planned, structured, repetitive and purposeful in which maintenance of physical fitness is the objective. More so, physical fitness includes cardiorespiratory fitness, muscle strength, body composition and flexibility which comprises a set of attributes that people have or achieve that relates to the ability to perform physical activity (Thompson et al., 2003).

Most often, focus is usually on embarking on physical activity without particular attention to the dose and intensity of the physical activity. According Pat et al., in 1995, 'dose refers to the total amount of energy expended in physical activity, whereas intensity reflects the rate of energy expenditure during such activity'. Also, intensity can be measured in absolute or relative terms. Absolute intensity reflects the rate of energy expenditure during exercise and it is usually expressed in metabolic equivalent (or METs) where 1 MET equals the resting metabolic rate of approximately 3.5 mL O_2 . kg^{-1} . min^{-1}. On the other hand, relative intensity refers to the percent of aerobic power utilized during exercise and it is expressed as the percent maximal heart rate.

1.5.6 Impacts of Cardiovascular Disease

The impact of CVD cannot be over-emphasized. The social, economic and psychological impact of the disease is not only borne by individuals but also by their families, communities and the society at large. The first impact includes the loss of life associated with CVD (Gaziano et al., 2005) and the sufferings these people go through. This impact is mostly felt in developing countries because of their inability to develop a workable system which can allow the people living with the disease live with it for a long time. This indicates that CVD has a major influence on the life expectancy of people in developing countries most especially sub-Saharan Africa unlike developed countries. Also, the impact of increase in the incidence and prevalence of CVD on the Gross National Income and healthcare budget of all countries in the world is very huge.

For instance, in 1998, the United States of America spent about $109 billion equivalent to 13 percent of the healthcare budget on hypertension, which is a major risk factor for CVD. In 2004, about $368 billion covering both direct and indirect costs of CVD was expended (Hodgson,

2001; Gaziano et al., 2005). In South Africa, about 2-3% of the country's Gross National Income (GNI) or about 25 percent of the healthcare budget was spent on the direct treatment of CVD. The economic implication of CVD consequently includes both direct and indirect cost. The direct cost includes the amount of money used in treating the disease but the indirect cost (which includes DALYs) is more than these and it's sometimes neglected when estimating the impact of the disease in a population especially in developing countries. The incidence of CVD usually occur earlier among adults of working population age and which this has serious impacts on the economic viability of these countries and consequently on the well-being of the entire member of the family. In a report "A Race against Time", the potential loss due to early CVD has been estimated in five countries including Brazil, India, China, South Africa, and Mexico. The estimates of the report show that at least 21 million years of future productive life are lost every year due to CVD (Leeder et al., 2004; Gaziano et al., 2005). For instance, in China, the annual direct costs of CVD are estimated to be more than $40 billion which is about 4 percent of its GNI. This really shows the extent to which CVD has eaten deep into the financial 'fabric' of different countries despite the fact that there are still a lot of diseases to be given adequate attention.

More recent work has confirmed that a strong inverse relationship between income and cardiovascular health in developed countries can be almost completely explained by adverse risk factors, suggesting that a great savings to society would occur if socioeconomic gradients were reduced. The conclusion applies most strongly where society bears some burden of ill health through health system costs or loss of productive lifetime. In poor countries, the immediate costs of chronic ill health rests with the ill individual and his family, but longer-term health and

economic consequences may increasingly affect health systems and other units in society, such as workplaces. According to the WHO report in 2005, these diseases can cause poverty in individuals and families, and draw them into a "downward spiral of worsening disease and poverty" (p. 61). This therefore becomes worrisome for those who are already poor.

In addition, Gaziano et al (2005) show that while the gross national income (GNI) per capita of developed countries ($27000) is nearly 25-fold that of developing countries ($1100), they also devote twice as much of their GNI (10%) to health care compared with low and middle income countries (6%). One need not wonder why the disease burden is great in the developing countries because of the little amount spent on taking care of these diseases. Although, it seems as if government in sub-Saharan Africa has neglected CVD because of the low priority in national agenda, they may not be blamed because of the conflict of CVD with infectious diseases which receive top priority in health financing. This is why it is very important to adopt primary prevention strategy because nearly all of CVDs can be prevented if people adopt a healthy lifestyles and this will also be cost effective in the long run. According to a popular saying "prevention is better than cure". Prevention strategies may be expensive in the short run, but in the long run, cure is more expensive. Also, the social impact of CVD is very great although this has not been quantified as the economic impact (Gaziano et al., 2005). The social impacts of CVD include loss of job and school drop out by the caregiver, relocation due to loss of job and the stigmatization that those living with the disease go through.

1.5.7 Prevention of Cardiovascular Diseases

In medieval times, research has shown that people suffered from few cholesterol-related diseases including heart disease. For instance, people living in Briton at this period had uncommon history of heart disease and death-related heart disease problems (FEH, 2008). The plausible reason given was the use of natural food that was not loaded with carbohydrates; not lacking proteins, and rich in harmful fatty compounds. Basically, in the pre-industrial societies, studies in the history of heart disease show that the occurrence of deaths resulting from heart problems was not common. However, the incidence of deaths from heart disease started to shoot up after the industrial revolution of the nineteenth century.

In other words, before the advent of sophisticated machines, many people engage in manual work/labour which served as a vigorous physical activity which kept the blood circulation high through the body, but the technological change has brought about more relaxed and sedentary lifestyles which predisposes people to the risk of heart disease most especially people in the urban areas. With increase in life expectancy, indicating that the longer people survive and the older they become, the more health becomes a dominant issue. This also means that with an aging population come alarming health problems such as chronic diseases, including cardiovascular disease (WHO, 2002). In the literature, there have been arguments on preventing the risk of cardiovascular diseases. Some were of the opinion that the length of life is fixed and that chronic disease can be postponed by adopting a healthy lifestyles, this is called compression of morbidity (Fries, 1980). According to those who hold this viewpoint, it is assumed that if morbidity can in reality be compressed into fewer years toward the end of a hypothetical “full life span”, the quantity of disability over the whole life span will be abridged (Vita et al., 1998).

On the other hand, the antithesis of compression is expansion and they pointed out that the present advances of medical technology allow people to save the frail and disabled from dying from complications and therefore, mortality will produce more years with morbidity and related disability. In other words, their hypothesis (called 'failure of success), would further lead to pandemic of mental disorders and associated chronic disease and disabilities. Their arguments was basically based on the fact that if the incidence of chronic disease like cardiovascular disease remain unchanged and survival improves, the stocks of frail patients will increase (Gruenberg, 1977; Kramer, 1980; Robine et al., 2009). The third theory which is between these two extreme proposed a dynamic equilibrium in which increased survival is offset by better control of chronic diseases, keeping the proportion of life lived in good health more or less constant (Manton, 1982, Robine et al., 2009).

However, in reality, should we focus on the prevention or the cure? Answering this question is very critical because it will inform policies or interventions that will be put in place. If the emphasis is on prevention, efforts will be directed at educating people on how to maintain healthy lifestyles but if the attention is on cure, efforts will be drifted towards making sure that people live with the condition. It is rather beneficial to adopt comprehensive intervention strategies which focus on epidemiology surveillance, primary prevention and secondary prevention. Nevertheless, primary prevention should be at the forefront of the regional fight to reduce prevalence rate of cardiovascular disease and this be possible if effective disease surveillance is put in place (Unwin et al., 2001; de-Graft Aikins et al., 2010).

A recent study of OECD (Organization for Economic Cooperation and Development) in twelve countries, which include Denmark, Finland, Italy, Netherlands, United States, Belgium, Japan, Sweden, Australia, Canada, United Kingdom and France, shows that putting aside Italy, the

countries showing clear evidence of disability decline were the countries displaying the weaker increase in life expectancy at age 65. In other words, most countries experiencing a strong increase in life expectancy at age 65 reported increasing or stable rates. According to Robine et al., (2009), 'these results suggest that it may be difficult to reduce the level of disability among older people in countries where life expectancy at age 65 strongly increases. This also implies that developing countries which have low life expectancy at age 65 years and above will have lower number of disabilities after age 65 years.

In recent times, the concept that coronary heart disease (CHD) can be prevented has increasingly become a driving force in cardiovascular medicine. For many years, the field gave lip service to prevention but neglected to take it seriously. The possibility of effective prevention was met with skepticism from many quarters. Gradually, however, the tide has turned, and prevention is getting the upper hand while emphasis is on adopting a healthy lifestyles. Widespread acceptance of the benefits of prevention came first in the area of secondary prevention, i.e, preventing recurrent coronary events in patients with established (Smith et al., 1995; Grundy, 1999).

Heart disease and stroke can be prevented through healthy diet, regular physical activity and avoiding tobacco smoke. Individuals can reduce their risk of CVDs by engaging in regular physical activity, avoiding tobacco use and second-hand tobacco smoke, choosing a diet rich in fruit and vegetables and avoiding foods that are high in fat, sugar and salt, and maintaining a healthy body weight.

Comprehensive and integrated action is the means to prevent and control CVDs. Comprehensive action requires combining approaches (integrated and population-wide interventions) that seek to reduce the risks throughout the entire population with strategies that target individuals at high

risk or with established disease (WHO, 2011). Examples of population-wide interventions that can be implemented to reduce CVDs include: comprehensive tobacco control policies, taxation to reduce the intake of foods that are high in fat, sugar and salt, building walking and cycle ways to increase physical activity, providing healthy school meals to children. Also, integrated approaches focus on the main common risk factors for a range of chronic diseases such as CVD, diabetes and cancer: unhealthy diet, physically inactivity and tobacco use.

Furthermore, the WHO report (2011) indicates that several treatment options for CVD are available. Firstly, the availability of effective and inexpensive medication to treat nearly all CVDs; simple tools such as specific risk prediction charts can be used to identify people at high risk of CVD. Also, people at high risk can be identified using simple tools such as specific risk prediction charts. This is because if people are identified early, it reduces the cost of treatment and also prevents many heart attacks and strokes. In addition, since, survivors of a heart attack or stroke are at high risk of recurrences and at high risk of dying from them. The risk of a recurrence or death can be substantially lowered with a combination of drugs – statins to lower cholesterol, drugs to lower blood pressure, and aspirin.

More so, availability of operations which is used to treat CVDs these include coronary artery bypass, balloon angioplasty (where a small balloon-like device is threaded through an artery to open the blockage), valve repair and replacement, heart transplantation, and artificial heart operations. Finally, medical devices are required to treat some CVDs. Such devices include pacemakers, prosthetic valves, and patches for closing holes in the heart. But the challenge is that how many of these treatment options are not available in developing countries and these partly account for why there is a lot of mortality arising from cardiovascular diseases compared to the

developed countries which have all these systems in place. This indicates that there is a need for government investment in the prevention and the control of CVDs through her national programmes.

1.6 Operational Definitions

i. **Cardiovascular Diseases (CVDs):** This is a disorder of the heart and the blood vessels. The categories of CVDs in this study include: Congestive heart failure, cerebrovascular diseases, pulmonary heart disease, hypertensive heart disease, myocardial infarction, coronary artery disease, deep vein thrombosis, rheumatic heart disease and congenital heart disease.

ii. **Proportionate Mortality Ratio (PMR):** This measure the proportion of death caused by a particular disease. Specifically, in this study, PMR was used to determine the proportion of deaths caused by cardiovascular diseases within the five-year period. It was derived by dividing the number of deaths from CVDs by the total death and multiplies the result by 100.

iii. **Years of Potential Life Lost (YPLL):** This is a mortality index which measure premature mortality or early death. It was estimated by subtracting the age at death from the predetermined age (which is the life expectancy).

iv. **Trend:** Trend in this study refers to a pattern of gradual change in cardiovascular diseases' mortality and years of potential life lost within the five-year period. This was used interchangeably with "pattern" in the course of this study.

1.7 Conceptual Framework

This study aims at examining the trend of CVD mortality at Korle Bu Teaching Hospital from 2006 to 2010. The study will majorly draw on the theory of health risk transition, as coined by the Global health impact. This theory emerged from Omran (1971) theory of health transition. According to this theory, change in the incidence and the prevalence of cardiovascular diseases at different year will not be seen as a result of the time dimension but as a result of the increase in the risk factors in each year. According to this theory, time is obviously not the true driver of the risk transition but many factors interact to give rise to changing patterns of risks. In other words, it is the increase in the risk factors that brings about increase in the level of mortality arising from CVDs and not necessarily the change in time. This indicates that as the nation experiences more of the effect of globalization and urbanization, the risk factors for CVDs increase. If this is coupled with inadequate knowledge of the disease risk factors, lack of regular screening and weak government policies, the incidence and prevalence of the disease may increase. For this study therefore, changes in the proportionate mortality ratio of CVDs mortality will be seen as a result of changes in the risk factors every year.

Cardiovascular disease has been seen as a preventable disease. However, increase in the incidence and the prevalence of the disease most especially in developing countries has been recorded overtime due to the epidemiological and nutritional transition which has increased the risk factors. Basically, risk factors are conditions or behaviours that speed up the development of plaque in the coronary arteries, placing an individual at increased risk for cardiovascular disease (Minneapolis Heart Institute, 2008). This implies that the more risk factors an individual is exposed to, modifiable, non-modifiable or proximal, the more likely he/she will develop CVDs and in a situation where there is inadequate health system, lack of adherence to medication,

poverty, e.t.c, CVDs mortality tends to be high. However, due to lack of data, most of the risk factors of CVDs are not measured in this study but they are only used to show the theoretical relationship with cardiovascular diseases' mortality. The few measurable risk factors measured in this study include age and sex which are seen as non-modifiable risk factors.

Modifiable risk factors are the risks that can be changed by individuals provided he/she adopt a healthy lifestyle. These include: physical inactivity, unhealthy diets, smoking, and alcohol consumption. For instance, tobacco smoke is full of substances that damage the lungs, blood vessels and heart. They take the place of the oxygen in the blood that the heart and brain need to work properly thereby increasing the chance of having a heart attack or stroke (Yach et al., 2000; WHO, 2005; Pampel, 2008). Also, intake of food with high salt content, high sugar content, high fat etc are associated with multiple adverse health issue most especially increase in blood pressure, diabetes and increase in blood cholesterol which are proximal risks of CVDs. Physical inactivity aids the development of diabetes, weight gain, hypertension etc which are risk of CVDs (Thompson et al., 2003).

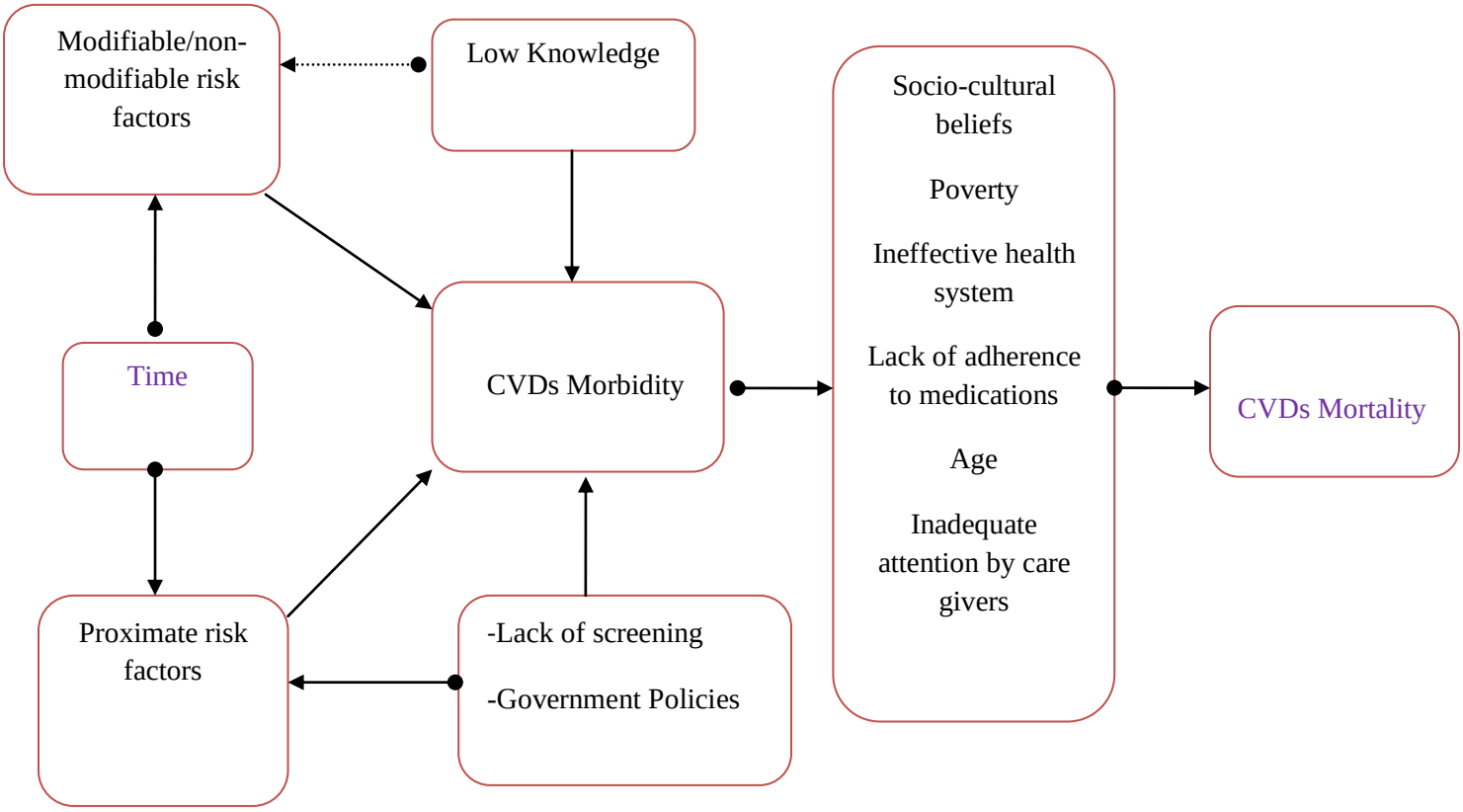
Non-modifiable risks are those which do not lend themselves to change and they can be hereditary. These risks include: age, gender, congenital abnormalities, and family history. As people grow older, they are more likely to have CVDs compared to those who are younger even if they engage in good lifestyle practices and they have no family records of CVDs or congenital abnormalities. According to the World heart foundation (WHF) report (2011), the risk of stroke doubles every decade after age 55. More so, people who have one or more of their family members with history of CVDs are more likely to have CVDs even if they engage in good lifestyle practices. For instance, if a first-degree blood relative has had coronary heart disease or

stroke before the age of 55 years (for a male relative) or 65 years (for a female relative), the individual risk of CVDs increases (WHF, 2011; Minneapolis Heart Institute, 2008).

In the same vein, anyone with congenital abnormalities runs the risk of developing CVDs even if he/ she engage in good lifestyle practices, he/she is young or he/she doesn't have any family history of CVD. Sex also plays significant roles as one of the non-modifiable risks. Men are said to be at higher risk of CVDs than pre-menopausal women. However, once a woman passes the menopause, her risk is similar to that of a man (WHO, 2011). But the risk of stroke tends to be similar for men and women. The proximal risk factors are those which directly predispose individuals to the risk of CVD. These include: hypertension (high blood pressure), diabetes, obesity and Hyperlipidaemias (high blood cholesterol). These factors are seen as the immediate causal factors of CVD.

Furthermore, living with CVDs is often based on the interaction of these risk factors. While some people are being diagnosed of the disease by medical personnel, some may not. This may be probably because of range of factors like access to good health system, economic reasons, beliefs, etc. After being diagnosed of the disease, one can either live with the disease (morbidity) or die of the disease (mortality) depending on various factors. These factors include: Poverty, spiritual causal theories, ineffective health system, lack of adherence to medications, age, family abandonment or social isolation.

Figure 1.7 Conceptual Framework Showing the Interrelationship between Time, CVDs risk factors, CVDs Morbidity and CVDs Mortality



Source: Author's Construct, 2012

1.8 HYPOTHESES

1. The proportionate mortality ratio from cardiovascular diseases in 2010 is more likely to be greater than that of 2006.
2. Females are more likely to have higher mortality from cardiovascular diseases than males within the five-year period.
3. Patients who are 35 years and above are more likely to have higher CVDs mortality compared to those who are less than 35 years.

4. Females are more likely to have higher years of potential life lost to cardiovascular diseases compared to males.

1.9 METHODOLOGY

1.9.1 Study area

The Korle Bu Teaching Hospital is the primary health care facility in Ghana. It is the largest tertiary hospital in Ghana and it is also a teaching hospital affiliated with the medical school of the University of Ghana. The hospital was founded in 1923 as the Gold Coast Hospital. The then Governor, Gordon Guggisberg laid the foundation for Korle Bu Hospital in 1921, and it was finally opened on 9th October, 1923. The hospital has expanded in phases and now has 1600 beds. Three centres of excellence, the National Cardiothoracic Centre, the National Plastic and Reconstructive Surgery and the Radiotherapy Centre are all located within it. In 2007, funded by the World Bank and the Ministry of Health, Ghana the standby power system to Korle-Bu was replaced after three years of no central backup supply. The expanded system of 3mVA provides power to the whole of Korle-Bu Hospital and was opened by the Minister of Health, Major Courage Quashigah (retd) and Mr G Asiedu of G&J Technical Services on June 6, 2007.

1.9.2 Source of Data

All cardiovascular deaths diagnosed at autopsy in the 5-year period from the beginning of January 2006 to the end of December 2010 were retrieved from the autopsy logbooks of the Department of Pathology. Between 1st January 2006 and 31st December 2010, all autopsies performed in the mortuary of the Korle Bu Teaching Hospital were documented. Autopsies were performed at the pathology department on an unselected basis on all consecutive patients from the hospital wards and the dead bodies brought by the police. The majority were medico-legal

cases. The medical history and clinical diagnosis before death were, in most of the patients, unavailable.

1.9.3 Method of Data Entry

The coding frame generated captured the followings: record date, case identification number, name of patients, age, sex, locality, causes of death and the name of pathologist who performed the autopsy. The data were entered using Statistical Package for the Social Sciences (SPSS) before analysis was done. The coding frame captures the multiple causes of death, from the underlying cause to the immediate cause of death. The multiple causes were entered as D1, D2, D3, etc depending on the number of the train of events leading to the death of the patients. For this study, the immediate cause of death was used as the number of deaths at Korle Bu Teaching Hospital within the five-year period. The reason why the immediate cause of death was used was to really ascertain what led to the death of the patients. All the diseases that were not cardiovascular diseases were coded as '0' while the categories of cardiovascular diseases (hypertensive heart disease, cerebrovascular diseases, congestive heart failure, myocardial infarction, pulmonary heart disease, coronary heart disease and "other cardiovascular diseases") were given values ranging from 1 to 7. The "other cardiovascular diseases" include: rheumatic heart disease, congenital heart disease and deep vein thrombosis. The reason why these were put together was because they have small cases. Also, The cases without sex, age, locality or/ and causes of death were excluded from the analysis.

1.9.4 Measures

The study showed that a total of 20,706 autopsy cases were done at KBTH within the five-year period. Out of this, 1,417 cases were missing and hence a total of 19,289 cases were used in the

analysis. The proportionate mortality ratio, which is a measure of the proportions of death caused by a particular disease, was calculated by dividing the number of cardiovascular diseases by total deaths at KBTH at each year and multiplied by 100. That is:

$$\mathbf{PMR} = \frac{\textbf{Number of cardiovascular diseases}}{\textbf{Total autopsy cases}} * \mathbf{100}$$

Also, the years of potential life lost (YPLL) was calculated by subtracting the age at death from the life expectancies. There are mainly two steps in calculating YPLL: the first step involves subtracting the deceased person's age at death from the standard age. In this study, the standard age was put at 59 years. This age is the average life expectancy within the five-year period. From the World population data sheet, the life expectancies for Ghana from 2006 to 2010 are 57 years, 59 years, 59 years, 59 years, and 60 years respectively. The reason why the average life expectancy was used was for easy comparison because this will serve as a way of standardizing the YPLL for the five-year period. This standard age is also based on the assumption that male and female have the same life expectancy. Although, people who died in each year may have been born in different years, this study treats everyone who died in the same year as having the same life expectancy.

Consequently, an infant dying at 1 year of age has lost 58 years of life (59 - 1) but a person dying at 59 years has lost nothing because he or she has fully lived the expected number of years. The implication of this is that the younger the age at which death occurs, the more years of potential life will be lost. In the second step of calculating the YPLL, all the YPLL for each individual are then added together to yield the total YPLL for specific cause of death. The %YPLL is calculated by dividing the YPLL for a particular cause of death by the total YPLL. In a nutshell,

YPLL = $\sum d_i (E - i)$, where,

i = Actual age at death,

d_i = Number of deaths at age i

E = Expected age at death

1.9.5 Methods of Analysis

This study used a univariate and bivariate analysis to describe the pattern of cardiovascular diseases at KBTH from 2006 to 2010. Frequency tables, line graphs and simple charts and descriptive statistics were used to show the patterns of cardiovascular diseases in relation to the patients' age, sex and locality. The independent sample t-test was also used to compare the relationship between sex and years of potential life lost. Also, the Yates correction chi-square was used to show the significant relationship between sex and categories of cardiovascular diseases. Odds ratio (OR) was used to show the likelihood of the occurrence of mortality and years of potential life lost to CVDs between males and females. Confidence intervals (CI) were also calculated at 95%.

1.9.6 Organisation of Chapters

The study was divided into five chapters. Chapter one focused on the background information, problem statement, literature review, objectives of the study, operational definitions, conceptual framework and methodology. In the second chapter, the study focused on the patterns of mortality at Korle Bu Teaching Hospital from 2006 to 2010. In chapter three, the proportionate mortality ratio of cardiovascular diseases was examined vis-à-vis its variations by age and sex. Chapter four looked at the trends in the categories of cardiovascular diseases by age-sex

differentials. In chapter five, the years of potential life lost (YPLL), and the percentage years of potential life lost (%YPLL) were examined. Finally, chapter six explains the summary of findings, recommendations and conclusion.

1.9.7 Limitations of the Study

The first limitation for this study is that deaths from the pathology department at KBTH were only recorded by age and sex while the other background characteristics like income status, level of education, occupation, religion, etc were not available. In other words, hospital admissions are usually selective in relation to personal characteristics, severity of disease, associated conditions and admission policies that vary from hospital to hospital. As a result, rigorous analysis could not be done. Also, records at KBTH are not majorly designed for research but for patient care and this may be why the other characteristics were not available. Since there are variations in diagnostic quality of the hospital records, physicians and clinical services, comparability of results to other hospitals may be difficult.

Also, as a hospital-based study, the observations made may not be representative of all cases of CVDs occurring in Accra or Ghana. This is because this study used the autopsy cases at the hospital as a proxy for deaths occurring at KBTH within the period. Due to this, some of the people who actually died of the disease may be missed out of the pathology records if patient's family refused autopsy. Although some cases were also brought from outside the hospital, they still may not be representations of deaths in Greater Accra or Ghana because there are other hospitals which also perform autopsies.

Furthermore, there is difficulty in calculating mortality rates because of the problem of defining denominators. This is because KBTH do not have defined catchment areas- that is, the fact that people come from different areas in the country makes it difficult to define the population. As a result, there was difficulty finding out whether the severity of the disease within the five-year period is increasing or not. Another limitation with this study is that the risk factors of cardiovascular diseases, i.e, modifiable, non-modifiable and proximal risks could not be determined because they were not available. This study only assumed that changes in the pattern of mortality at KBTH within the five-year period may be due to changes in the risk factors which in actual sense may not be so.

CHAPTER TWO

PATTERNS OF MORTALITY AT KORLE-BU TEACHING HOSPITAL

2.0 Introduction

In order to have a proper understanding of the trends of cardiovascular diseases mortality at Korle-Bu teaching hospital (KBTH), it is important to know the patterns of the morality. Mortality data basically indicate number of deaths by place, time and cause. Thus, this chapter focuses on examining the patterns of mortality at Korle-Bu Teaching Hospital from 2006 to 2010. It examines the number of deaths and its variation by age, sex, locality, and distribution of mortality between the wards (i.e within the hospital).

2.1 Number of deaths

From the standpoint of studying disease occurrence, expressing mortality in quantitative terms can pinpoint differences in the risk of dying from a disease in a population (Gordis, 2009). Monitoring the number of deaths can consequently help in the assessment of measures put in place to combat the occurrence and the prevalence of diseases in the population.

Table 2.1: Number of Autopsy Cases at KBTH (2006 – 2010)

Year	Number of deaths	Missing cases	% missing	Valid cases	% Valid
2006	5450	359	6.4	5091	93.4
2007	4637	318	6.9	4319	93.1
2008	3942	134	3.4	3808	96.6
2009	3770	330	8.8	3440	91.2
2010	2907	276	9.5	2631	90.5
Total	**20706**	**1417**	**6.8**	**19289**	**93.2**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Table 2.1 shows the number of autopsy cases and the completeness of the records at KBTH from 2006 to 2010. A total of 20,706 autopsy cases were recorded at the hospital within the five-year

period. The table shows that the number of autopsy cases at Korle-Bu teaching hospital is seen to be significantly decreasing from 2006 through to the year 2010. Although there is a decrease in the number of autopsy cases in each year, it may not be concluded that the risk of dying at KBTH was decreasing because the only information that was provided was the number of deaths (numerator) while the population at risk was not known (denominator). Furthermore, a number of missing cases were identified probably because the age, sex, locality or cause of death was not available and they will not be used in the analysis. Generally, more than 90% of the autopsy cases were complete within the five-year period. Therefore, the number of valid cases that will be used for analysis in the course of this study is 19,289, which is spread over the five-year period.

2.2 Age Pattern of mortality

The importance of showing the distribution of mortality by age cannot be overemphasized. This is because age shows clearly the structure of the population who are being over-burdened by mortality in the population. Consequently, it is important to know the age pattern of mortality for policy purposes.

Figure 2.2 Age patterns of Mortality at KBTH from 2006 to 2010

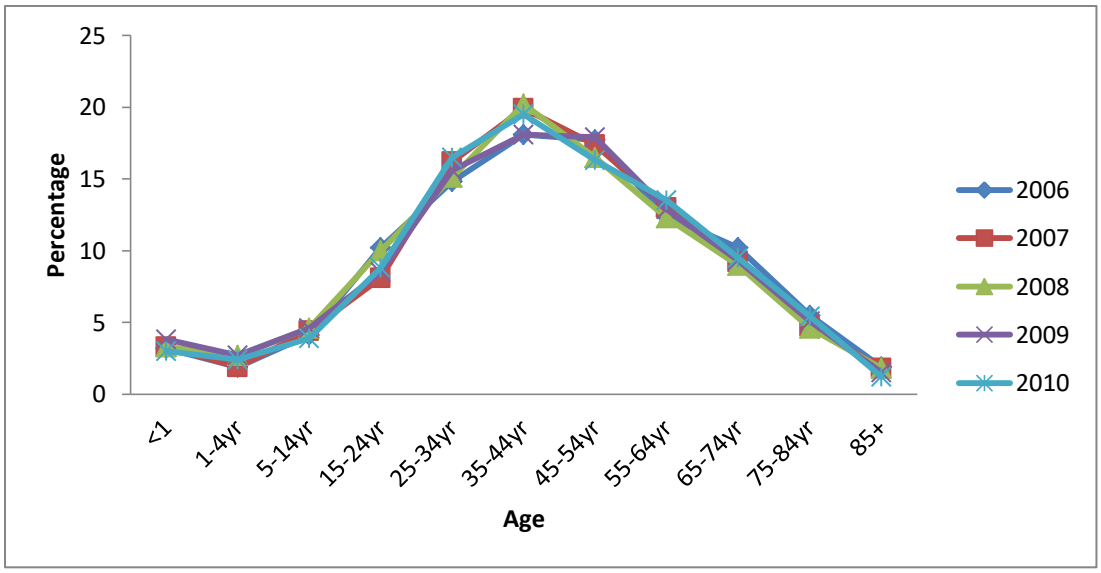


Figure 2.2 shows the age distribution of mortality patterns at KBTH from 2006 to 2010. The results show that the median age at death within the period ranges between 41 years and 43 years with the highest occurring in 2006 and the lowest in 2008. The median age at death for 2007, 2009 and 2010 are the same (42 years). The results further show that the infant mortality within these periods is higher than the child mortality. However, the highest infant mortality was recorded in 2008 and that is also the period when the highest child mortality also occurred. Also, the figure shows that mortality within these periods picked up after age four and plateaued at ages 35-44 years before it started to decline till ages 85 years.

It is important to note that the age pattern of mortality shown in this study does not follow the normal mortality pattern in a population which is a U-shaped pattern. This is because with respect to age, normal mortality rates start at a high level at birth, fall rapidly to a minimum at about age 10 and thereafter increase throughout life. A plausible reason for the pattern shown in this study may be because of the under-representation of autopsy cases in the population. This is

because many people refuse autopsy and all they are concerned about is the death certificate. So, many of the dead bodies may not be brought for autopsy provided the family members can get the death certificate somehow. This may in a way have skewed the mortality pattern. Also, the pattern shown here may be due to the fact that the mortality ratio was used to show the age pattern of deaths instead of rates. Finally, another plausible explanation for the age pattern of mortality revealed in this study may be that there were high rates of accident from age 14 through ages 85. Further studies need to be carried out to examine the rates of accident mortality at KBTH within this period.

2.3 Patterns of Mortality by Sex

Sex is also a major factor in monitoring the mortality of a disease in the population. This is because mortality varies by sex and this basically points to population differences in the biologic, behavioural and environmental factors influencing health. Table 2.3 shows that generally, about six out of ten deaths at KBTH in occurred in the male population.

Table 2.3 Sex distribution of mortality at KBTH

	Sex		
Year	**Male**	**Female**	**Total**
2006	3164 (62.1%)	1927 (37.9%)	5091 (100.0%)
2007	2590 (60.0%)	1729 (40.0%)	4319 (100.0%)
2008	2267 (61.1%)	1441 (38.9%)	3708 (100.0%)
2009	2057 (59.8%)	1383 (40.2%)	3440 (100.0%)
2010	1575 (59.9%)	1056 (40.1%)	2631 (100.0%)
Total	**11653 (60.7%)**	**7536 (39.3%)**	**19189 (100.0%)**

Source: **Computed from autopsy records from the KBTH 2006-2010**

In general, the table shows that out of the total deaths within these periods, less than forty percent (39.3%) were female deaths which may probably indicate lower female deaths compared to male deaths, although this may not be absolutely true because of the difficulty in calculating

the crude death rates for both sexes since the population is not known . The results also show that the male-female ratio of mortality within this period is 1.5:1. This pattern of mortality is different from the Burden of Disease (BOD) and the Global Burden of Disease Study (GBDS) estimated for sub-Saharan Africa. In the qualitative study of the burden of disease for sub-Saharan Africa, it is estimated that about 53.9% of the burden of disease is carried by men while the global burden of disease study estimated the share to be 53.2% (Wurthwein et al., 2001).

2.4 Patterns of mortality by Age and Sex

Figures 2.4.1 and 2.4.2 show the patterns of mortality at KBTH from 2006 to 2010 by age and sex and this may be referred to as age specific death ratio. The results show that the median age at death among males within these five-year period ranges from 42 years to 44 years while that of females ranges from 39 years to 40 years**.** This in a way shows that the age at which women died within this period was actually lower than that of men. In other words, this may implies that women tend to die earlier than the men within the period under review at KBTH. This may probably be due to high maternal mortality among females within this period.

Also, the figures show that the peak age at death among females in 2010 was between ages 25-34 years which is actually lower than the previous years. This in a way suggests that the age at death among females was declining. More so, the same pattern is partially seen among the males. Another notable observation is that the infant mortality among females within the five-year period was higher than that of males. Conversely, studies have shown that for all causes of deaths combined, female mortality in infancy and throughout life in most countries is lower than male mortality (Pollard et al., 1991). However, the pattern shown in this study may be due to under- reporting or under-representation of female infant mortality examined at the hospital.

Furthermore, after ages 35-44 years, mortality among males was higher than that of females but after ages 65-74 years, mortality among females seemed to be higher than that of males.

Figure 2.4.1 Age patterns of mortality among males (2006-2010)

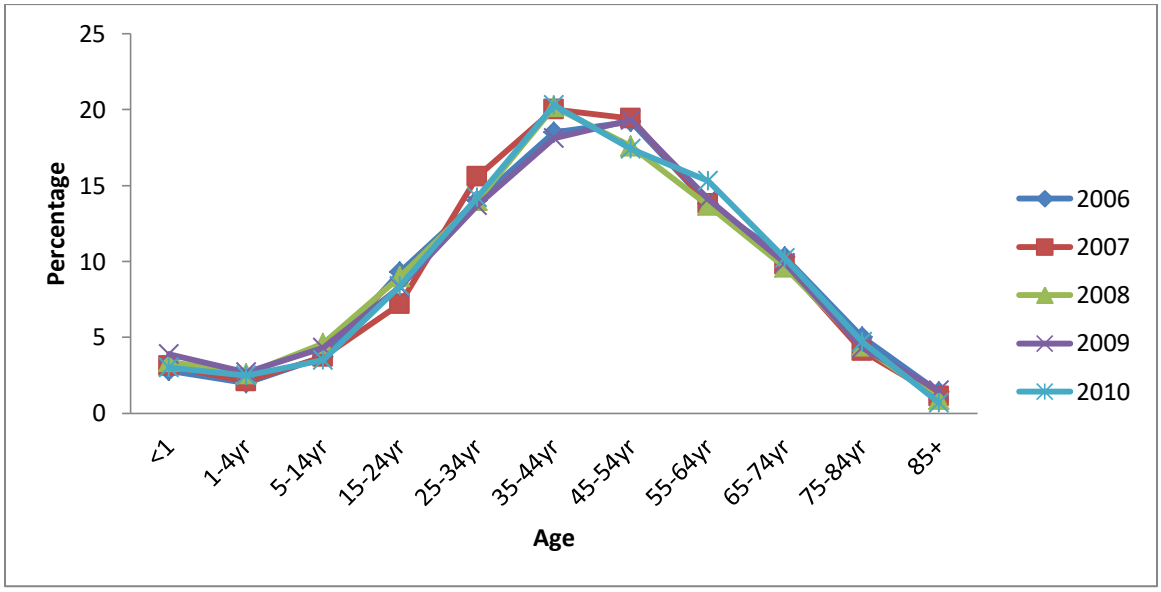
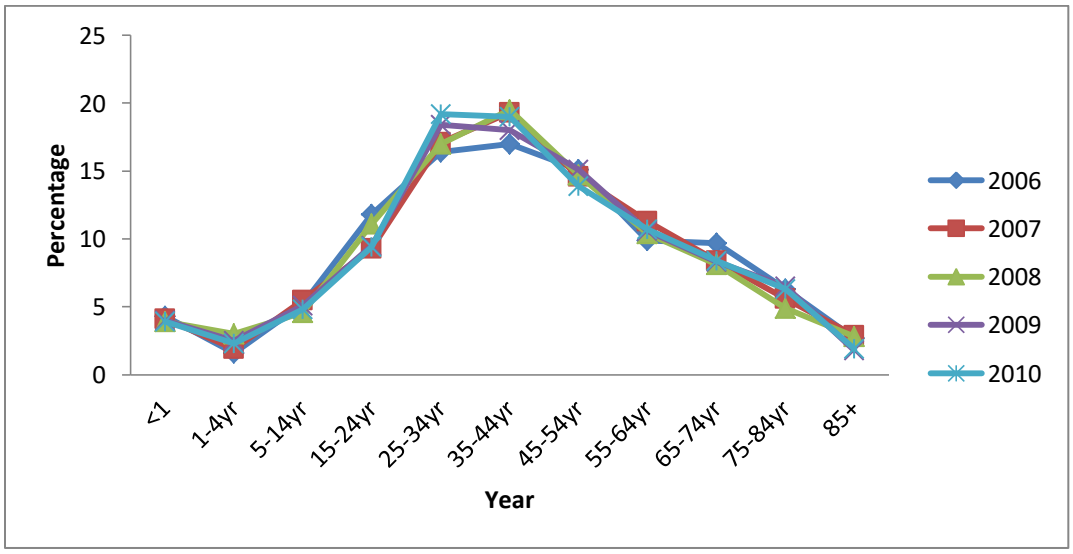


Figure 2.4.2: Age patterns of mortality among females (2006-2010)



2.5 Sources of deaths

The sources of deaths in this analysis refer to the institutional body that brought the cases for autopsy to be done at KBTH. While some were brought directly from the wards within the hospital, some were also brought from outside the hospital but with reports from the police (and this basically represents deaths outside the wards).

Figure 2.5 Percentage distribution of the Sources of death examined at KBTH

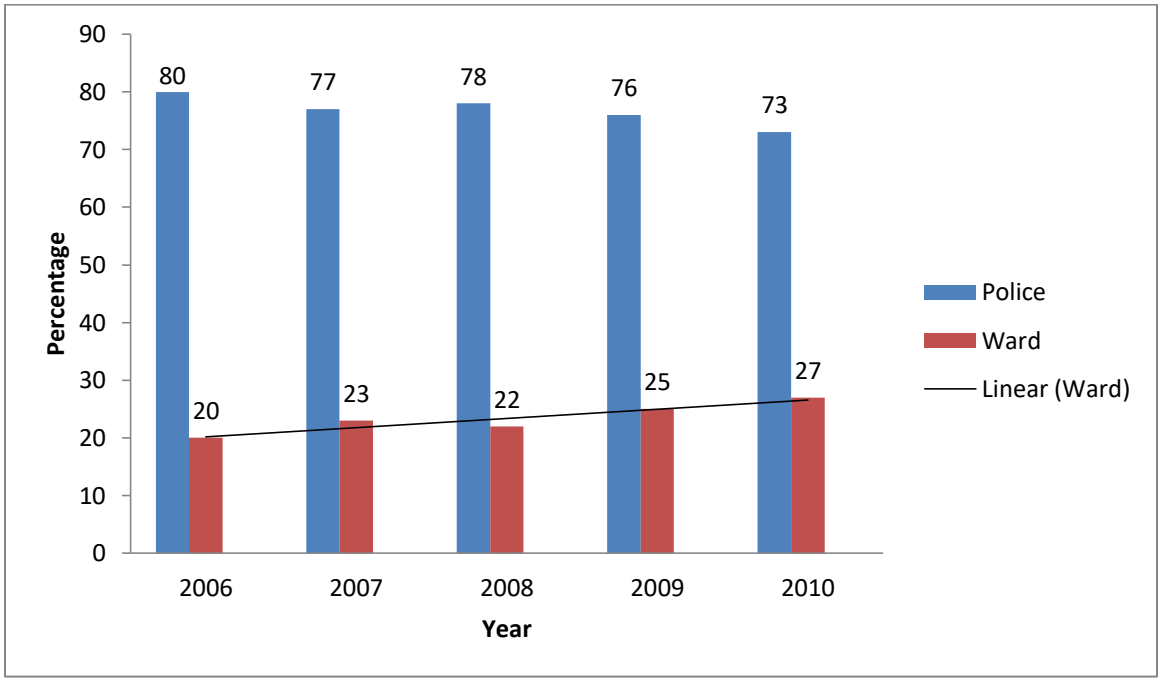


Figure 2.5 shows that more than seven out of ten deaths (autopsy cases) at KBTH from 2006 to 2010 were brought from outside the hospital. It is also clearly seen that the proportions of death brought from the ward at KBTH increases within the 5-year period except between 2007 and 2008 (as shown by the trend line).

2.6 Locality of patients

It is important to know the location where mortality occurs so as to fully understand the environmental dynamics in mortality variations. Basically, before death certificate is issued, autopsy has to be done in order to know the cause of death. As a result, people who die outside the hospital are required to bring a police report before autopsy could be done at the pathology department. This section examined the area where the police stations were located for the patients' family member to get a police report before autopsy was done. It is assumed that people will get the permit from the nearest police station where the death occurred and so it can be inferred that the location of the police station may be the locality of the patient.

Figure 2.6 Percentage Distribution of deaths by Locality

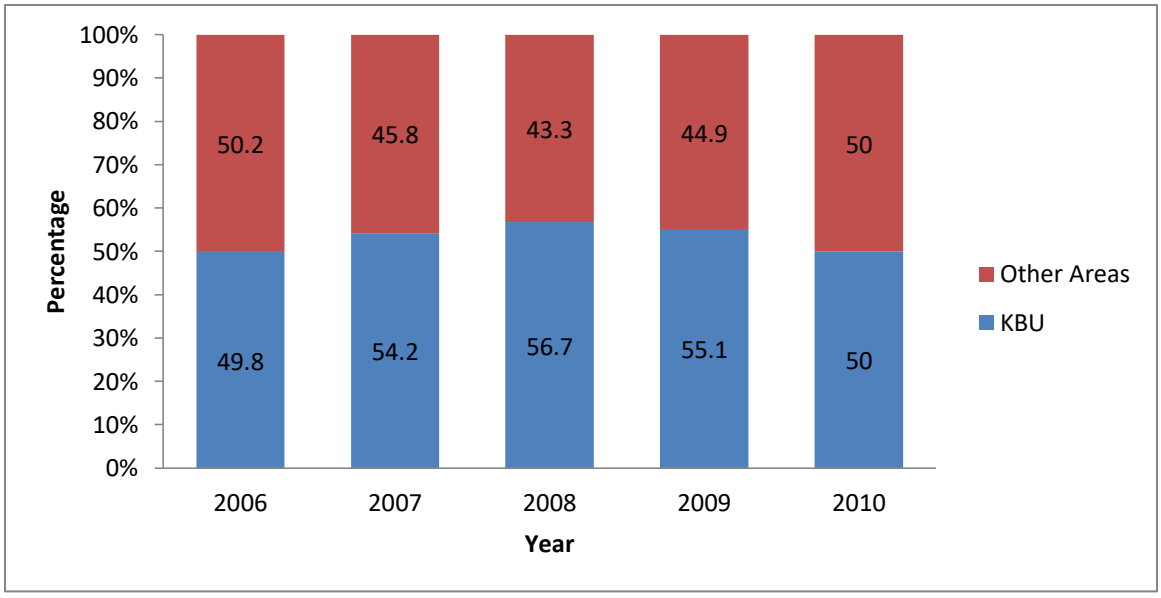


Figure 2.6 shows that from 2007 to 2010, more than half of the deaths examined at KBTH were brought from Korle Bu Police Station. Some other Police Stations in which significant cases were brought include Kotobabi, La, Nima, Odokor and Tesano and it is important to note that all

these areas are within the Greater Accra Region. This indicates that most of the autopsy cases within the five-year under review may be residents of The Greater Accra Region.

CHAPTER THREE

PROPORTIONATE MORTALITY RATIO (PMR) OF CARDIOVASCULAR DISEASES AT KORLE-BU TEACHING HOSPITAL

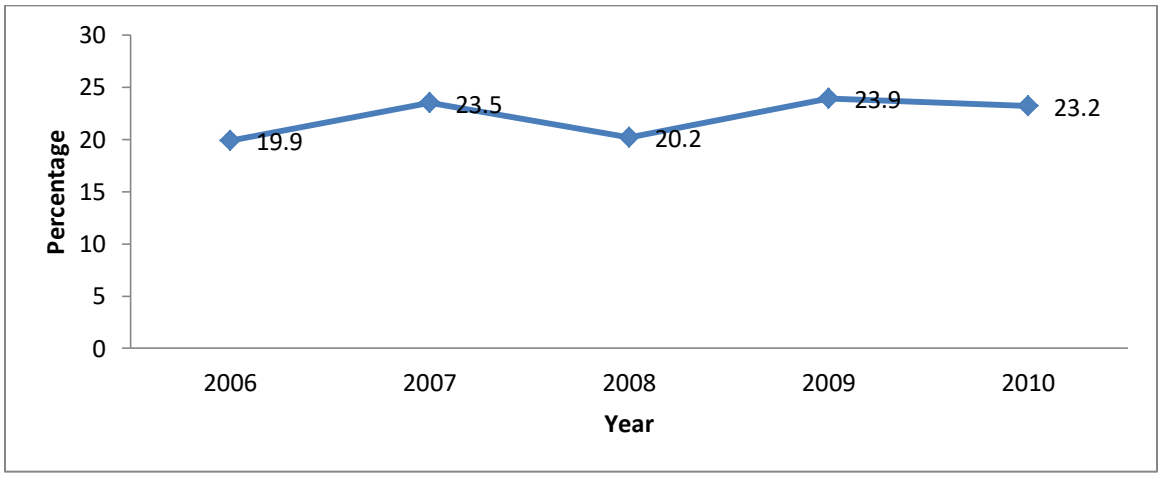
3.0 Introduction

Proportionate Mortality Ratio (PMR) is a measure of mortality which is used to determine the proportions of death caused by a particular disease. In this chapter, the focus will be on determining the PMR of Cardiovascular Diseases (CVDs) vis-à-vis other causes of deaths from 2006 to 2010.

3.1 Proportionate Mortality Ratio at KBTH

Figure 3.1 shows the trends in Proportionate Mortality ratio of CVDs at KBTH from 2006 to 2010. The results show that CVDs fluctuated between 20 to 24% over the five-year period under review.

Figure 3.1 Trends in PMR at Korle-Bu Teaching hospital from 2006 to 2010

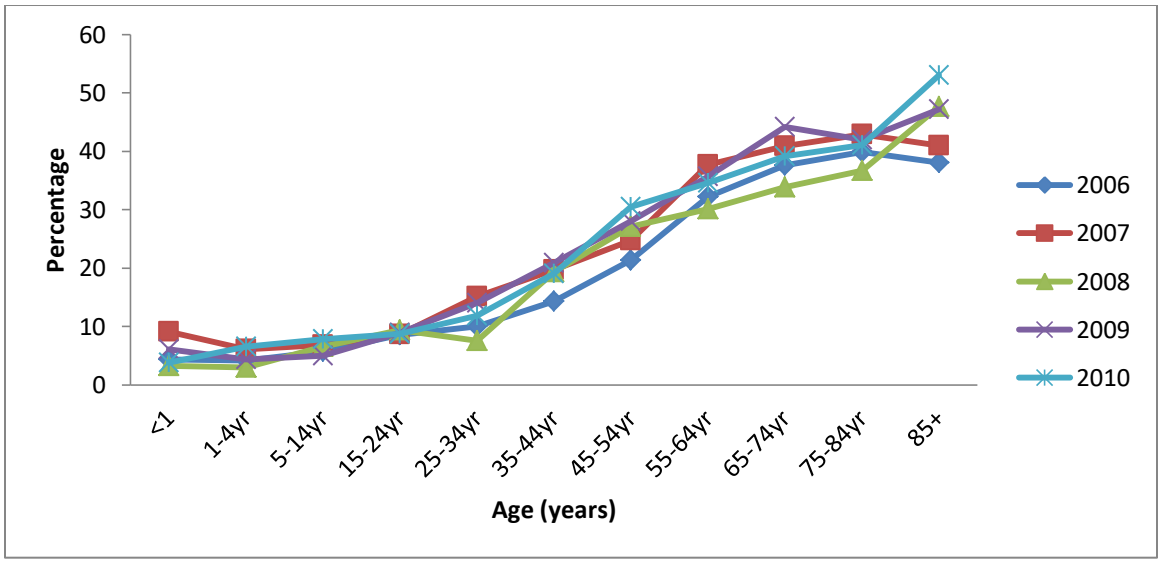


Basically, the Figure shows that cardiovascular diseases accounted for about one-fifth of the causes of death examined at Korle-Bu Teaching hospital from 2006 to 2010.

3.2 Age pattern of Proportionate Mortality Ratio (PMR) of cardiovascular diseases

Figure 3.2 shows the age pattern of PMR over the five-year period. The Figure shows that for each of the five year under review, PMR for CVDs increases from young age (15-24 years) with a steep rise in the middle ages to peak in the very old, accounting for almost 50% of deaths examined by age 85 years. Also, of interest is the steep rise in the mortality between 25 and 65 years when there was some appearance of plateauing thereafter.

Figure 3.2 Age Pattern of Proportionate Mortality Ratios of CVDs from 2006 to 2010



3.3 Age pattern of Proportionate Mortality Ratio (PMR) of CVDs and other causes of deaths from 2006 to 2010

In order to have a good understanding of the pattern of PMR of CVDs in relation to other diseases at the hospital within the five-year period, it is important to look at the mortality variations at each year by age so as to get a good grasp of the pattern. This will give a vivid picture of the interplay between the proportions of CVDs and all other diseases by age at KBTH. Also, in order to see the association between age and CVDs, Pearson chi-square was calculated. Studies have shown that after 35 years, chronic non-communicable diseases are major cause of deaths in Africa, the odds ratio (OR) of deaths from CVDs at age 35 years and above relative to under-35 years was calculated with 95% confidence interval (CI).

Figure 3.3.1 shows the Proportionate Mortality Ratio of CVDs and all other causes of deaths by age in 2006. The results show that while the PMR of cardiovascular diseases significantly increases at each age group but dropped at age 85 years, the proportions of all other diseases reduces at each age group except at age 85 years. The results show that in 2006, at infancy, there was a wide gap between proportionate mortality ratio of CVDs and all the other causes of death (a funnel-shape structure) but the gap began to close up at ages 55-64 years. This implies that CVDs mortality was higher among the older age groups than the younger age groups and also that CVDs accounted for higher proportions of deaths at older ages. The chi-square results show that there was a significant variation between age of patients and CVDs mortality in 2006 with an odds ratio of 3.840 (95% CI= 3.166-4.658). The results basically show that patients who are 35 years and above were about three times more likely to have died from CVDs compared with those who were below 35 years.

Figure 3.3.1 Age Patterns of PMR of CVDs and other causes of deaths in 2006

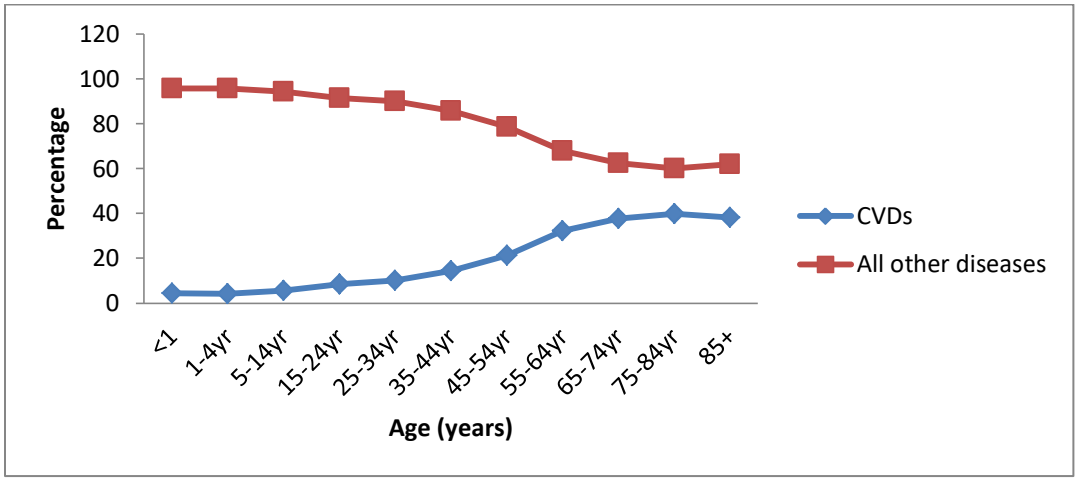


Figure 3.3.2 Age Patterns of PMR of CVDs and other causes of deaths in 2007

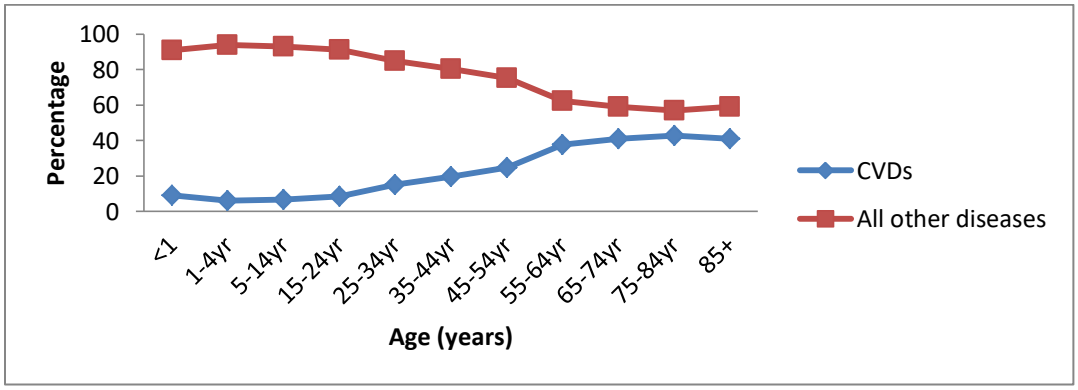


Figure 3.3.3 Age Patterns of PMR of CVDs and other causes of deaths in 2008

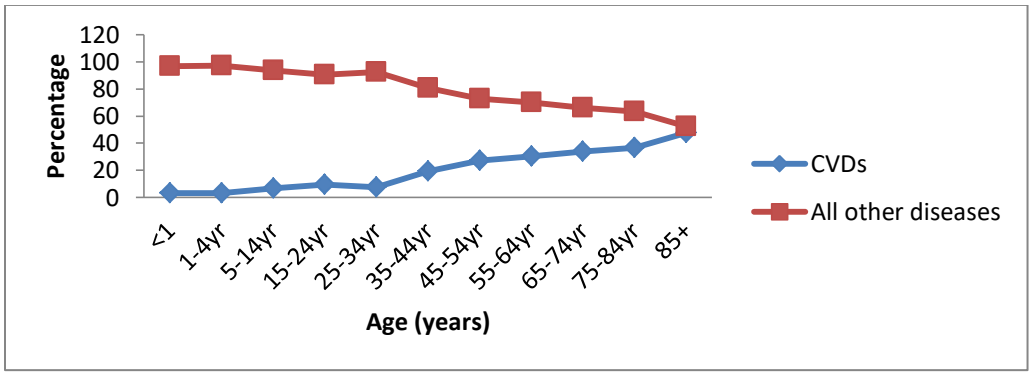


Figure 3.3.4 Age Patterns of PMR of CVDs and other causes of deaths in 2009

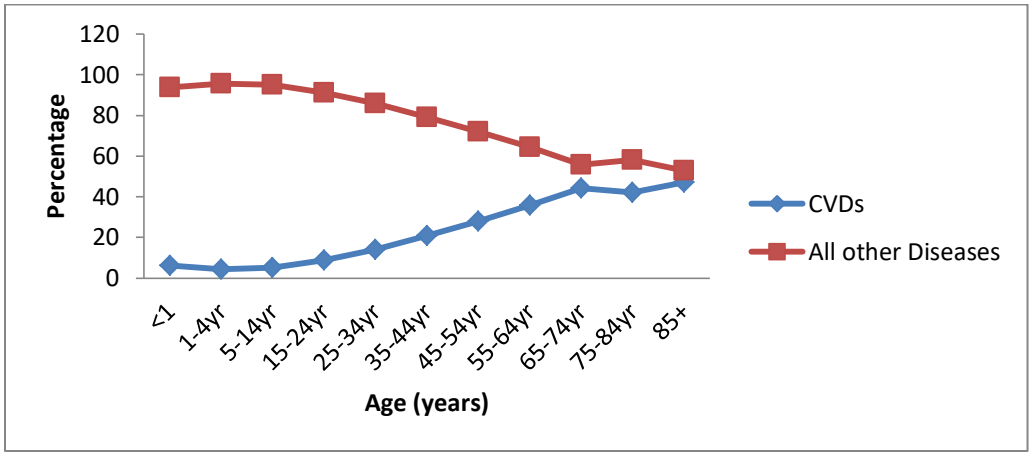


Figure 3.3.5 Age Patterns of PMR of CVDs and other causes of deaths in 2010

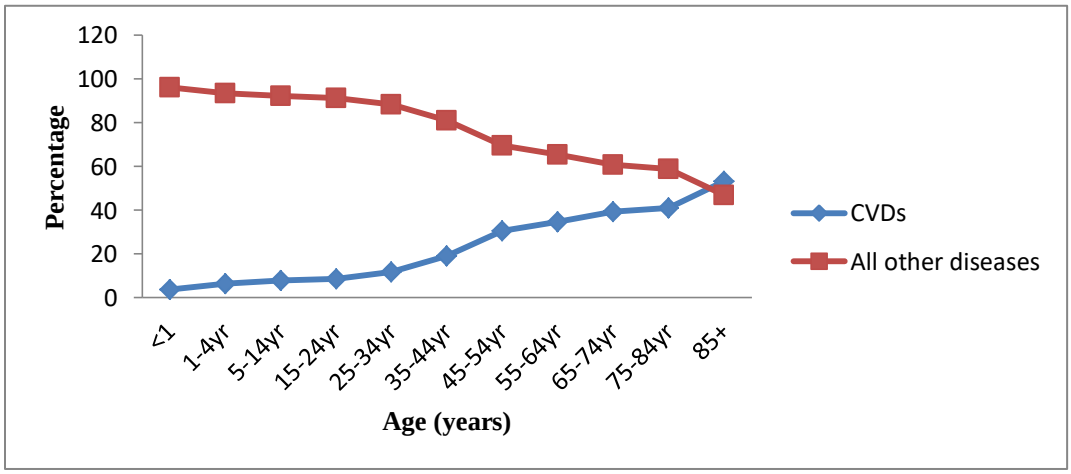


Figure 3.3.2 also shows the same pattern (funnel-shape) of PMR of CVDs in 2007 as in 2006 in which a wide gap existed between PMR of CVDs and all other causes of death at infancy but also began to close up at ages 55-64 years. The person chi-square also shows that there was a significant association between age and CVDs mortality. An estimate of the odds ratio of deaths among patients who are 35 years and above compared to those below 35 years was 3.220

(95% CI= 2.679 - 3.869). This indicates that in 2007, patients who are 35 years and above were about two times more likely to have died from CVDs compared to those who were less than 35 years.

In Figure 3.3.3, which shows the age pattern of PMR of CVDs and other causes of death in 2008, the pattern seen is quite different from that of 2006 and 2007. The Figure shows that although a wide gap existed between PMR of cardiovascular diseases and all other causes of death at infancy during this year, this gap started to close up by ages 35-44 years which was earlier than that of years 2006 and 2007. By age 85 years, almost equal proportions of people died from cardiovascular diseases and all other causes of death at KBTH. In 2008, the Pearson chi-square shows that there was significant variation between age and CVDs mortality. The results show that those who are 35 years and above had higher likelihood of death from CVDs compared to those who were below 35 years (OR= 4.739; 95% CI =3.759 - 5.974).

Figure 3.3.4 shows that although there existe a wide gap (in 2009) between PMR of CVDs and all the other causes of diseases at infancy as shown in the other previous years. The gap began to close at ages 45-54 years which is also earlier than year 2006 and 2007 but still higher than that of 2008. Also, a different pattern seen in this year (2009) is that the gap nearly closed up at ages 85 years indicating that cardiovascular diseases accounted for a significant high proportion of the causes of death among people age 85 years and above. In 2009, the Pearson chi-square showed that age was significantly associated with CVDs mortality. An estimate of the odds ratio of patients who were 35 years and above compared to those who were below 35 years was 3.996 (95% CI = 3.228 - 4.946). This also indicates that those who were 35 years and above were about four times more likely to have died from CVDs compared to their counterparts.

In 2010, Figure 3.3.5 shows the same pattern of the causes of death at infancy as in the other previous years. Similarly, the gap in the proportion of death from CVDs and all other causes of deaths began to close up at ages 45-54. However, a different pattern seen in this year is that by age 85 years, the proportion of deaths from CVDs was higher than that of the other causes of death examined at KBTH. The Pearson chi-square results showed that a significant variation existed between age and CVDs mortality. Hence, the findings revealed that those who are 35 years and above had a higher likelihood of CVDs deaths compared to their counterparts who are below 35 years (OR=4.116; 95% CI = 3.211 - 5.278).

Generally, the results in this section show that patients who are 35 years and above had higher likelihood of CVDs mortality compared to those who were below 35 years within the 5 years under review. This indicates that CVDs was a major cause of death among those who were 35 years and above.

3.4 Number of cardiovascular diseases mortality

Table 3.4 shows the number of cardiovascular diseases mortality among the autopsy cases at Korle-Bu teaching hospital (KBTH) from 2006 to 2010. The results show that the highest number of cardiovascular diseases' mortality was recorded in 2007 and a total of 4284 CVDs deaths were recorded within the period under review.

Table 3.4 Number of cardiovascular diseases mortality

Year	Number of Cardiovascular Diseases
2006	1019
2007	1035
2008	768
2009	841
2010	621
Total	**4284**

Source: **Computed from autopsy records from the KBTH 2006-2010**

3.5 Cardiovascular Diseases' Mortality by Sex

Literatures have shown that specific cause of death does not strike both males and females with the same intensity (Pollard et al., 1991). Also, female mortality at infancy and throughout life in most countries is lower than male mortality and thus, the importance of showing the proportionate mortality of CVDs by sex.

Table 3.5 Cardiovascular Diseases' Mortality by Sex (2006 – 2010)

	Sex		
Year	**Male**	**Female**	**Total**
2006	585 (57.4%)	434 (42.6%)	1019 (100%)
2007	582 (56.2%)	453 (43.8%)	1035 (100%)
2008	463 (60.3%)	305 (39.7%)	768 (100%)
2009	465 (55.3%)	376 (44.7%)	841 (100%)
2010	361 (58.2%)	260 (41.8%)	621 (100%)
Total	**2456 (57.2%)**	**1827 (42.8%)**	**4284 (100%)**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Table 3.5 shows that the CVDs mortality was higher among the males compared to females for the five-year period. Also, the results show that in general, about fifty-seven percent (57.2%) of CVDs mortality from 2006 to 2010 occurred among the males indicating a male-female ratio of

1.7: 1. This pattern is also similar to the overall mortality at KBTH which shows a male-female mortality ratio of 1.5: 1.

In order to determine the statistical significance of the relationship between sex and patterns of CVDs, Yates correction chi-square and the odds ratio were calculated. In 2006, the results show that the sex difference in terms of CVDs was statistically significant (X^2 with Yates correction = 11.554, $P < 0.05$). An estimate of the odds ratio (OR) of death from cardiovascular diseases in females compared to males is 1.279 (95% CI= 1.111- 1.472). This means that females were about 28% more likely to have died from CVDs compared to males. Also, in 2007, there is a significant variation between sex and cardiovascular diseases mortality (X^2 with Yates correction = 7.754, $P < 0.05$). The likelihood of dying from CVDs among females in 2007 is 1.225 relative to males with a 95% confidence interval (CI) ranging from 1.062 to 1.411.

Also, the findings show that in 2008, females were about 4.6% more likely to have died from CVDs compared to males (odds=1.046; 95% CI=0.9213 - 1.1181). In 2008, sex did not show significant variation with CVDs (X^2 with Yates correction = 0.030, $P > 0.05$). However, the odds of dying from CVDs among females are 1.018 compared to their counterparts (95% CI= 0.864 – 1.200). This indicates that females were about 1.02 times as likely to have died from CVDs as males. Also, the likelihood that more females died from CVDs compared to males in 2009 is 1.278 (95% CI= 1.089 - 1.494). These results also show a statistical significance between sex and CVDs (X^2 with Yates correction = 8.850, $P > 0.05$). In 2010, the results show that females were 9.8% more likely to die from CVDs compared to males (95% CI= 0.907, 1.310), although, the results show that there is no significant relationship between sex and CVDs (X^2 with Yates correction = 0.846, $P > 0.05$).

Generally, the results in this section show that females were more likely to die from CVDs compared to males within the five-year period, although the association was not significant in 2008 and 2010. However, the implication of this is that the burden of cardiovascular diseases was more on females than males within the five years under review.

CHAPTER FOUR

CATEGORIES OF CARDIOVASCULAR DISEASES MORTALITY

4.0 Introduction

This chapter examines the various categories of cardiovascular diseases (CVDs) mortality at Korle-Bu Teaching Hospital. The major categories include: hypertensive heart disease, cerebrovascular diseases, congestive cardiac failure, myocardial infarction, pulmonary heart disease and diseases of pulmonary circulation, coronary artery disease and "other cardiovascular diseases". Those in the other categories of cardiovascular diseases include: rheumatic heart disease, congenital heart disease and deep vein thrombosis. The trends in the categories of cardiovascular diseases will be examined vis-à-vis age, sex, year and place of residence.

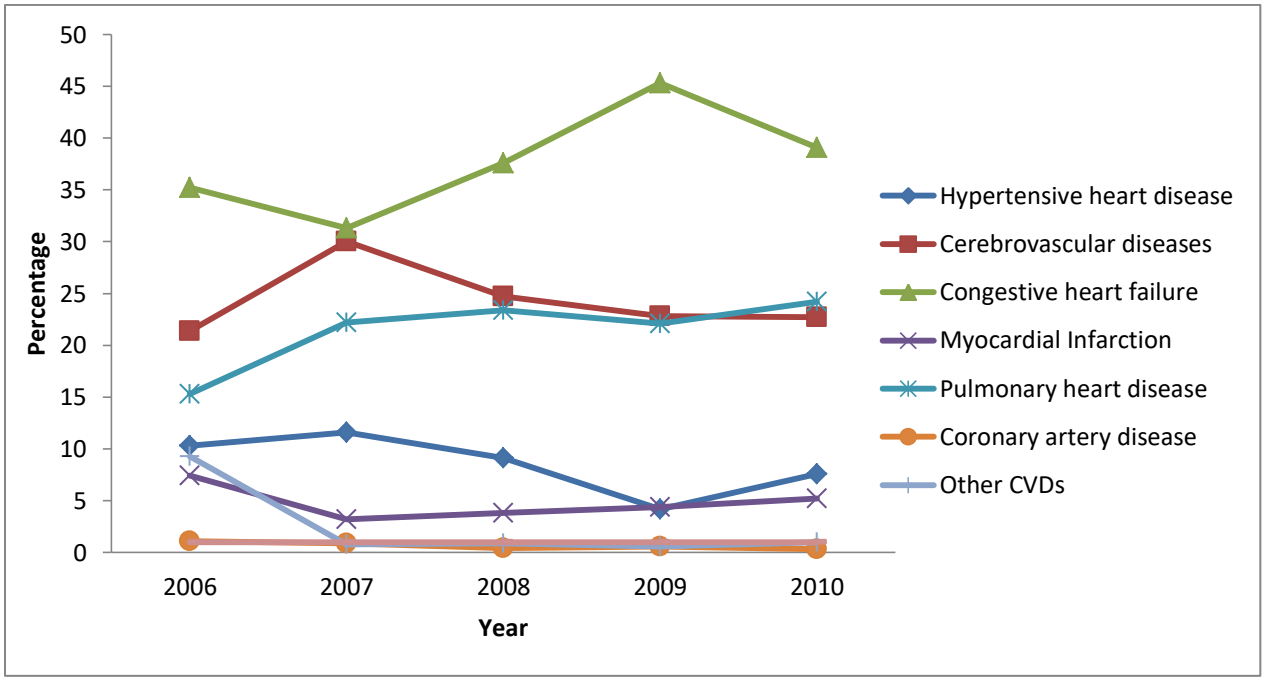
4.1 Categories of Cardiovascular Diseases from 2006 to 2010

Figure 4.1 shows the pattern in the seven categories of cardiovascular diseases at Korle-Bu teaching hospital from 2006 to 2010. The figure shows that congestive heart failure constituted the highest proportion of the causes of death within the five-year period followed by cerebrovascular diseases. The pattern that can be seen is that at a point when the proportions of death from congestive heart failure dropped in 2007, deaths from cerebrovascular diseases and pulmonary heart diseases were rising.

Also, when congestive heart failure picked up again in 2007 to 2009, deaths from cerebrovascular diseases dropped while that of pulmonary heart diseases was also increasing although not as congestive heart failure. The pattern in hypertensive heart disease shows that deaths from this category of cardiovascular diseases declined every year but increased between

2009 and 2010. Also, the trends in Myocardial Infarction, coronary artery diseases and other categories of cardiovascular diseases show that they were not major causes of death examined among the autopsy cases at KBTH within the 5-year period. The results basically show that congestive heart failure was the leading cause of death at KBTH within the five-year period, followed by cerebrovascular diseases and pulmonary heart disease.

Figure 4.1 Patterns of Cardiovascular diseases Mortality (2006 – 2010)



4.2 Age Patterns of Categories of Cardiovascular diseases from 2006 to 2010

It is important to know the patterns of the categories of cardiovascular diseases by age so as to understand the age variations in mortality. Figure 4.2.1 shows that hypertensive heart disease constituted the highest proportions of CVDs at older ages in 2006 with a median age of 54 years. It started to rise after age 15-24 years, reaches the peak at age 45-54 years (plateau), and dropped afterwards till age 85 years. Cerebrovascular diseases also started to rise after ages 15-24 years

and reached its peak at age 65-74 years and a significant proportion of those age 85 years and above (7.6%) also died of cerebrovascular diseases. The pattern in congestive heart failure shows that there was a steep rise in the death among the youth (15-24 years) and reaches its peak at ages 55-64 years. Myocardial Infarction also follows the same pattern as hypertensive heart disease, cerebrovascular diseases and congestive heart failure by picking up among the youth but going down among those aged 25-34 years before picking up again and plateauing at ages 55-64 years.

In essence, although congestive heart failure constituted the highest proportion of deaths examined due to cardiovascular diseases in 2006, its impact is widely spread across the different age groups whereas although hypertensive heart disease was not among the first three leading causes of mortality due to cardiovascular diseases, its impact was mostly felt between ages 45 to 54 years just as coronary artery disease. The Figure shows that nobody was reported to have died of coronary artery disease between ages 0-14 years which is expected because this age group would not have been so exposed to the risk factors of the disease which are mostly due to lifestyles. However, it is surprising that nobody died of the disease at ages 35-44 years and 75-84 years. Also, among those which belong to "other categories of CVDs", rheumatic heart disease and congenital were the major causes of death at younger ages whereas deep vein thrombosis was a major cause at older ages.

Figure 4.2.2 shows that half of those who died from "other cardiovascular diseases categories" in 2007 are infants. This was mainly due to rheumatic heart disease and congenital heart disease. Also, slightly more than ten percent of the people who died of coronary artery disease were youth (15-24 years). The peak of deaths from coronary artery disease was reached at ages 55-64 years. The pattern generally seen is that most of the categories of cardiovascular diseases pick up

at ages 15-24 years. However, it is surprising to see that about six percent (6.1%) of deaths from myocardial infarction in 2007 occurred among those age 5-14 years. Further studies need to be carried out in order to determine why this age group died of these diseases because myocardial infarction is mainly due to lifestyles and aging which ordinarily shouldn't occur among this age group.

Figure 4.2.1 Age patterns of categories of cardiovascular diseases Mortality in 2006

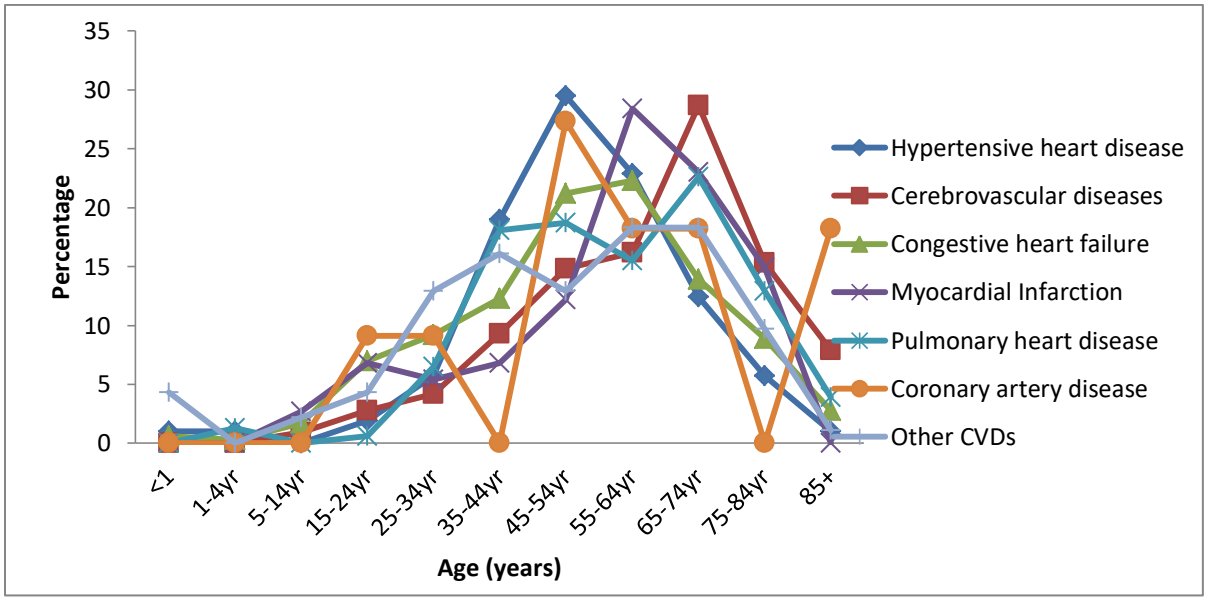


Figure 4.2.2 Age Patterns of categories of cardiovascular diseases Mortality in 2007

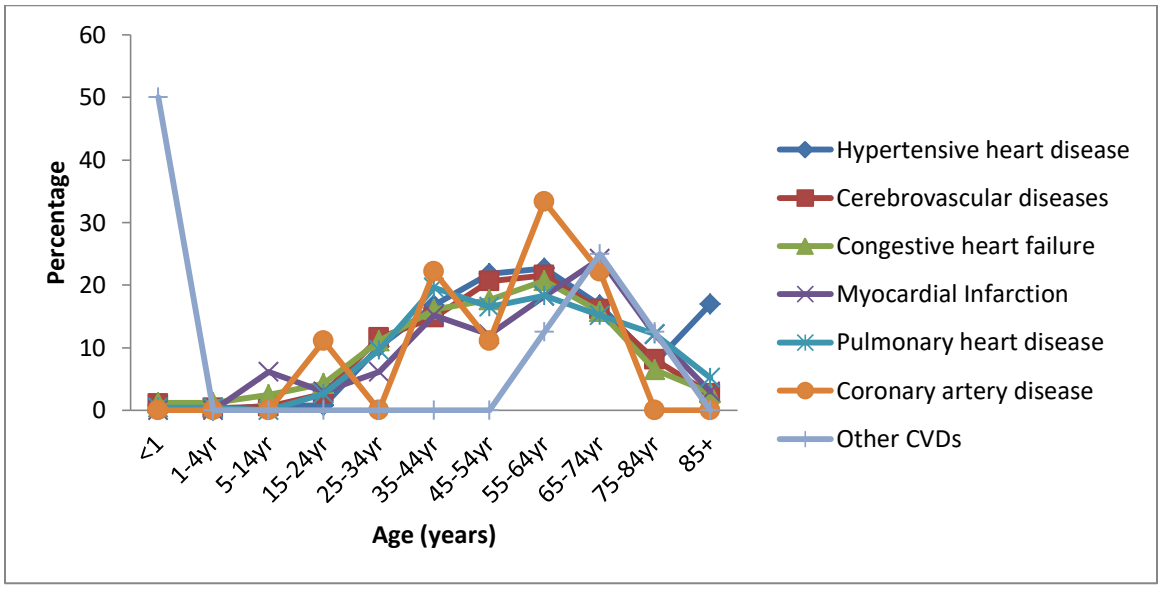


Figure 4.2.3 Age Patterns of Categories of Cardiovascular diseases Mortality in 2008

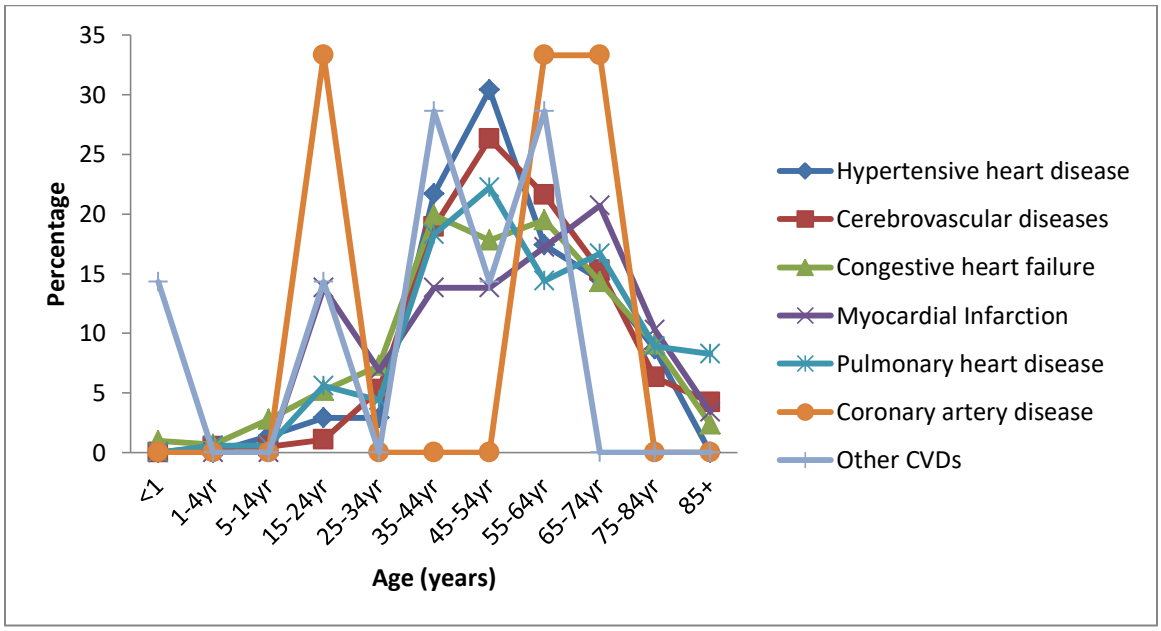


Figure 4.2.4 Age Patterns of Categories of Cardiovascular diseases Mortality in 2009

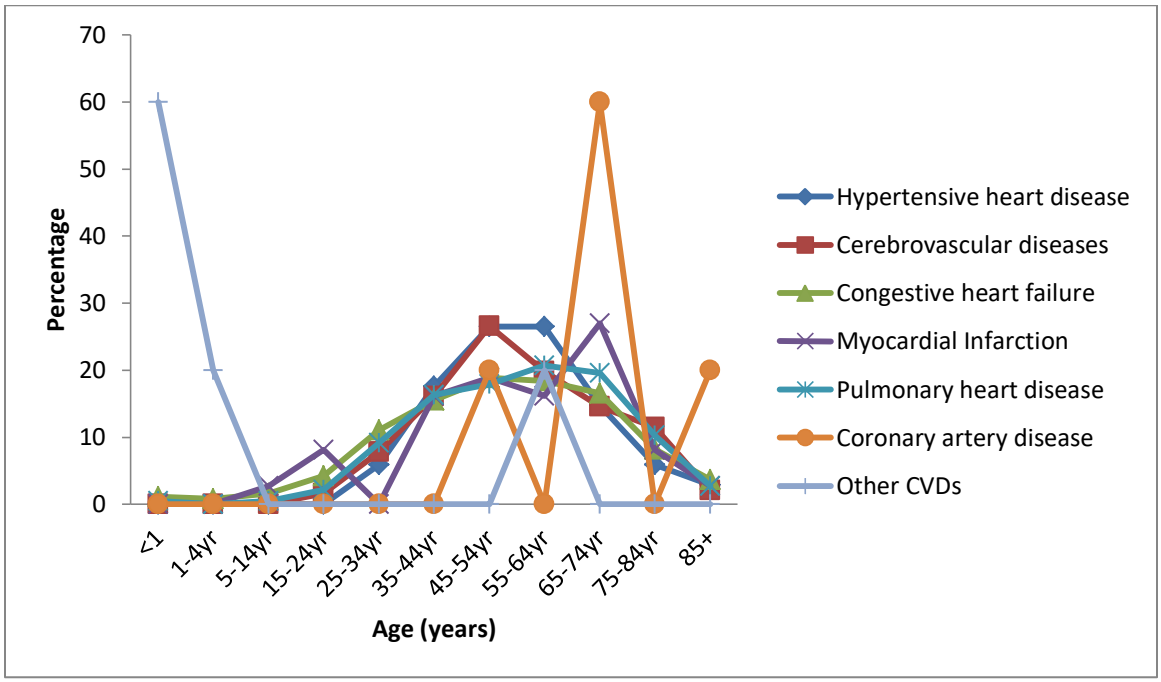
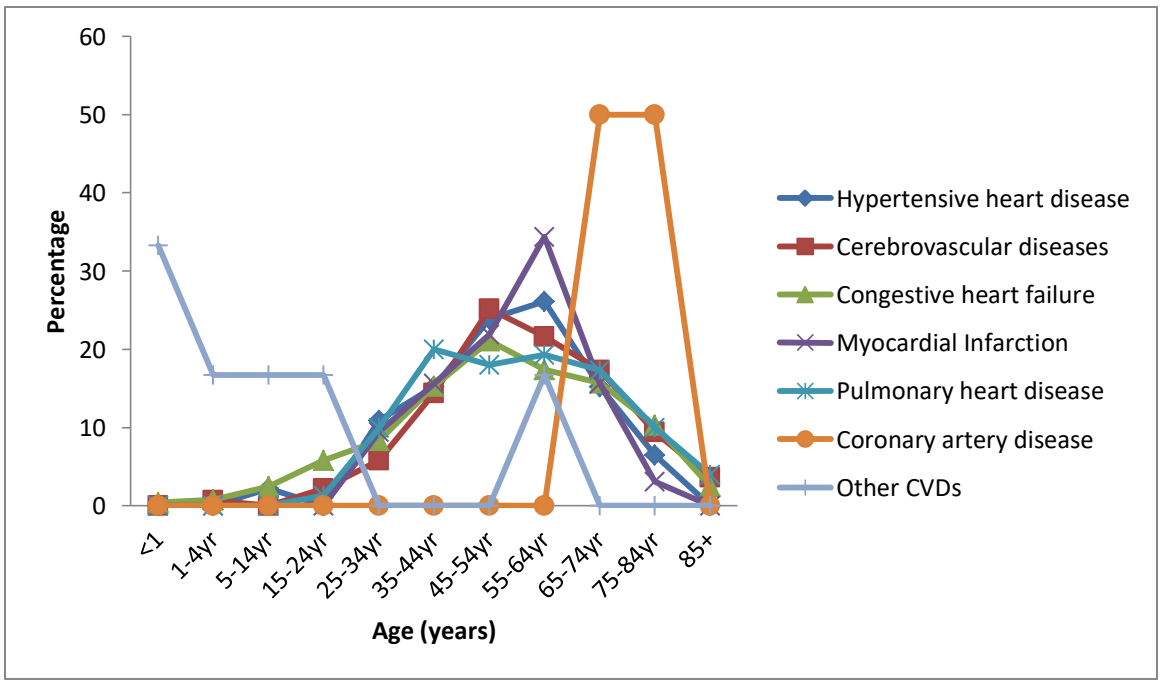


Figure 4.2.5 Age Patterns of Cardiovascular diseases Mortality in 2010



In 2008, the figure 4.2.3 shows that equal proportions of people died of coronary artery disease at ages 15-24 years, 55-64 years and 65-74 years. This indicates that coronary artery disease constitutes a major cause of death among the youth and older age group (55-74 years) with no effect at the other age groups. Mortality from the other categories of cardiovascular diseases tends to be widely distributed among the age groups.

In Figure 4.2.4, about six of ten deaths (60%) from "other categories" of cardiovascular diseases occurred among the infants. About sixty percent of the deaths from coronary artery disease occurred among those age 65-74 years which also constituted the highest proportion of deaths in this age group relative to other categories of cardiovascular diseases. The results also show that deaths from myocardial infarction occurred among those age 5-14 years which is usually not the case based on statistics on age pattern of myocardial infarction. Also, deaths from congestive heart failure, myocardial infarction, hypertensive heart disease and pulmonary heart disease spread across the age groups.

Figure 4.2.5 shows the pattern of cardiovascular diseases mortality in 2010. The patterns of categories of cardiovascular diseases in 2010 also show that all the deaths from coronary artery disease occurred between ages 65 and 84 years. Also, a higher proportion of deaths from "other categories" of cardiovascular diseases occurred at infancy. Death from other categories of cardiovascular diseases spread across the age groups.

The age pattern generally shows that other categories of cardiovascular diseases like rheumatic heart disease and congenital heart disease were major causes of under-five CVDs death within the five-year period. Also, myocardial infarction featured prominently as the main cause of CVDs mortality among children ages 5-14 years within the period. Among the young adult (25-

64 years), hypertensive heart disease and myocardial infarction constitute the highest causes of CVDs' mortality from 2006 to 2010. Among those who are 65 years and above, the main causes of death within this period are cerebrovascular diseases, coronary artery disease, pulmonary heart disease and deep vein thrombosis.

4.3 Sex pattern of categories of cardiovascular diseases (2006 – 2010)

This section examines the sex pattern of the categories of cardiovascular diseases at different years. This is very important because mortality varies by sex and determining a pattern will go a long way to help in putting appropriate policies in place.

Table 4.3 shows that a higher proportion of the males died of hypertensive heart disease, cerebrovascular diseases, congestive heart failure, myocardial infarction and coronary artery disease. On the other hand, a higher proportion of women died from pulmonary heart disease and "other categories" of cardiovascular diseases like rheumatic heart disease, congenital heart disease and deep vein thrombosis. In general, the results basically show that a higher proportion of males died of cardiovascular diseases compared to females in 2006.

In 2007, the Table shows that a higher proportion of males died of hypertensive heart disease, cerebrovascular diseases, congestive heart failure, myocardial infarction, coronary artery disease and "other categories" of cardiovascular diseases. However, more than half of the people who died of pulmonary heart disease were females. The sex distribution of categories of cardiovascular diseases in 2007 shows the same pattern with that of 2006 because of the higher proportion of females dying from pulmonary heart disease. The results basically show that more than half of those who died of cardiovascular diseases in 2007 were males.

Table 4.3 further shows that a higher proportion of the males died of all the categories of cardiovascular diseases except pulmonary heart disease in which more than half of those who died of the disease were women. In general, more than six out of ten people (60.3%) who died of cardiovascular diseases at KBTH in 2008 were males. This also shows that more women died of pulmonary heart disease in 2006, 2007 and 2008. In 2009, the results slightly show a pattern different from the other preceding years because more than six out of ten people (62.9%) who died of hypertensive heart and more than half (57.5%) of those who died of pulmonary heart disease were females. Another pattern noted is that all the people who died of coronary artery disease in this year were males. Basically, more than half of the people who died of cardiovascular diseases in 2009 were males.

Then in 2010, Table 4.3 shows that more males died of hypertensive heart disease, cerebrovascular diseases, congestive heart failure and myocardial infarction. However, a higher proportion of females died of pulmonary heart disease, a pattern which is seen in other years. The results show that in 2010, an equal proportion of males and females died of coronary artery disease and "other cardiovascular diseases" and this is a pattern which was not seen in previous years.

In summary, this section shows that generally, a higher proportion of CVDs mortality for the different categories of CVDs (congestive heart failure, cerebrovascular diseases, pulmonary heart disease, hypertensive heart disease, coronary artery disease, myocardial infarction, and other categories of CVDs) occurred among males within the five-year period except for pulmonary heart disease. The results also show that equal proportion of males and females died from coronary artery disease and other categories of CVDs in 2010.

Table 4.3 Sex Pattern of Categories of CVDs (2006 - 2010)

Year	Categories of CVDs	Male		Female		Total	
		Number	%	Number	%	Number	%
2006	Hypertensive heart disease	57	54.3	48	45.7	105	100.0
	Cerebrovascular diseases	138	63.3	80	36.7	218	100.0
	Congestive heart failure	222	61.8	137	38.2	359	100.0
	Myocardial Infarction	54	72.0	21	28.0	75	100.0
	Pulmonary heart disease	69	44.2	87	55.8	156	100.0
	Coronary artery disease	6	54.5	5	45.5	11	100.0
	Other CVDs	39	41.1	56	58.9	95	100.0
2007	Hypertensive heart disease	66	55.0	54	45.0	120	100.0
	Cerebrovascular diseases	191	61.4	120	38.6	311	100.0
	Congestive heart failure	195	60.2	129	39.8	324	100.0
	Myocardial Infarction	22	66.7	11	33.3	33	100.0
	Pulmonary heart disease	95	41.3	136	58.7	230	100.0
	Coronary artery disease	7	87.5	1	12.5	8	100.0
	Other CVDs	6	75.0	2	25.0	8	100.0
2008	Hypertensive heart disease	46	65.7	24	34.3	70	100.0
	Cerebrovascular diseases	116	61.1	74	38.9	190	100.0
	Congestive heart failure	192	66.4	97	33.6	189	100.0
	Myocardial Infarction	22	75.9	7	24.1	29	100.0
	Pulmonary heart disease	79	43.9	101	56.1	180	100.0
	Coronary artery disease	2	66.7	1	33.3	3	100.0
	Other CVDs	6	85.7	1	14.3	7	100.0
2009	Hypertensive heart disease	13	37.1	22	62.9	35	100.0
	Cerebrovascular diseases	127	66.1	65	33.9	192	100.0
	Congestive heart failure	212	55.6	169	44.4	381	100.0
	Myocardial Infarction	25	67.6	12	32.4	37	100.0
	Pulmonary heart disease	79	42.5	107	57.5	186	100.0
	Coronary artery disease	5	100.0	0	0.0	5	100.0
	Other CVDs	4	80.0	1	20.0	5	100.0
2010	Hypertensive heart disease	28	59.6	19	40.4	47	100.0
	Cerebrovascular diseases	90	63.8	51	36.2	141	100.0
	Congestive heart failure	152	62.6	91	37.4	243	100.0
	Myocardial Infarction	23	71.9	9	28.1	37	100.0
	Pulmonary heart disease	64	43.0	86	57.0	149	100.0
	Coronary artery disease	1	50.0	1	50.0	2	100.0
	Other CVDs	3	50.0	3	50.0	6	100.0

Source: **Computed from autopsy records from the KBTH 2006-2010**

4.4 Categories of cardiovascular diseases by Locality

Literatures have shown that environmental factors may have an influence on the morbidity and mortality of cardiovascular diseases. For instance an area that is more prone to the risk factors of cardiovascular diseases may likely experience more mortality from the disease. This section will examine the variation of the categories of cardiovascular diseases by locality from 2006 to 2010. The locality in this work refers to the Police Station in which the police report was gotten before autopsy was being done at KBTH. It is assumed that people will normally get the police report from the closest police station which they will be brought for autopsy. In other words, it may be extrapolated that the report may reflect the locality of the dead person. This section is therefore based on this assumption.

Figure 4.4.1 shows the pattern of hypertensive heart disease from 2006 to 2010 by locality. The Figure shows that from 2006 to 2009, a higher proportion of people who died from hypertensive heart disease were from Korle Bu Police Station. However, in 2010, less than half of the autopsy cases were from Korle Bu Police Station. This basically indicates that a larger proportion of deaths from hypertensive heart disease within the five year period were from Korle Bu Police Station. This may be as a result of under reporting of deaths from the other areas and it may also mean that there may be high prevalence of hypertensive heart disease at Korle Bu areas (i.e, Korle Gonno) within this period. There is need for screening exercise to be done in this area so as to know the prevalence of the disease and also help primary and secondary prevention of the disease. In Figure 4.4.2, a larger proportion of deaths from cerebrovascular diseases within the five-year period were also from Korle Bu Police Station. The Figure shows that the highest proportion of death from cerebrovascular diseases at Korle Bu Police Station occurred in 2009.

Figure 4.4.1 Patterns of Hypertensive heart disease at KBTH (2006 – 2010)

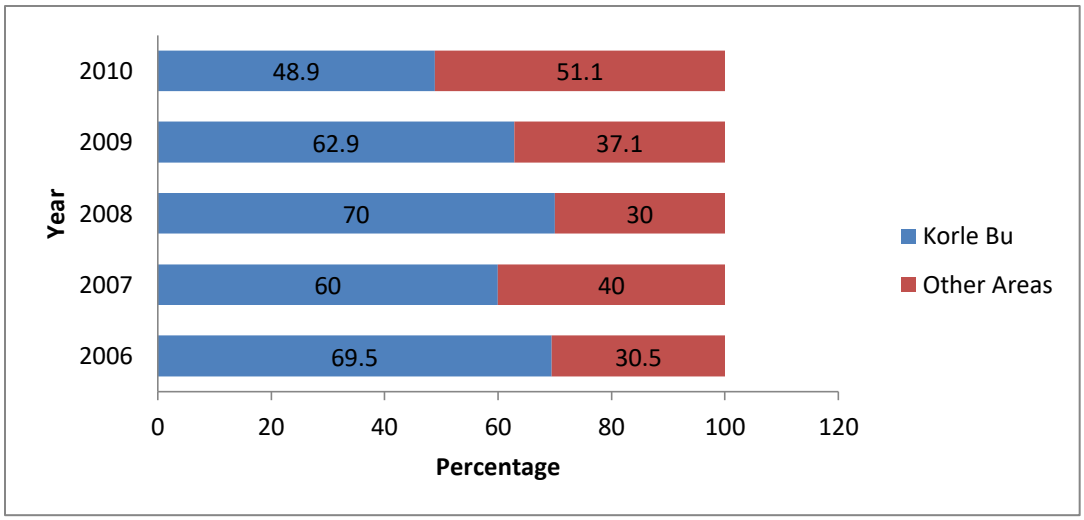
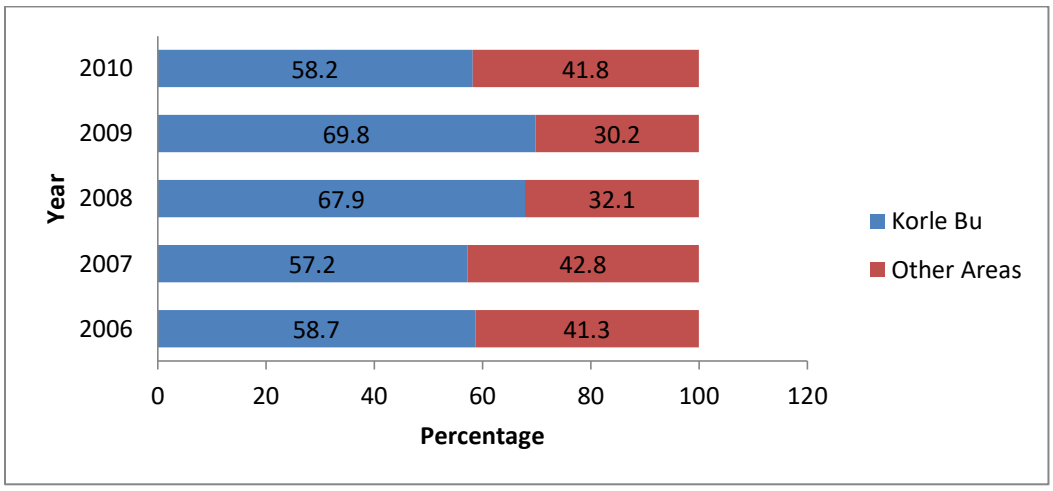


Figure 4.4.2 Patterns of cerebrovascular diseases at KBTH (2006 – 2010)



Also, as shown in Figure 4.4.3, the pattern seen here is that most of the deaths from congestive heart failure within the five-year period were from Korle Bu Police Station. Specifically, the highest proportion of death from congestive heart failure at Korle Bu Police Station occurred in 2007. The results basically show that about six or more out of ten deaths from congestive heart failure at KBTH within this period were from Korle Bu Police Station. In Figure 4.4.4, most of the deaths from myocardial infarction within the period came from Korle Bu Police Station

except in 2010 in which a larger proportion came from other Police Station within The Greater Accra Region. Just as the pattern of congestive heart failure, the results show that a larger proportion of death from myocardial infarction at Korle Bu Police Station within the five-year period occurred in 2007.

Also, Figure 4.4.5 reveals that in 2006, a higher proportion of deaths from coronary artery disease came from other police stations in The Greater Accra Region. The pattern changes from 2007 to 2009 in which a larger number of deaths from coronary artery disease came from Korle Bu Police Station. The results showed that an equal proportion of deaths from coronary artery disease occurred at Korle Bu Police Station and other Police Stations. Specifically, the highest proportion of death from this disease occurred in 2007. Figure 4.4.6 shows that a larger proportion of deaths from pulmonary artery disease within the five-year period came from Korle Bu Police Station. There was no significant difference from 2007 to 2010 in terms of deaths from pulmonary heart disease at Korle Bu Police Station. In other words, the lowest proportion of death from pulmonary heart disease occurred in 2006. In Figure 4.4.7, a larger proportion of deaths (57.1%) in 2008 came from other police stations within Greater Accra Region. Also, in the other years, a higher proportion of death from other categories of cardiovascular diseases (rheumatic heart disease, congenital heart disease and deep vein thrombosis) came from Korle Bu Police Station with the highest seen in 2009.

Figure 4.4.3 Patterns of Congestive Heart Failure at KBTH (2006 – 2010)

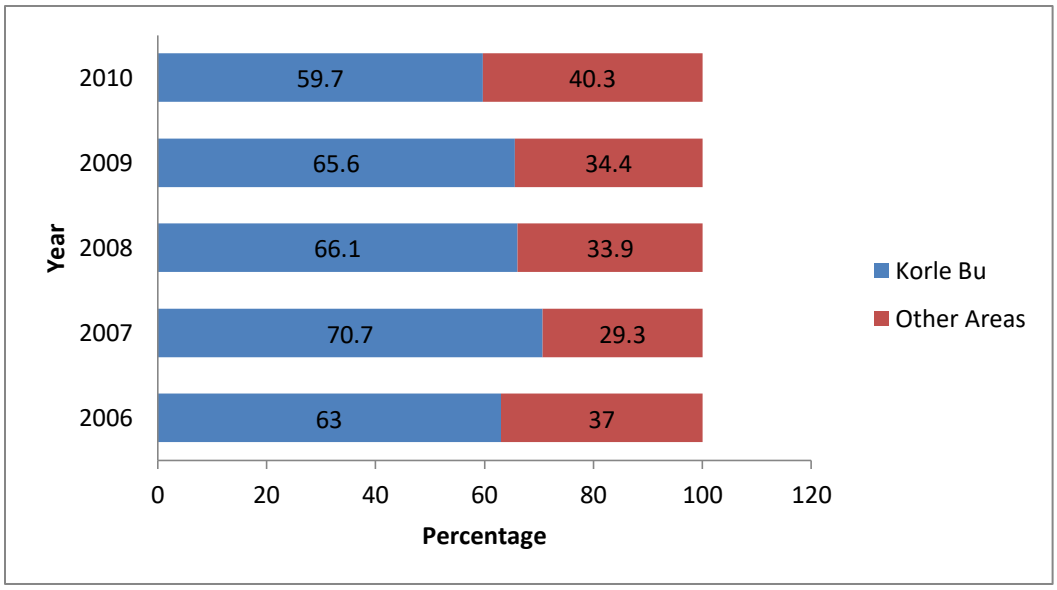


Figure 4.4.4 Patterns of Myocardial Infarction at KBTH (2006 – 2010)

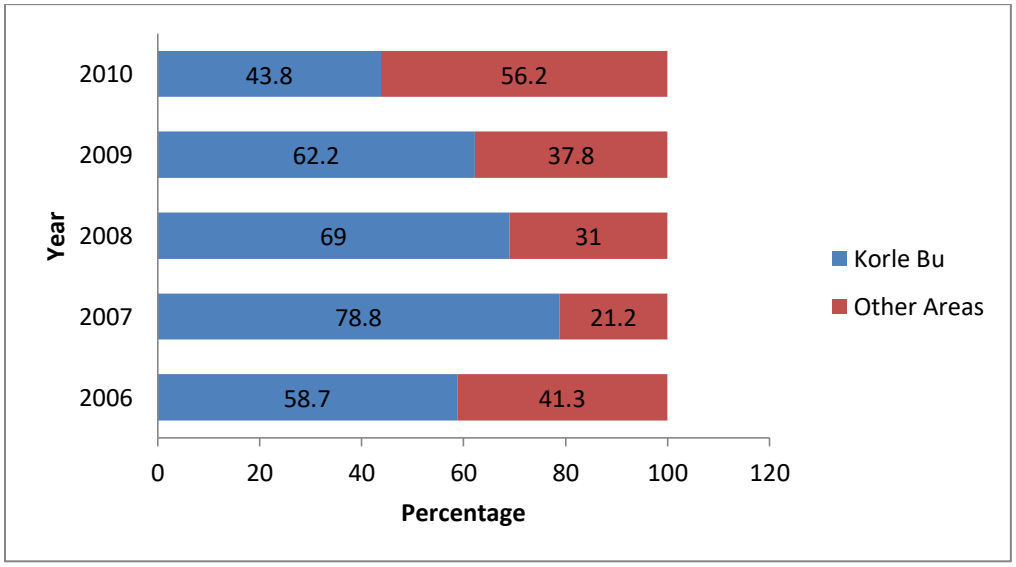
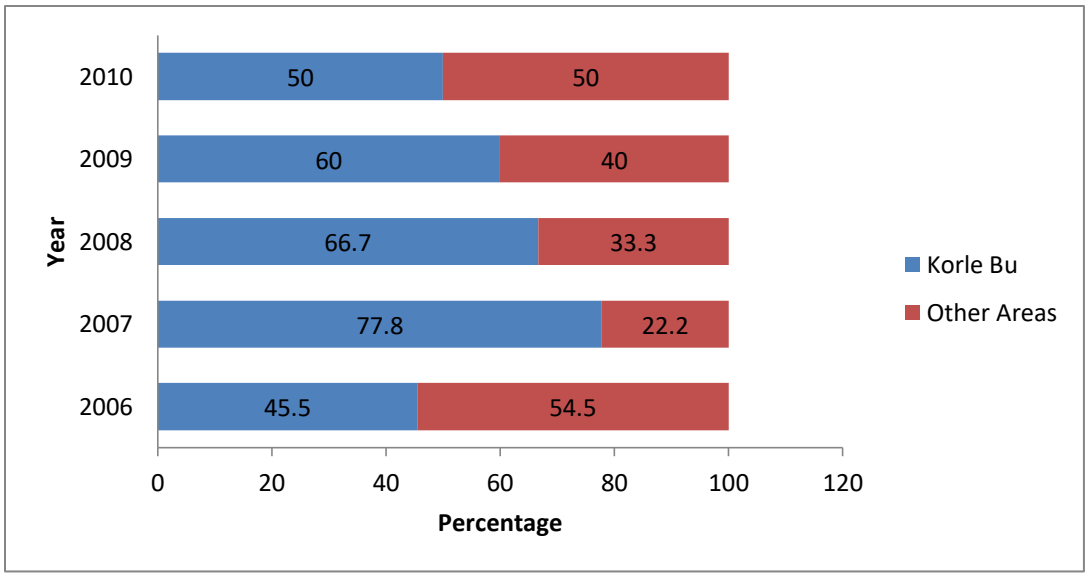


Figure 4.4.5 Patterns of Coronary Artery disease at KBTH (2006 – 2010)



4.4.6 Patterns of Pulmonary heart disease at KBTH (2006 – 2010)

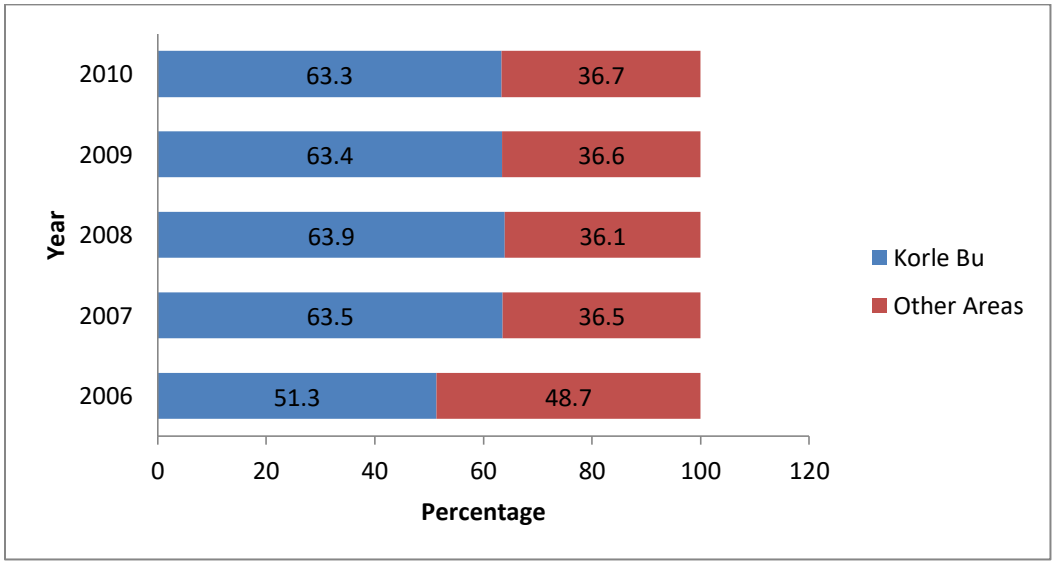
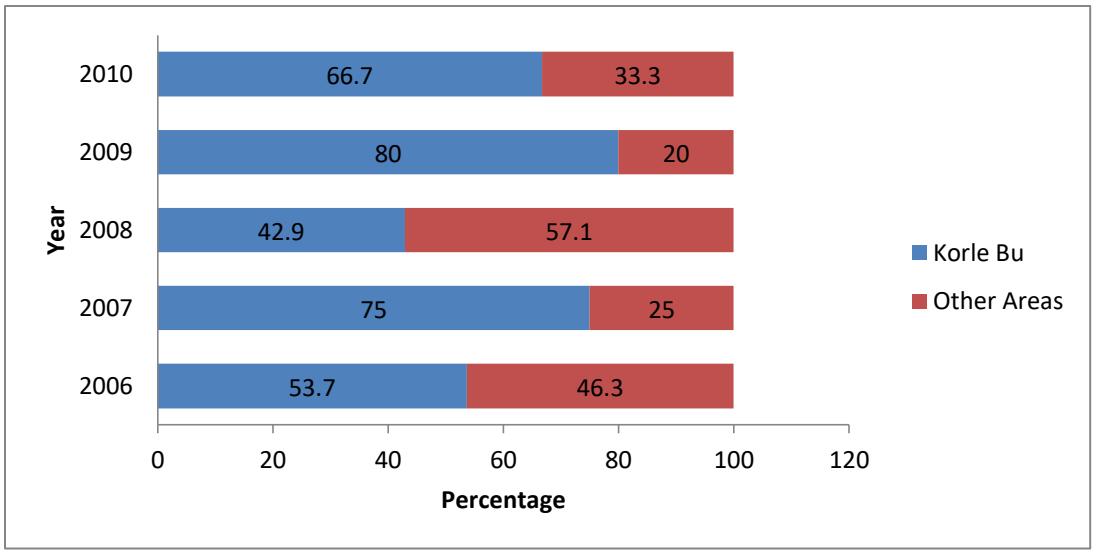


Figure 4.4.7 Patterns of 'other cardiovascular' diseases at KBTH (2006 – 2010)



In summary, this section shows that out of the deaths from the different categories of CVDs in 2006 and 2008, a larger proportion of deaths from hypertensive heart disease came from Korle Bu Police Station. This indicates that hypertensive heart disease may be predominant in this year. Also, the results basically showed that congestive heart failure, myocardial infarction and coronary artery disease were major causes of CVDs' deaths among the autopsy cases from Korle Bu Police Station in 2007. In 2009, cerebrovascular diseases accounted for the highest cause of CVDs' death from Korle Bu Police Station while other categories of cardiovascular diseases (rheumatic heart disease, congenital heart disease and deep vein thrombosis) constituted the highest proportion of the causes of CVDs' deaths from Korle Bu Police Station in 2010. This clearly indicates a kind of fluctuations in terms of the pattern of CVDs among the deaths from Korle Bu Police Station. However, it is important that community studies be carried out at Korle Gonno which is located around Korle Bu Police Station in order to examine the knowledge of people in this area about cardiovascular diseases and to see the gaps between knowledge and

behaviour towards the risk factors of CVDs. This will eventually help to improve the life expectancy of people in this area most especially since they are closer to Korle Bu Teaching Hospital. It will also be interesting to find out why people do not seek medical care on time.

CHAPTER FIVE

YEARS OF POTENTIAL LIFE LOST (YPLL) AT KORLE-BU TEACHING HOSPITAL FROM 2006 TO 2010

5.0 Introduction

This section examines the years of potential life lost (YPLL) and percentage years of potential life lost (%YPLL) from cardiovascular diseases at Korle-Bu teaching hospital from 2006 to 2010. Basically, Years of potential life lost involves estimating the average time a person would have lived had he or she not died prematurely (Gordis, 2009; Gardner et al., 1990). Also, YPLL recognizes that death occurring in the same person at a younger age clearly involves greater loss of future productive years than death occurring at an older age. In essence, YPLL is used to estimate the burden of disease in the population.

There are mainly two steps in calculating YPLL: the first step involves subtracting the patients' age at death from the standard age, which is 59 years in this study (the average life expectancy within the five-year period). This indicates that an infant dying at 1 year of age has lost 58 years of life (59 - 1) but a person dying at 59 years has lost nothing because he or she has fully lived the expected number of years. Also, anyone who dies at ages above 59 years has also lost nothing because he/she is assumed to have lived above the expected years. The implication of this is that the younger the age at which death occurs, the more years of potential life will be lost. In the second step, the YPLL for each individuals are then added together to yield the total YPLL for specific cause of death. The %YPLL was calculated by dividing the YPLL for a particular cause of death by the total YPLL.

5.1 Years of Potential Life Lost (YPLL) at KBTH (2006 – 2010)

Table 5.1 shows the total years of potential life lost before age 59 years from autopsy cases at KBTH (2006-2010). It also shows the sex differences in terms of the years of potential life lost. The results show that the number of YPLL to CVDs increased from the base year (2006) to a peak in 2008. After 2008, the YPLL to CVDs dropped in 2009 and picked up again in 2010. Basically, there was a kind of fluctuation in the number of YPLL to CVDs within the five years under review. Generally, Table 5.1 shows that the greatest single source of YPLL occurred in 2008. Looking at the proportion of YPLL to CVDs relative to other diseases among the autopsy cases, it can be seen that in 2006, the proportion of the YPLL due to CVDs was about one-tenth (10.2%) of the total YPLL to all diseases. This proportion increased significantly in each year and by 2010, the YPLL to CVDs was about one-fifth (20.3%) of the total YPLL to all diseases (which is about twice that of 2010). This in a way implies that the premature deaths from CVDs increased in each year within the five-year under review except in 2009 in which a drop in YPLL was observed. One reason why one may say that the pattern seen may depict that the burden of CVDs increased in each year is because the contribution of CVDs to YPLL increased while that of the other diseases decreased within the 5-year under review.

Also, Table 5.1 shows the sex variation in the YPLL and percentage YPLL from cardiovascular diseases and other diseases at KBTH from 2006 to 2010 before age 59 years. The results show that the proportion of YPLL to CVDs among males increased significantly between 2006 and 2007 and dropped between 2008 and 2009, but rose again in 2010. The highest proportion of YPLL to CVDs among males occurred in 2010 which is approximately one-fifth (19.5%) of the total YPLL to all diseases among males in this year.

Among the females, the results show that the proportion of YPLL to CVDs increased from 2006 through 2008, dropped in 2009 and picked up again in 2010. The pattern shown among females slightly reflects the pattern of the total YPLL to CVDs in the five-year period. This is because in 2006, the proportion of YPLL to CVDs among females was slightly more than one-tenth (11.6%) of the total YPLL to all diseases among the autopsy cases, but by 2010, about one-fifth (21.3%) of the total YPLL to all diseases among females was due to CVDs.

Table 5.1 Years of Potential Life lost at KBTH (2006 - 2010)

Year	Diseases	Male		Female		Total	
		YPLL	%YPLL	YPLL	%YPLL	YPLL	%YPLL
2006	Cardiovascular Diseases	5068	9.2	4496	11.6	9564	10.2
	Other diseases	49907	90.8	34114	88.4	84021	89.8
	All Mortality	**54975**	**100**	**38610**	**100**	**93675**	**100**
2007	Cardiovascular Diseases	6806	14.4	4694	13.4	11500	14.0
	Other diseases	40552	85.6	30208	86.6	70760	86.0
	All Mortality	**47358**	**100**	**34902**	**100**	**82260**	**100**
2008	Cardiovascular Diseases	5001	12.8	8173	22.9	13174	16.5
	Other diseases	39061	87.2	27453	77.1	66514	83.5
	All Mortality	**44062**	**100**	**35626**	**100**	**79688**	**100**
2009	Cardiovascular Diseases	4585	11.7	6475	20.7	11060	15.7
	Other diseases	34438	88.3	24845	79.3	59283	84.3
	All Mortality	**39023**	**100**	**31320**	**100**	**70343**	**100**
2010	Cardiovascular Diseases	6131	19.5	5086	21.3	11217	20.3
	Other diseases	25253	80.5	18846	78.7	44099	79.7
	All Mortality	**31384**	**100**	**23932**	**100**	**55316**	**100**

Source: **Computed from autopsy records from the KBTH 2006-2010**

In order to really examine which of the two sexes is exposed to higher risk of experiencing loss of potential life due to cardiovascular diseases, odds ratio was calculated to address this. The results show that the odds of females having higher YPLL due to CVDs compared to males is

1.298 (95% CI= 0.334 – 2.262). This indicates that females are about 29.8% more likely to experience YPLL to CVDs in 2006 compared to males. This also means that a higher risk of premature deaths occurred among females compared to males. In 2007, the results show that the odds of a female losing more potential life compared to males is 0.926 (95% CI= 0.8845 - 0.9317). This means that females are about 7.4% less likely to have higher YPLL compared to males. Also, the odds of experiencing YPLL in 2008 is greater for females compared to males at 2.325 (95% CI= 1.2715 - 3.3038). This implies that in 2008, females are about 1.3 times more likely to experience loss of potential life to CVDs as males. Also, in 2009, the results show that females have a higher likelihood of losing more years of potential life compared to males (odds ratio= 1.957, 95% CI= 1.1913 - 2.2280). In 2010, females were about 11% more likely to have lost more potential life to CVDs compared to males (odds ratio=1.111, 95% CI= 1.0143 - 2.0603).

Generally, this section shows that the proportion of YPLL to CVDs increased in each year (except in 2009) and also higher among females compared to males within the five-year under review. This may indicate that there was higher premature mortality (before the age of 59 years) among females compared to males. This may not mean that in general, females have higher number of CVDs death but it may imply that many of the female deaths occurred before the expected years to be lived while a higher number of CVDs among males may have occurred after the expected years of life, i.e 59 years.

5.2 Years of Potential lost due to Categories of CVDs at KBTH (2006 – 2010)

Table 5.2 shows the YPLL and %YPLL of categories of cardiovascular diseases at KBTH from 2006 to 2010. Looking at the pattern in the YPLL to congestive heart failure, the results show

that the proportion of the YPLL due to the disease decreased from 2006 through 2008, picked up again in 2009 and reached its highest in 2010. Generally, congestive heart failure accounted for more than thirty percent of the total YPLL due to CVDs within the five-year under review. Also, the sex pattern shows that the YPLL to congestive heart failure among the two sexes followed the same pattern. For instance, the YPLL to congestive heart failure among both sexes dropped in 2007, picked up in 2008 and increased through 2009 before dropping again in 2010. Throughout the five-year under review, the proportion of YPLL to congestive heart failure was higher among males compare to females. This may indicate that males have higher likelihood to have experienced more premature deaths from congestive heart failure compared to females within the five-year period.

Also, the pattern in pulmonary heart disease show that its contribution to YPLL to CVDs decreased between 2006 and 2007 but increased from 2007 through 2010. Also, the proportion of the YPLL to pulmonary heart disease in 2006 and 2008 was the same (13.7%). Basically, the results show that pulmonary heart disease constituted more than one-tenth of the total YPLL to CVDs within the 5-year period. The sex variation in terms of the YPLL to pulmonary heart disease shows that among the two sexes, the proportion of the YPLL to the disease increased from 2006 through 2010 except in 2009. Although both sexes show the same pattern of fluctuations, the proportion of YPLL to pulmonary heart disease was higher among females than males in each year of the 5-year period. The highest proportion of YPLL to pulmonary heart disease occurred in 2010, which is about twenty-eight percent (27.6%) of the total YPLL to CVDs in that year. This indicates that the highest proportion of premature deaths from pulmonary heart disease among females occurred in 2010.

For cerebrovascular diseases, the general pattern in the YPLL to the disease shows a steep rise from 2006 to 2007 and a sharp decrease in 2008 after which it increased through 2010. The results show that the highest contribution of cerebrovascular diseases to YPLL occurred in 2006, which is more than one-quarter (29.0%) of the total YPLL to CVDs in that year. The pattern shown by the contribution of cerebrovascular diseases to YPLL is quite different from that of congestive heart failure and pulmonary heart disease. This is because while the highest proportion of the YPLL to heart failure and pulmonary heart disease occurred in 2010; that of cerebrovascular diseases occurred in 2006.

Also, the sex pattern of the YPLL to cerebrovascular diseases within the 5-year under review shows that among the females, the YPLL to the disease increased between 2006 and 2007 but decreased thereafter through to 2010, with the highest occurring in 2010. For males, the YPLL to cerebrovascular diseases increased between 2006 and 2007 and decreased between 2007 through 2009, but picked up thereafter in 2010. The results show that generally, a higher proportion of YPLL to cerebrovascular diseases occurred among males within the 5-year period.

Furthermore, the results show that the YPLL to hypertensive heart disease among the autopsy cases at KBTH decreased from 2006 through 2009 and increased slightly in 2010. That is, the proportion of the YPLL to the disease decreased from about one-tenth (9.9%) of the total YPLL to CVDs in 2006 to about three percent (2.5%) in 2009 and increased to about seven percent (7.1%) in 2010. The reason for the decline for a period of four years (i.e, 2006-2009) may be as a result of expansion in the life expectancies of people who are living with hypertension. This is because hypertension has been seen as an increasing contribution to the burden of disease in Africa and as a result, there have been a lot of systems in place to help people control their blood pressure. Although, the morbidity of the disease may have been increasing in each year, the

mortality may have declined as a result of improved measures of prevention. Hence, the pattern in the contribution of hypertensive heart disease to YPLL to CVDs show similar trend with that of pulmonary heart disease.

In terms of the sex pattern of the YPLL to hypertensive heart disease, the results show that the same pattern was observed among the two sexes. In other words, the pattern shows that for both males and females, the YPLL to hypertensive heart disease decreased from 2006 through 2009 and a steep increase occurred between 2009 and 2010. A notable observation is the fact that among the males, there was a sharp decline of about 77.4% in the proportion of the YPLL to hypertensive heart disease between 2008 and 2009. In summary, the sex pattern in the YPLL to hypertensive shows that a higher proportion of YPLL to hypertensive heart disease between 2006 and 2008 occurred among the males but females had higher YPLL to hypertensive heart disease between 2009 and 2010.

The general pattern observed in the YPLL to myocardial infarction is that its contribution to the YPLL decreased from 2006 through 2008 and picked up thereafter till 2010. Also, the highest contribution of myocardial infarction to YPLL to cardiovascular diseases within the 5-years under review occurred in 2006 (6.3%). This may mean that myocardial infarction did not contribute significantly to the YPLL to CVDs within the 5-year period. Also, the sex variation in the YPLL to myocardial infarction shows that among the males and females, the proportion of the YPLL decreased between 2006 and 2007 and this was followed by an increase from 2007 through 2010. On the other hand, that of females showed a decrease between 2009 and 2010. The results basically show that within the five-year period, the male proportion of the YPLL to myocardial infarction was higher than that of females, except in 2009.

Furthermore, the YPLL to other categories of CVDs like rheumatic heart disease, congenital heart disease and deep vein thrombosis shows that in 2006, their contribution to the total YPLL to CVDs was slightly more than one-tenth (13.4%) but there was a sharp decline to about two percent between 2006 and 2007. Also, the contribution of other categories of CVDs to the total YPLL to CVDs increased from 2008 through 2010. Basically, although other categories of CVDs contributed somehow significantly to the YPLL to CVDs in 2006, their impacts became insignificant from 2007 through 2010.

In 2006, the results show that more than one-fifth (21.2%) of the YPLL to CVDs among females was as a result of other categories of CVDs. A sharp decline was observed in 2007 and in 2008; other categories of CVDs contributed nothing to the YPLL to CVDs among the females. This may indicate that during this year, all the people who died from other categories of CVDs died after the expected age at death (59 years). This also means that other categories of CVDs were not really a burden of disease among the autopsy cases at KBTH in 2008. Conversely, the results show that among males, other categories of CVDs showed a decrease in its contribution to the YPLL to CVDs between 2006 and 2007, increased from 2006 through 2009 but declined slightly in 2010. Basically, the contribution of other categories of CVDs to the YPLL to CVDs in 2008 was by males.

Also, the results show that the contribution of coronary artery disease to the total YPLL decreased from 2006 through 2010, with the highest contribution of 1.0% in 2006. The results reveal that coronary artery disease contributed nothing to the YPLL to CVDs in 2010. This may show that probably all the people who died from the disease died after the age of 59 years and which implies that no year would have been lost as a result of this. The insignificant contribution of coronary artery disease may also imply that coronary artery disease may not be a burden of

disease in our part of the world. This in a way suggests that a prevalence study needs to be done in order to determine the burden of the disease in Ghana. The general sex pattern in the five-year period shows that there was higher YPLL to coronary artery disease among males compared to females.

Table 5.1.1 Years of Potential Life lost from different Categories of CVDs (2006 - 2010)

Years	Diseases	Male		Female		Total	
		YPLL	%YPLL	YPLL	%YPLL	YPLL	%YPLL
2006	Congestive heart failure	2441	48.2	1537	34.2	3978	41.6
	Pulmonary Heart disease	570	11.2	742	16.5	1312	13.7
	Cerebrovascular diseases	701	13.8	584	13.0	1285	13.4
	Hypertensive heart disease	589	11.6	449	10.0	1038	10.9
	Myocardial Infarction	419	8.3	183	4.1	602	6.3
	Other CVDs	296	5.8	953	21.2	1249	13.1
	Coronary artery disease	52	1.0	48	1.1	100	1.0
	Total	**5068**	**100**	**4496**	**100**	**9564**	**100**
2007	Congestive heart failure	2631	38.7	1496	31.9	4127	35.9
	Pulmonary Heart disease	974	14.3	1279	27.2	2253	19.6
	Cerebrovascular diseases	2022	29.7	1310	27.9	3332	29.0
	Hypertensive heart disease	689	10.1	451	9.6	1140	9.9
	Myocardial Infarction	249	3.7	79	1.7	328	2.9
	Other CVDs	176	2.6	59	1.3	235	2.0
	Coronary artery disease	65	1.0	20	0.4	85	0.7
	Total	**6806**	**100**	**4694**	**100**	**11500**	**100**
2008	Congestive heart failure	2195	43.9	1305	41.1	3500	26.6
	Pulmonary Heart disease	853	17.1	946	29.8	1799	13.7
	Cerebrovascular diseases	1079	21.6	616	19.4	1695	12.9
	Hypertensive heart disease	463	9.3	174	5.5	637	4.8
	Myocardial Infarction	224	4.5	131	4.1	355	2.7
	Other CVDs	143	2.9	0	0.0	143	1.1
	Coronary artery disease	44	0.8	0	0.0	44	0.3
	Total	**5001**	**100**	**3172**	**100**	**13174**	**100**
2009	Congestive heart failure	2517	54.9	1938	47.2	4455	40.3
	Pulmonary Heart disease	640	14.0	1029	25.0	1669	15.1
	Cerebrovascular diseases	952	20.8	752	18.3	1704	15.4
	Hypertensive heart disease	55	1.2	221	5.4	276	2.5
	Myocardial Infarction	232	5.1	114	2.8	346	3.1
	Other CVDs	177	3.9	55	1.3	232	2.1
	Coronary artery disease	12	0.3	0	0.0	12	0.1
	Total	**4585**	**100**	**4109**	**100**	**11060**	**100**
2010	Congestive heart failure	2882	47.0	2184	42.9	5066	45.2
	Pulmonary Heart disease	999	16.3	1402	27.6	2401	21.4
	Cerebrovascular diseases	1365	22.3	639	12.6	2004	17.9
	Hypertensive heart disease	389	6.3	411	8.1	800	7.1
	Myocardial Infarction	320	5.2	150	2.9	470	4.2
	Other CVDs	176	2.9	300	5.9	476	4.2
	Coronary artery disease	0	0.0	0	0.0	0	0.0
	Total	**6131**	**100**	**5086**	**100**	**11217**	**100**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Generally, the results in this section show that females were more likely to experience higher YPLL than males within this period except in 2008. This means that there was higher number of premature deaths among females due to cardiovascular diseases compared to males. Also, among the categories of cardiovascular diseases, congestive heart failure contributed significantly to the years of potential life lost among the two sexes within the five-year period. The other prominent ones are cerebrovascular diseases (among males) and pulmonary heart disease (among females). It can be said that the first three leading contributors in the YPLL to CVDs among the various categories include: congestive heart failure, pulmonary heart disease and cerebrovascular diseases.

Since the YPLL is used to show the burden of disease in a population, the results in this section indicate that congestive heart failure was a major burden of disease at KBTH within the five-year period and serious measures need to be put in place in order to minimize the risk factors of the disease. Also, it is important that screening program be developed for this disease because although the burden may not be huge now, it may eventually be a major contribution to YPLL among all diseases. Furthermore, it was observed that the contribution of most of the categories of CVDs to YPLL to CVDs generally showed a slight increase between 2009 and 2010. This really should be a matter of concern because even though the increase may have been as a result of under-representation of deaths in 2010, it may just be that the age of CVDs deaths in this year is actually decreasing. This in a sense calls for urgent attention.

Therefore, there is need to have a national study of the diseases' prevalence so as to have a proper epidemiologic surveillance of the disease. Also, comprehensive and integrated action is very important in the prevention and control of CVDs. Comprehensive action requires combining approaches (integrated and population-wide interventions) that seek to reduce the

risks throughout the entire population with strategies that target individuals at high risk or with established disease (WHO, 2011). According to the World Health Organization, the population-wide interventions include: comprehensive tobacco control policies; taxation to reduce the intake of foods that are high in fat, sugar and salt; building walking and cycle ways to increase physical activity; providing healthy school meals to children; etc. Putting all these measures in place is very important because health investments will eventually help to build a strong virile nation socially, psychologically and economically.

CHAPTER SIX

SUMMARYOF FINDINGS, RECOMMENDATIONS AND CONCLUSION

6.1 Summary of Findings

The main objective of this study was to examine the trends of cardiovascular diseases (CVDs) at Korle Bu Teaching Hospital (KBTH) from 2006 to 2010. Specifically, the study sought to examine the variations in mortality at KBTH by age, sex, locality and sources. Secondly, the study looked at the proportionate mortality ratio (PMR) of CVDs from 2006 to 2010; described the pattern of the categories of CVDs within the five-year period and finally; estimated the years of potential life lost (YPLL) due to cardiovascular diseases within this period.

The results show that a total of 20,706 deaths were recorded at KBTH from 2006 to 2010 and the highest number of deaths (5,091) occurred in 2006. The median age at death ranged between 41 years and 43 years with the highest being in 2006 (43 years) and the lowest in 2008 (41 years). Also, the findings showed that mortality within this period picked up after age four and plateaued at ages 35-44 years before declining through 85years. Although a normal age pattern of mortality should have been U-shaped, this is rather different in this study. A plausible explanation for the pattern shown in this study may be because of the under-representation of autopsy cases in the population. This is because many people refuse autopsy and all they are concerned about is how they will get the death certificate. Another explanation is because this is not a population data.

In terms of the sex pattern of mortality among the autopsy cases at KBTH, the results showed that a higher proportion of deaths occurred among males within this period. In essence, the male-female ratio of mortality was 1.5: 1 and this partly supports the estimation by the global burden of disease for sub-Saharan Africa where the larger proportion of deaths occurs among males

(Wurthwein et al., 2001). The study further showed that a larger proportion of the autopsy cases came from Korle Bu Police hospital except for that of 2006 in which a larger percentage came from other Police stations within the Greater Accra Region. A plausible explanation for a larger proportion of deaths coming from around Korle bu a Police station may be because of proximity to KBTH.

Also, the study hypothesized that PMR of cardiovascular diseases in 2010 will be more than that of 2006. Hence, the study showed that the PMR of CVDs in 2010 (23.2%) was more than that of 2006 (19.9%). Furthermore, the study showed that the PMR of CVDs at KBTH fluctuated between 20 and 24 percent over the five years under review. One may not confidently say that the severity of the disease fluctuates because the rate of disease, which would have given the real severity of the disease, was not calculated because the population (which is the denominator in calculating mortality rates) was not known. Another plausible explanation for the fluctuations in mortality may be that the risk factors of CVDs may have fluctuated from year to year within this period. In view of this, the highest PMR (23.9%) which occurred in 2009 may probably be due to more exposure to the cardiovascular diseases' risk factors within this period. This plausible explanation is based on the premise of health risk transition, which assumes that the changes in the patterns of mortality may not be because of the changes in time but due to the changes in the risk factors. Finally, the fluctuations in the CVDs mortality may be a function of the total number of autopsies conducted in each year.

The results showed that in terms of the age pattern of PMR of CVDs, the general trend observed was that for each of the five years under review, PMR for CVDs increased from young age (15 years) to 85 years and by this age, CVDs accounted for more than 50% of deaths examined. A

steep rise in the PMR was observed between 25 and 65 years when there was some appearance of plateauing thereafter.

This may partly support literatures that have shown that the previous trends seen in the age-pattern of CVDs mortality is actually changing because the age at which people die of the disease is gradually reducing (Leeder et al., 2004). In view of this, however, caution should be taken by not neglecting the youth in terms of primary prevention of cardiovascular diseases because current data from different countries are showing a rise in the burden of the disease among the youth. The findings from this study may also imply a rise in the level of urbanization in the country which has brought about increase in sedentary lifestyles and the burden of the disease among the youth that is gradually shifting from infectious diseases (majorly HIV/AIDS) to chronic non-communicable diseases like cardiovascular diseases. Generally, the results showed that patients who were 35 years and above had higher likelihood of CVDs mortality compared to those who were below 35 years within the 5-year under review.

Also, the results showed that within the five-year under review, there was a wide gap between CVDs mortality and other causes of deaths at infancy, but this gap closed up at each age through age 85 years. This implies that PMR of CVDs was higher among the older ages compared to the younger ages within the five years under review. This may partly support the study done by Ogeng et al (2011) in Kenya which shows that cardiovascular diseases mortality picks up at ages 40-60 years while the pattern in America shows that cardiovascular diseases mortality occur at later age (65 years and over). This may in a way suggest that deaths from cardiovascular diseases actually occur at lower ages in developing countries compared to the developed countries. Although cardiovascular diseases are threat to both developed and developing countries, it seems the burden of the disease is mostly borne by the developing countries due to many factors

ranging from their poor health system to their poverty status (Mbewu et al., 2006; WHO, 2007; de-Graft, 2007).

This study hypothesized that females are more likely to have higher CVDs mortality compared to males within the five-year period. In support of this, the results showed that females have more likelihood of CVDs mortality than males within this period. This indicates that the burden of the disease was more on females than for males. Although CVDs is an' equal opportunity attacker', striking people from different demographic and socio-economic characteristics, studies have shown that women are disproportionately affected. For instance, in a study carried out among West Virginia residents in 1998, it was found that there were more women who died of CVDs compared to men (Aubert et al., 1998; Bradshaw et al., 2003). One explanation is that women fail to recognize symptoms related to CVDs and they do not get immediate treatment compared to men. Even when they are diagnosed, they do not adhere to medications as men do. Also, studies have shown that the signs of CVDs are well recognized in men (left or mild chest pain) but in women, signs of CVDs vary and it can be nausea, vomiting, tightness, etc.

Also, the estimation of the YPLL to CVDs showed that within the five-year period, females were more likely to lose more years of life to CVDs compared to males. This implies that in terms of the mortality and YPLL, the burden of CVDs was more on females compared to males within the 5-year under review. This is also in a way similar to the pattern which has been reported that in sub-Saharan Africa, females lost more years of productive life to CVDs compared to males. For instance, Kadiri (2005) reported that the number of disability adjusted life years (DALYs) lost to CVDs in sub-Saharan Africa rose from 5.3 million for males and 6.3 million for females in 1990 to 6.5 million and 6.9 million in 2000 for males and females respectively.

The results further showed that congestive heart failure constituted the leading cause of CVDs mortality and YPLL within the five-year period followed by cerebrovascular diseases and pulmonary heart disease (which was prevalent among the females). This study reflects what studies have shown that congestive heart failure is the most prevalent cardiovascular disease in Africa (Sliwa et al., 2005). This is in a way similar to the study carried out by Ogeng et al (2011) where 134 autopsy cases were examined. They found out that myocardial infarction was the most common followed by congestive heart failure. The predominance of congestive heart failure as the causes of death may partly be because of the increase in the rate of hypertension in Africa which is a major risk factor for congestive heart failure in the country (Betrand, 1999; Sliwa et al., 2005).

Also, in a MEDLINE search (January 1, 1966 – February 12, 2005) by Sliwa et al., (2005) on the epidemiology and etiology of cardiomyopathy (congestive heart failure) in Africa, they found out that this disease poses a great challenge in Africa most especially because the treatment often requires specialized cardiological investigations which are lacking in the continent. Also, they found out that lack of access to effective interventions such as heart transplantation and the irreversible disorders of the disease trigger the high rate of the diseases mortality. There is no doubt that there is need for large scale epidemiological studies of the incidence, prevalence, causes, and outcome of congestive heart failure in Ghana so as to inform strategies for prevention and treatment of the disease. Although the findings from this study may not be generalizable to all parts of Ghana, it is not impossible that congestive heart failure may be a dominant cause of cardiac deaths in all parts of Ghana.

Although, hypertension is a major disease in sub-Saharan Africa, hypertensive heart disease was not among the first three leading causes of CVDs mortality among the autopsy cases. This may

mean that although hypertensive heart disease may not have been the leading cause of CVDs' death at KBTH, it may have been the most prevalent proximal risk factor for the first three leading causes of CVDs' mortality in this study. Also, the findings showed that among the causes of CVDs deaths examined within the period under review, coronary artery disease did not contribute significantly to CVDs mortality and YPLL. This is unlike what happens in some developed countries, most especially America. Studies have shown that despite substantial decline in cardiovascular diseases, coronary artery disease still accounts for nearly 700, 000 deaths per year (Caroline et al., 2004). Also, in the WHO report on "global burden of coronary heart disease (2002)", it was shown that while coronary artery disease is decreasing in many developed countries, it is increasing in developing countries as a result of increasing longetivity, urbanization and lifestyles changes. Also, the report shows that more than 60 percent of the global burden of the disease and 82 percent of the future increase in coronary artery disease will occur in developing countries. However, coronary artery disease at KBTH showed a decline from 2006 through 2010 indicating a different pattern from the WHO projections. This may partly be because this is not a representation of Ghana and it may also imply that coronary artery disease may not have similar effect in all the developing countries. Also, extra caution should be taken in generalizing projections of the patterns of diseases to all developing countries because patterns or trends of diseases may vary from country to country or even vary widely within a country.

6.2 Conclusion

The aim of this study was to examine the trends of cardiovascular diseases at KBTH from 2006 to 2010. It is hoped that the findings from this study will be relevant to issues in clinical practice and community health and to population approaches to disease prevention and health promotion.

The importance of looking at the trends of CVDs is to estimate the burden of the disease which will set the ground for further studies to be done in identifying the populations at risk of CVDs, ascertain the cause of their increased risk and analysing the cost and benefits of reducing exposure to the factors associated with the disease. However, the crossroads in Ghana now is that how much of data are needed to justify a prevention effort? Should effort be directed at primary prevention of the disease or the secondary prevention of the disease? In other words, should prevention approach target groups that are known to be at high risk or it should extend primary prevention efforts to the general population as whole? These are major questions that need to be addressed to come up with appropriate policy measures.

But in a population like Ghana where there may be a lot of people with high risk of CVDs, it is advisable to combine a high risk approach with a population approach, that is, one set of preventive measures addressed to those at particularly high risk and another designed for primary prevention of the disease. Since it is a known fact that the proximal risk factors (hypertension, diabetes and obesity) increases the risk of CVDs mortality, preventive measures in Ghana should incorporate both primary and secondary prevention. Also, in order to make the preventive measures generally acceptable by the population, the cost of the measures on the population should be minimal. This is why it is important that before any public policy is formulated on the disease, the percentage of the population that the policy wants to protect should be known; the level of risk the society is willing to tolerate should be clearly defined; the level of control of risk the society is willing to pay for should be known and the institution who will make the decision about the risk should be identified.

Addressing these issues will allow the government of Ghana and other stakeholders in the country come up with concrete measures to minimize the burden of cardiovascular diseases in

the country. In other words, these issues cannot be addressed if effective surveillance system is not put in place to monitor the severity of the diseases or data at the hospitals or other epidemiologic studies are not systematically collected, analysed, interpreted and disseminated timely. Therefore, effort should be made at ensuring that developing policies for cardiovascular diseases in Ghana is not based on mere extrapolations or assumptions but on actual data.

6.3 Recommendations

This study has shown that a larger proportion of CVDs mortality came from Korle bu area. As a result, community-based/population-based studies need to be carried out throughout the country in order to determine the prevalence of CVDs and to examine the level of exposure to the risk factors of the disease. This will eventually help to enhance primary and secondary prevention of the disease in the country. Since the hospital records are fast becoming a tool in epidemiologic surveillance of disease, efforts should be made that at KBTH, the socio-economic and demographic characteristics of patients are documented. It is also important that effective institutions or mechanisms are put in place at KBTH by the administrative head to ensure that the information about patients is properly collected and kept. This should be kept in a form that could easily be made available to researchers who will analyse and interpret the data and timely disseminate the results to the policy makers or those who need them.

Also, since the study showed that congestive heart failure featured prominently among the causes of CVDs' mortality, measures should be put in place by the Government in order to simultaneously promote knowledge on avoiding the risk factors and putting appropriate technology in place to expand the life expectancies of those who are already living with the

disease. Since studies have shown that although both the poor and the rich are exposed to CVDs and that the poor are more affected because of their inability to access the health facilities, government should incorporate the treatment of CVDs in the national health insurance scheme or provide a way of subsidizing the treatment of the disease (Agyei-Mensah et al., 2010). Also, it is a known fact that Ghana has no national health policy on chronic diseases and in view of this, the government, both at the regional and national level should ensure that the policy measures on chronic diseases are clearly established. This can easily be done by strengthening the Non-Communicable Disease Programme (NCDP) which was set up in 1992, but which has been ineffective due to lack of human and financial resources.

Also, an effective surveillance system should be developed at national, regional and community levels in order to monitor the disease's mortality. This will eventually help to determine the severity of the disease and to assess the various programs put in place to minimize the burden of the disease in the population. In other words, for preventive actions to be taken by the government or medical personnel, adequate observation of the disease's mortality is very crucial. This is because history has shown that the reduction in a disease's mortality has been due to effective epidemiologic observations. For instance, Gordis reported that the solutions to small pox (which was a major cause of death among women in the 18th century); death from childbed fever in the 19th century; the high mortality from cholera in England in the middle of the 19th century; and the discovery of HIV as a virus in the 20th century- were all due to effective observation/surveillance system put in place to monitor the diseases' mortality (Gordis, 2009). This indicates that the importance of monitoring CVDs' mortality in Ghana cannot be over-emphasized if indeed government wants to reduce the years of potential life loss to the disease.

Although this may in the short-run be very costly, in the long-run, it is cost-effective because of the person-years that will be saved in the country.

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Appendices

Age Pattern of Mortality at KBTH (2006-2010)

Age	2006	2007	2008	2009	2010
<1	3.2	3.3	3.3	3.8	3.0
1-4yr	1.9	1.9	2.7	2.7	2.4
5-14yr	4.1	4.4	4.6	4.6	3.9
15-24yr	10.2	8.1	10	8.5	8.8
25-34yr	14.8	16.2	15.1	15.6	16.5
35-44yr	18.1	19.9	20.2	18.1	19.5
45-54yr	17.7	17.4	16.5	17.9	16.3
55-64yr	12.4	13	12.3	12.9	13.5
65-74yr	10.2	9.2	9.0	9.3	9.5
75-84yr	5.5	4.7	4.6	5.1	5.4
85+	1.9	1.8	1.8	1.5	1.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Age Pattern of Mortality at among Males (2006-2010)

Age	2006	2007	2008	2009	2010
<1	2.8	3.1	3.4	3.9	3.0
1-4yr	2.0	2.1	2.6	2.7	2.5
5-14yr	3.7	3.7	4.6	4.3	3.5
15-24yr	9.3	7.2	9	8.3	8.4
25-34yr	14.0	15.6	14	13.7	14.2
35-44yr	18.5	20.0	20.2	18.1	20.3
45-54yr	19.2	19.4	17.6	19.3	17.4
55-64yr	13.8	13.8	13.7	14.1	15.3
65-74yr	10.3	9.8	9.6	9.9	10.2

75-84yr	5.0	4.1	4.4	4.3	4.7
85+	1.4	1.1	0.9	1.5	0.7
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Age Pattern of mortality among females (2006-2010)

Age	**2006**	**2007**	**2008**	**2009**	**2010**
<1	4.3	4.1	3.9	4	3.9
1-4yr	1.6	1.9	3	2.5	2.3
5-14yr	5.2	5.5	4.6	5.1	4.8
15-24yr	11.8	9.3	11.1	9.5	9.4
25-34yr	16.4	17.1	17	18.4	19.2
35-44yr	17	19.3	19.5	18	19
45-54yr	15.1	14.6	14.7	15.1	13.9
55-64yr	9.9	11.3	10.4	10.6	10.7
65-74yr	9.7	8.4	8.1	8.3	8.4
75-84yr	6.3	5.6	4.9	6.5	6.3
85+	2.7	2.9	2.8	1.8	1.9
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Age Pattern of Proportionate Mortality Ratio CVDs from 2006-2010

Age	**2006**	**2007**	**2008**	**2009**	**2010**
<1	4.3	9.1	3.2	6.1	3.8
1-4yr	4.2	6.1	3	4.3	6.5
5-14yr	5.7	6.8	6.5	5	7.8
15-24yr	8.5	8.6	9.4	8.9	8.7
25-34yr	10	15.1	7.5	14	11.8
35-44yr	14.3	19.7	19.3	20.9	19.1
45-54yr	21.3	24.7	27.1	28	30.5
55-64yr	32.2	37.7	30.1	35.7	34.6
65-74yr	37.6	40.9	33.9	44.2	39.2
75-84yr	39.9	42.9	36.7	42	41.1

85+	38.1	41	47.7	47.2	53.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Patterns of CVDs Categories at KBTH (2006-2010)

Year	Hypertensive heart disease	Cerebrovascular diseases	Congestive heart failure	Myocardial Infarction	Pulmonary heart disease	Coronary artery disease	Other CVDs	Total %
2006	10.3	21.4	35.2	7.4	15.3	1.1	9.3	100
2007	11.6	30	31.3	3.2	22.2	0.9	0.8	100
2008	9.1	24.7	37.6	3.8	23.4	0.4	0.9	100
2009	4.2	22.8	45.3	4.4	22.1	0.6	0.6	100
2010	7.6	22.7	39.1	5.2	24.2	0.3	1	100

Source: **Computed from autopsy records from the KBTH 2006-2010**

Age Pattern of Categories of CVDs at KBTH in 2006

Age	Hypertensive heart disease	Cerebrovascular diseases	Congestive heart failure	Myocardial Infarction	Pulmonary heart disease	Coronary artery disease	Other CVDs
<1	1.0	0.0	0.6	0.0	0.0	0.0	4.3
1-4	1.0	0.0	0.3	0.0	1.3	0.0	0.0
5-14	0.0	0.9	1.7	2.7	0.0	0.0	2.2
15-24	1.9	2.8	7.0	6.8	0.6	9.1	4.3
25-34	5.7	4.2	9.2	5.4	6.5	9.1	12.9
35-44	19.0	9.3	12.2	6.8	18.1	0.0	16.1
45-54	29.5	14.8	21.2	12.2	18.7	27.3	12.9
55-64	22.8	16.2	22.3	28.4	15.5	18.2	18.3
65-74	12.4	28.7	13.9	23.0	22.6	18.2	18.3
75-84	5.7	15.3	8.9	14.7	12.9	0.0	9.7
85+	1.0	7.8	2.7	0.0	3.9	18.2	1.1
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Age Pattern of Categories of CVDs at KBTH in 2007

Age	Hypertensive heart disease	Cerebrovascular diseases	Congestive heart failure	Myocardial Infarction	Pulmonary heart disease	Coronary artery disease	Other CVDs
<1	0.8	1.0	1.2	0.0	0.4	0.0	50.0
1-4	0.0	0.3	1.2	0.0	0.4	0.0	0.0
5-14	0.8	0.6	2.5	6.1	0.0	0.0	0.0
15-24	0.8	2.6	4.3	3.0	2.6	11.1	0.0
25-34	10.1	11.6	11.1	6.1	9.6	0.0	0.0
35-44	16.8	14.8	16.1	15.2	19.6	22.2	0.0
45-54	21.8	20.6	17.6	12.1	16.5	11.1	0.0
55-64	22.7	21.6	20.7	18.2	18.3	33.3	12.5
65-74	16.8	16.1	15.8	24.2	15.2	22.2	25.0
75-84	7.6	8.1	6.5	12.1	12.2	0.0	12.5
85+	17.0	2.6	2.8	3.0	5.2	0.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Age Pattern of Categories of CVDs in 2008

Age	Hypertensive heart disease	Cerebrovascular diseases	Congestive heart failure	Myocardial Infarction	Pulmonary heart disease	Coronary artery disease	Other CVDs
<1	0.0	0.0	1.0	0.0	0.0	0.0	14.3
1-4	0.0	0.5	0.7	0.0	0.6	0.0	0.0
5-14	1.4	0.5	2.8	0.0	0.6	0.0	0.0
15-24	2.9	1.1	5.2	13.8	5.6	33.3	14.3
25-34	2.9	5.3	7.3	6.9	4.4	0.0	0.0

35-44	21.7	18.9	19.9	13.8	18.3	0.0	28.6
45-54	30.4	26.3	17.8	13.8	22.2	0.0	14.3
55-64	17.4	21.6	19.5	17.2	14.4	33.3	28.6
65-74	14.5	15.3	14.3	20.7	16.7	33.3	0.0
75-84	8.7	6.3	9.1	10.3	8.9	0.0	0.0
85+	0.0	4.2	2.4	3.4	8.3	0.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Age Pattern of Categories of CVDs in 2009

Age	Hypertensive heart disease	Cerebrovascular diseases	Congestive heart failure	Myocardial Infarction	Pulmonary heart disease	Coronary artery disease	Other CVDs
<1	0.0	0.0	1.1	0.0	0.5	0.0	60.0
1-4	0.0	0.0	0.8	0.0	0.0	0.0	20.0
5-14	0.0	0.0	1.6	2.7	0.5	0.0	0.0
15-24	0.0	1.6	4.2	8.1	2.2	0.0	0.0
25-34	5.9	7.8	11.1	0.0	9.2	0.0	0.0
35-44	17.6	16.1	15.5	16.2	16.3	0.0	0.0
45-54	26.5	26.6	18.9	18.9	17.9	20.0	0.0
55-64	26.5	19.8	18.4	16.2	20.7	0.0	20.0
65-74	14.7	14.6	16.6	27.0	19.6	60.0	0.0
75-84	5.9	11.5	8.2	8.1	10.3	0.0	0.0
85+	2.9	2.1	3.7	2.7	2.7	20.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Age Pattern of Categories of CVDs in 2010

Age	Hypertensive heart disease	Cerebrovascular diseases	Congestive heart failure	Myocardial Infarction	Pulmonary heart disease	Coronary artery disease	Other CVDs
<1	0.0	0.0	0.4	0.0	0.0	0.0	33.3
1-4	0.0	0.7	0.8	0.0	0.0	0.0	16.7
5-14	2.2	0.0	2.5	0.0	0.0	0.0	16.7
15-24	0.0	2.2	5.8	0.0	1.3	0.0	16.7
25-34	10.9	5.8	8.3	9.4	10.0	0.0	0.0
35-44	15.2	14.4	15.3	15.6	20.0	0.0	0.0
45-54	23.9	25.2	21.1	21.9	18.0	0.0	0.0
55-64	26.1	21.6	17.4	34.4	19.3	0.0	16.7

65-74	15.2	17.3	15.7	15.6	17.3	50.0	0.0
75-84	6.5	9.4	10.3	3.1	10.0	50.0	0.0
85+	0.0	3.6	2.5	0.0	4.0	0.0	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Source: **Computed from autopsy records from the KBTH 2006-2010**