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KWAME NKRUMAH UNIVERSITY OF SCIENCE AND TECHNOLOGY

LOGISTIC REGRESSION ANALYSIS OF FACTORS ASSOCIATED WITH HYPERTENSION PREVALENCE CASE STUDY: KOMFO ANOKYE TEACHING HOSPITAL(KATH), KUMASI,GHANA

By

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Declaration

I hereby declare that this submission is my own work towards the award of the MSc degree and that, to the best of my knowledge, it contains no material previously published by another person nor material which had been accepted for the award of any other degree of the university, except where due acknowledgement had been made in the text.

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Dedication

I dedicate this work to the LORD God Almighty and His daughter Sandra AfariKissi whom He gave to me as a wife. We did this work together, Sandra, and without you there would not have been Master Alexandra Afari-Kissi. Also to my beloved son Reverend Nana Yaw Afari-Kissi and daughter, Awurabena Adepa Asabea Afari-kissi.

Abstract

Hypertension is one of the most important chronic non communicable diseases with increasing trend worldwide. According to Owusu et al (2012), hypertension topped the chart of cardiovascular risk pro le in Kumasi Metropolis. This study therefore examines the factors associated with hypertension prevalence in Kumasi Metropolis. The study employed binary logistic regression model based on 2013 data from cardiac clinic of the Komfo Anokye Teaching Hospital (KATH) Kumasi Ghana. The sample size used for this study was 300 patients who visited cardiac clinic of the Komfo Anokye Teaching Hospital (KATH) Kumasi in 2013. The

study found out that educational attainment, alcohol intake, gender, age, BMI, family history and religious a liation were signi cant in explaining hypertension prevalence in Komfo Anokye Teaching Hospital (KATH), Kumasi, Ghana with

these probabilities; 0.196(Primary), 0.1073(Tertiary), 0.1189, 0.0045, 0.4465, 0.147, 0.033 and 0.0612 respectively. This study recommended that Ghana health Service should intensify it education on the consequence of obesity and how to reduce weight. Also, Ghana Food and Drugs Board should regulate the rate at which alcoholic drinks are being advertised on our media and also use the media to educate the general public the side e ects of alcoholic drinks. Last but not the least, there should be mass health education on the dangers, prevention and control of hypertension.

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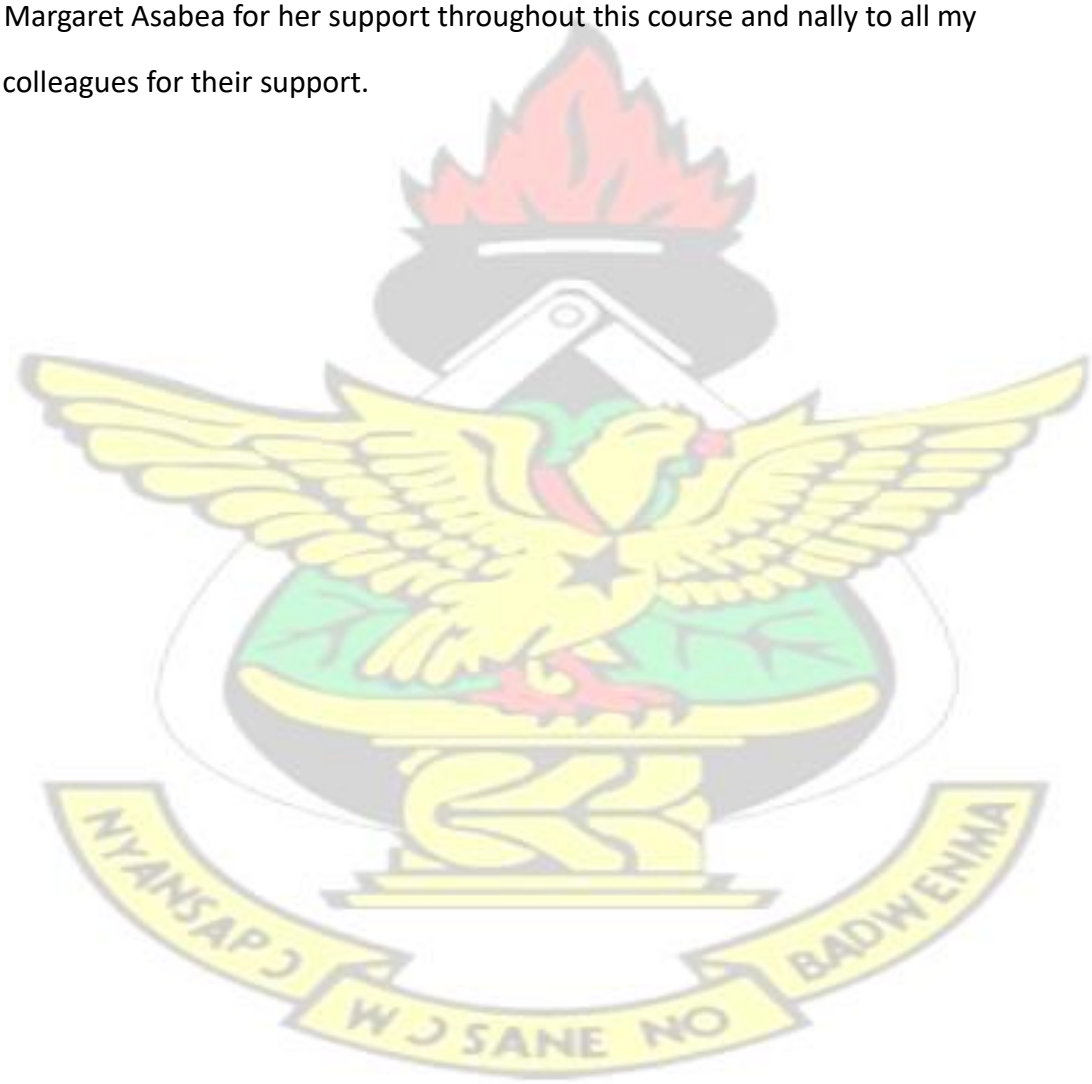

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Chapter 1

INTRODUCTION

1.1 Background of the Study

The prevalence of risk factors for cardiovascular Diseases (CVD) is increasing worldwide. Obviously, this increase has been translated into mortality from CVD being the leading cause of death. Hypertension is a strong risk factor for cardiovascular as well as renal and neurological disorders. Recently, hypertension was identi ed as the most common risk factor for coronary heart diseases (Hajjar & Kitchen, 2003).

Approximately 15 to 37% of world's adults have hypertension, and in some population high blood pressure a ects as many as 50% individuals older than 60 years. Worldwide hypertension is responsible for about 13% of all deaths (7.1 million people each year), 62% of strokes, and 49% of myocardial infarctions (American Heart Association, 2005).

Currently hypertension is classi ed into three categories. The rst category is Prehypertension. Previously, it was considered that systolic and diastolic pressure which varies between 120-139 and 80-89 mmHg respectively is high normal. The prevalence was more in male which is 39% compared to female 23% (Hosia et al.; 2007). Upon a report by Durham Regional Hospital (2004), American peoples that fall under this type of hypertension are almost 45 million. A person with prehypertension is three times more likely to have heart attack and 1.7 times to have heart related diseases compared to a normal individual
(American Heart Association 2005)

Hypertension without any cause is the second category known as essential or primary hypertension and this account for 95% of a given total population (carretero and operil 2000). Often essential or primary hypertension is also
termed clinically as idiopathic hypertension.

Essential hypertension is a silent killer because it goes unnoticed without any visible complications initially. If not treated, at a later stage it contributes to cardiovascular complications like stroke, angina and heart failure. People with primary hypertension usually seen with combined elevation of both systolic and diastolic pressure. The speci c cause for the combined systolic and diastolic or isolated systolic hypertension is not known. Although there is no speci c reason mentioned yet how primary hypertension develops several underlying factors may presumably be associated with it.

According to (Morton et al., 1962) genetic and environmental factors may contribute to primary hypertension even though there is no exact cause for the development of primary hypertension. It is believed that many genes come together to function as a network in order to determine genetic and environmental changes which is inherited from persons to persons (Melander, 2001). Some factors such as high dietary salt intake, heavy alcohol consumption, ethnicity impaired glucose tolerance, gender, age, and genetic disposition known as family history of hypertension are associated with high blood pressure.

The third category which is secondary hypertension, that is hypertension with the known cause. This type is less popular and account for about 5-10-% of the hypertensive total population (Onusku, 2003). This often associated with other diseases like renal artery, stenosis, chronic renal disease as well as pheochromocytoma (Saken and Kates 1997).
The reported prevalence of hypertension varies around the world, with the rate

as low as 5.2% in rural North India and as high as 70.7% in Poland. Blood pressure variations also exist from within communities in the same country depending upon the economic development and a uence. In economic developed countries, the prevalence of hypertension range between approximately 20 and 50%. Prevalence of hypertension in the Asia paci c region ranges from 5 to 47% in men and from 7 to 38% in women (WHO 2003). Cardiovascular disease illustrates this trend in transition from communicable to non communicable illness. Decreasing rates in western countries over the past 30-40 years have been attributed to heightened awareness and control of known risk factors.

According to WHO (2009), deaths due to non communicable diseases such as hypertension will rise by 17% over the next decade with the highest rise in the African region to the tune of 27% . The most cost e ective mode of prevention is the primary prevention (Maher et al.,2003). In 2003, a cross-sectional study by Amoah et al. (2003) conducted in Ghana concluded that high prevalence in women (29.5%) compared to male (27.6%) and low of awareness.

In Ghana, the prevalence of hypertension in urban Accra was estimated to be 28.3% (Crade) and 27.3% (age-standardize) (Amoah, 2003). However, to a considerable extent the growth and e ectiveness of reducing maternal death by means of prevent and treatment of hypertension has been e ective even though it can be prevented.

Also, a study on the changing patterns of hypertension in four rural communities in Ghana showed prevalence of 25.4%. The study revealed that of those with hypertension only 32.3% had prior knowledge of their condition and less than half of these were on treatment (Addo et al., 2006). A survey conducted by Burket, (2006) on blood pressure in the Volta Region of Ghana reported a frequency of

32.8% for hypertension with percentages of male and female been 30.7% and 39.4% respectively. Cappucio et al., (2004) in their study in the Ashanti Region divulge a prevalence of hypertension of 28% for the Ashanti tribe in Ghana. According to the World Health Organization (WHO, 2008) African Regional Consultation Meeting report on global strategy on death, physical activity and health, the risk for non-communicable disease appears to be gaining importance in Ghana, with prevalence of high blood pressure estimated at 30-40% although prevalence data for survey are generally inadequate.

Knowledge on the pattern of this detrimental disease could help public health workers and government to organize education programs for citizen and cause of hypertension and its associated problem.

1.2 Problem Statement

The prevalence of hypertension disease in Africa has increased in recent years. Hypertension is a common clinical condition a ecting more than 600 million people worldwide and it is seen in nearly all populations (Boatayeb and Boutayeb, 2005). Cardiovascular disorders were seen as rare in African countries but today, non-communicable diseases are major health burden in African countries.Non-communicable diseases such as hypertension will soon be the most important cause of morbidity and mortality in developing countries. Hypertension occurs in the lower as much as in the higher socio-economy group. It is a powerful independent risk factor for the death from cardiovascular disease.

Recent studies provide important and worrisome ndings in both epidemiology and clinical outcomes of hypertension. It has been reported to account for up 30% of hospital admissions for heart failure in West Africa and the prognosis hypertension

heart failure (HHF) among Black Africa has also been found to be poor (Owusu, 2007). Even though according to Owusu

et al.(2012), over hypertension prevalence is between 10%-15%, prevalence rates as high as 30%-32% have been reported in the middle-income urban and some rural in Africa. Hypertension awareness, treatment, and control rate is as low as 20%, 10% and 1% respectively have been found by (Owusu et al., 2012).

The prevalence of hypertension and the resulting morbidity are su ciently high to justify viewing the condition as a serious health problem. This burden of hypertension is also felt in Kumasi Metropolis. According to Owusu et al. (2012), hypertension topped the chart during a recent study on cardiovascular risk pro le in Kumasi Metropolis and it had 48.4%. This is seen as an increase of the previous study of hypertension prevalence of (28%) in the Kumasi Metropolis in the Ashanti Region of Ghana (Capprucio et al, 2004).

Even though the prevalence of hypertension in KATH does not compare to disease like malaria the cost of caring for hypertension far exceeds the cost involved in curing malaria and most communicable disease. The burden of hypertension has a signi cant implication on the economic and social development of KATH. Therefore, there is a need to examine factors associated with hypertension prevalence in KATH within Kumasi, Ghana.

1.3 Objective of the Study

1. to model hypertension prevalence using binary logistic regression
2. to determine signi cant factors a ecting hypertension prevalence in KATH, Kumasi, Ghana.

1.4 Justi cation of the Study

Communicable diseases seem to have taken the attention of everyone including health professional as well as all stakeholders to the neglect of chronic diseases. This will become worse in the Ashanti Region and by extension Kumasi Metropolis when proper attention is not given to the hypertension in the metropolis. It is to be noted that in (2004) hypertension was (28%) in the Kumasi Metropolis and currently hypertension is (48.4%). It is the leading risk factor for the cardiovascular disease in the Metropolis.

However hypertension has not reached epidemic proportion in the Kumasi Metropolis, there appear to be an increasing trend with the disease as it's incidence keep increasing from year to year. Gradually hypertension is proving to be the major health problem in the Kumasi Metropolis. It has been realized in the course of this study that, little work has been done on hypertension in the entire country and even worse when the Ashanti Region part of Ghana is considered and even worse when its narrowed down to the Kumasi Metropolis (Owusu (2007)). It should be noted that the rate at which the disease is

increasing as well as it has been neglected, it's highly possible it might reach epidemic proportion in not too distant future.

This study is therefore meant to bring to the attention of all stakeholders on hypertension because increasing development and improvement in the living condition of people seem to go along with increasing chronic diseases. Again this study presents as useful reference or guideline in the administration of health services, management and control of the disease in the Metropolis. This will not guide how a health system measures up to issues of hypertension incidence but how future potential incidence can be controlled in the Metropolis.

1.5 Limitations of the Study

This study is limited by some factors. The rst limitation is that this study did not examine all the possible factors associated with hypertension prevalence in Kumasi Metropolis. It is believed that other variables excluded from the model could have in uence on the decision under investigation. Sodium consumption, potassium intake and physical activity as determining factors were some of the variables omitted from our model. Omitting variables that are associated with hypertension prevalence can lead to possible omitted variable bias and may slightly overestimate the magnitude of the e ect of all the other determinants.

There may be measurement error since the data used for the study was secondary data and this error could a ect the completeness and quantitative accuracy of investigation.

1.6 Organization of the Study

The study is organized into ve chapters. Chapter One discusses the background to the study, the problem statement, the study objectives justi cation of the study, the limitation of the study and the organization of the study. Chapter two reviews related literature.

Chapter three focuses on the methodology of the study. Issues discussed include analytical framework, data source, sample and sampling procedure, logistic regression, generalized linear model and logistic regression, binary logistic regression, logistic regression with single independent variable, estimating the single regression model, estimation techniques, marginal e ect, de nition and measurement of variables priori expected signs and data analysis procedure. Chapter Four discusses

the ndings of the study. Finally, Chapter Five discusses the summary, conclusions and recommendations arising from the ndings and conclusions of the study.

Chapter 2

LITERATURE REVIEW

2.1 Introduction

This section of the thesis reviews some literature on hypertension. It focuses on, causes of hypertension, lifetime risk of hypertension, the e ect of high blood pressure, epidemiological trends of hypertension, prevention and treatment of hypertension. In developing countries most studies have been based on data from cardiovascular health centers and other health surveys.

2.2 Causes of Hypertension

The cause of hypertension is not yet known unless it is a secondary high blood pressure. Moreover other factors such as sedentary lifestyle, genetic factors, ageing, as well excess intake of salt causes hypertension (Cunha et al, 2011). According to research, high blood pressure is predominant among adult in ages between 20-79 (Keaney et al, 2005).

2.2.1 Age

According to Scho eld and Hazel (1999) age increase with time and this cause decline in performance of most organs. Loss activity as a result of aging also causes high blood pressure. Hormonal changes causes high blood pressure in elderly women due to menopause (Scho eld et al, 1999).

2.2.2 Excess Sodium or Salt Intake.

Excess intake of salt however is a contributing factor among persons with hypertension. Excess sodium intake can increase blood pressure in several ways.

This induces hypertension by increasing uid volume and preload.

2.2.3 Sedentary lifestyle

Little or no physical activities is medically referred to as sedentary lifestyle. Sedentary lifestyle is as dangerous to ones health as smoking.

2.2.4 Obesity

One of the factors that causes hypertension is excess storage of body fat and weight. Genes put one at risk of gaining weight, however the balance of exercise is vital determinant. Blood pressure usually a ected by various activities of the body in a day. As the heart react di erently to this activities of the day such as drinking and eating. High alcohol consumption according to Mittal, (2010), alcohol has been associated with high blood pressure over the years. According to (Sheldon, 2011) and Bakx et al, 1999), high alcohol intake increase the chance of obesity which in tend increase high blood pressure. This is because the kidney and the liver work extra hard to get rid of waste from the body thereby causing the body to exert more pressure in the arteries. As suggested by the National Institute of Health NIH (1998), the normal BMI for an adult over 18 years is less than or equal to 18.5-24.9. Body Mass Index greater than this put one at risk of obesity related disease as high blood pressure.

2.3 Risk Factors Associated with High Blood Pressure

Approximately everybody is at risk of developing high blood hypertension if healthy lifestyle habit is not adopted. However, there are risk groups, which relate to characteristics that contribute to the development of the diseases. According to Cunha and Marks (2011), 90 to 95% of the causes are unknown, however there are risk group as well as several factors that increase one chance of getting high blood pressure.

Blacks Americans recorded early age of developing high blood pressure than white Americans (American Heart Association, (AHA) 2009). Individuals with family history of high blood pressure, stroke and other cardiovascular diseases are always at risk of developing the disease. A study conducted by (Terry et al., 2007), hereditary was referred to as participant with one or more family members diagnosed of hypertension to identify risk group. Findings from this study shows that prevalence of hypertension in black Americans is higher than white Americans despite that there are other factors such as poverty, stress, lack of access to health care as well as racial discrimination associated with the high prevalence. Good nutrition is essential for proper growth of the body. Diets that are high in salt, sugar, fat and so on increase the risk of becoming overweight and developing high blood pressure.

According to Stabouli et al., (2011), several studies conducted support the theory that primary hypertension at early age is associated with overweight and excessive salt intake. This is due to two established facts: rstly, excess gain of weight puts pressure on the heart. Secondly, excess salt intake causes uid retention in the body causing too much burden to the heart. Furthermore, studies have shown that a high body weight in adolescents is related to the development of high blood pressure in adulthood.

In addition to that, an 18 years study was conducted by Bakx et al., (1999) about weight gain predicted as a future risk for hypertension. Results from this study showed that women are at a higher risk of developing high blood pressure irrespective of age and body mass index.

Generally, excess intake of alcohol has been linked to a number of serious medical conditions as well as social problem. These medical conditions can usually become acute or chronic without lifestyle modi cation.

2.4 Life Time Risk of Hypertension

2.4.1 Increased Age

Hypertension is an increasingly important medical and public health issue. The prevalence of hypertension increases with advancing age. The age related rise in systolic blood pressure is primarily responsible for an increase in both incidence and prevalence of hypertension with increasing age

2.5 The E ect of High Blood Pressure

High blood pressure is related to high occurrences of deaths. This is due to the fact that it can cause life threatening illness as heart attacks, stroke as well as other disease. WHO report in 2009 indicated that, on mortality and burden of disease, the risk of dying was more in low and middle income countries. African countries recorded about 25% deaths attributed to HBP below the age of 60 years. Even though there is not yet detailed data on the expenditure of treating high blood pressure, the cost of treatment has been approximated as high per capital expenditure on drugs in Ghana was approximated as US $8.

However, considering the fact that it is a developing country and most participants for the study were unemployed. This could be justi ed that compliance to pharmacological treatment is una ordable (Buabeng et al., 2004). According to Procor (2009), lowest treatment of hypertension ranges between 75-12% of a monthly income of Ghanaian average worker. This makes it expensive to be treated, therefore the need for understanding the disease and controlling it. Preventive measures is therefore the key to reduce the high prevalence of the disease in developing countries such as Ghana. This can only be achieved through creating awareness by educating the public.

Another factor is also due to the fact that acute management of hypertension is limited in most developing countries. This is as a result of the unavailability of su cient hospitals. Visitation to the hospitals trend to be inconvenient and these results to poor management of the disease. The high rate of mortality related to high blood pressure diseases also cause low workforce. This can result to an economic burden for families and society. Especially most African women tend to be house wives (dependent soley on husband). According to Buabeng et al (2004), studies by Wang et al (2002), Oke, and Bandale (2004) in Nigeria (West Africa) showed that poverty was the disposing factors of hypertensive patient's non-compliancy to treatment. This caused depression and anxiety as they could not manage the treatment. This resulted to resorting the alternative care from

traditional healers.

2.6 Epidemiological Trends of Hypertension

According to the report submitted to the Africa Union Conference of Ministers of Health by Steven et al, (2013), showed that globally, there are trends in population structure, population movements, lifestyle changes and diseases pattern that thought to explain the increasing burden of non-communicable disease including CVD. Health and disease patterns change over time in societies depending on the degree of changes in population structure and the rate of economic development to as a result of epidemiological transition. As societies develop, communicable diseases like tuberculosis prevail, whiles non-communicable diseases like hypertension become more prevalent especially in urban populations as a result of environmental changes and behavioral

determinants like increasing tobacco use, increasing fat and calories consumption

and decreasing physical activity and longer periods of exposure to those determinants. As in other parts of the world, the prevalence of hypertension in Africa,

South of Sahara has increased as manifestation of the epidemiological transition. Hypertension has become a signi cant problem in many African countries experiencing the epidemiological transition from communicable to non-communicable disease.

Rural-to-urban migration coupled with acculturation and modernization results in high blood pressure as observed in Kenyan and Ghanaian epidemiological studies of hypertension by Lore, (1993) and Owusu-Sekyere et al, (2013) respectively. The increasing urbanization is one of the main resources for the rise of prevalence in hypertension in Africa. The levels of hypertension are structurally higher in urban than in rural settings. Mainly because of contextual and behavioral factors associated with urban environments such as dietary changes, sedentary lifestyle that together form a complex system conducive for developing hypertension. As the region becomes more urbanized, as per current trend in Africa, so will the prevalence of hypertension.

In United States, estimates of hypertension (generally de ned as systolic blood pressure ≥ 140mmHg and or diastolic blood pressure ≥ 90mmHg or taking antihypertensive medication). A study by Nieto et al, (1995) shows that out of United State population of 15739, aged between 45-55 years review a prevalence rate of 35% in the years 1987-1989. Women's Health Initiative in U.S in the years between 1993 and 1997 also did a similar study of a population of 900,755 women aged 50-79 shows a prevalence rate of a total hypertension of
37.8% (Wassertheil et al, 2000). Self-reported hypertension rate increases from 21.2% in 1999 to 25.7% in the Behavioral Risk Factor Surveillance System (BRFSS) in US (Ahluwalia et al, 2003). Hypertension prevalence has decreased in developing countries whiles it shows an increased trend in the developed countries according to (Hajjar and Kitchen 2003). Generally, the worldwide burden of hypertension in 2000 was estimated to be 972 million persons or 26.4% of the adult world population, with

333 million in-developed and 639 million in developing countries (Kearney et al, (2005)). It has been estimated that by 2025, 156 billion individuals will have hypertension, an increase of 60% from 2000 (Kearney et al, 2005).

Chronic diseases have a larger history in Ghana than is usually thought especially stroke (Addae et al, 1996). According to Agyemang et al, (2012), stroke constitutes a signi cant cause of morbidity in Ghana. A study by Juliet (2006), showed that hypertension is now of public health signi cance in rural Ga district of Ghana. The high rate of hypertension was associated with low level of awareness, drug treatment and high blood pressure control. Overweight and obesity are modi able risk factors for hypertension that can be addressed through life style intervention. Another study by Juliet et al, (2012), showed that an increased burden of hypertension should be expected in Ghana as life expectancy increases and with rapid urbanization. Without adequate detection and control, this will translate into a higher incidence of stroke and other adverse health outcomes for which hypertension is an established risk factor. Prevention and control of hypertension in Ghana is imperative and any delay in instituting preventive measures would most likely pose a greater challenge on the already overburdened health system.

According to Owusu-Sekyere et al, (2013), showed that hypertension exists in substantial rates in low-income communities of the Kumasi Metropolitan Area. The study further revealed that the incidence of hypertension was higher for females than for males. This female dominance in hypertension is seen more often in densely populated low-income communities in the metropolis. The research has again shown that changing lifestyle due to rapid urbanization and the struggle for livelihood activities is a strong determinant responsible for the high incidence of the disease in the metropolis.

2.7 Prevention and Treatment of Hypertension

The prevalence and management of hypertension are major health challenges for the individual. The rise in BP with age could be prevented or diminished, much of hypertension, cardiovascular, renal disease and stroke might be prevented. A number of important causal factors for hypertension have been identi ed including excess body weight, excess dietary sodium intake, reduced physical activity, inadequate intake of fruits vegetables and potassium and excess alcohol intake. The prevalence of those characteristics is high. Mean sodium intake is approximately 4,100mg per day for men and 2,750mg per day for women, 75 percent of which comes from processed foods. Fewer than 20 percent of Americans engage in regular physical activity and fewer than 25 percent consume ve or more servings of fruits and vegetables daily. Because the lifetime risk of developing hypertension is very high a public health strategy is warranted. To prevent blood pressure levels from rising primary prevention measures should be introduced to reduce or minimize those cause factors in the population, particularly in individuals with prehypertension. A population approached that decreases the BP level in the general population by even modest amounts has the potential to substantially reduce morbidity and mortality or at least delay the onset of hypertension. It is the cheapest and most e ective way of controlling high blood pressure primary prevention has been proposed as the most e ective approach to the emerging epidemic (Maher et al, 2010). This is due to the fact that research has proven primary prevention to be the most e ective way of preventing illness. This is because; the type of approach makes health services easily accessible to the general public. It also promotes health through education,

making individual and the community as a whole to understand and develop

skills that helps to improve and maintain health. This participation incorporates the individuals into the delivery of care as well as encouraging people to reduce the risk of acquiring diseases by adopting a healthy lifestyle (Ndolindjock et al, 2011)

A large number of drugs are currently available for reducing blood pressure. More than two-thirds of hypertensive individuals cannot be controlled on one drug and will require two or more antihypertension agents selected from di erent
drug classes.

In hypertensive patients with lower BP goals or with substantially elevated BP, three or more antihypertensive drugs may be required. However there are also excellent clinical trial data proving that lowering BP with other classes of drugs including beta blockers (BBs) and calcium channel blockers (CCB's).

2.8 Related Works Using Logistic Regression

Logistics regression analysis is an important tool used in the analysis of the relationship between various explanatory variables and nominal response variables. A study by Kori(2009), used this statistical method to determine the factors which are considered to be signi cant contributors to the use or abuse of substances in school - aged children . The logistic regression model was used to build models for the three main types of substances used in this study; Tobacco,Alcohol and Drugs and this facilitated the identi cation of the signi cant factors which seem to in uence their used in children. A study conducted by Asiedu (2011), used multiple logistic regression to model malaria prevalence. This tool was used to determine the relative e ect of each of the independent variables such as ;mothers age, educational level, Marital status and household wealth index on the dependent variable malaria. Another study by Stella (2012), used multiple logistic regression analysis to determine if risk factors like age, gender, Marital status,hypertension,smoking,family history, alcohol consumption and occupational status are associated with having diabetes . Logistic model was tted to determine factors with high risk compared to others . Logistic regression tool is also used in psychological research. A research conducted by Wuensch and Poteat (1998), logistic regression was used in predicting decision from gender, ideology and scenario.

This analysis was employed to predict the probability that a participant would approve the continuation of the research. This tool was chosen over discriminant function analysis because the researchers wanted to evaluate simultaneously the e ect of two continuous predictors, one dichotomous predictor and one qualitative predictor. A research by James (2006), employed multi level logistic linear model in answering the core research questions. Logistic model were chosen so that the results could be interpreted in terms of the probability of success rather than point scores on a test. Another study by Lee and Smith (1997), used multi level regression linear model to investigated the relationship between high school size and students academic achievement .

Chapter 3

METHODOLOGY

3.1 Introduction

This chapter highlights the methods, data and analytical techniques employed in order to achieve the objectives of the study. More speci cally, it discusses the analytical framework, data source, sampling and sample size, logistic regression, generalized linear model and logistic regression, binary logistic regression, logistic regression with single independent variable, estimating the single regression model, estimation techniques, marginal e ect, de nition and measurement of variables priori expected signs and data analysis procedure.

3.2 Data Sources

The analysis in this research is based on data taken from cardiac clinic of the Komfo Anokye Teaching Hospital (KATH) Kumasi Ghana. The data was

collected from January 2013 to December 2013. This survey provides a wide range of information on demographic characteristics of respondents as well as other variables including, educational attainment, Body Mass index (BMI), fatigue, religious a liation, occupation and employment. A total of three Hundred (300) patients records were used.

3.3 Sample and Sampling Procedure

The data from cardiac clinic of the Komfo Anokye Teaching Hospital contains 300 patients. After merging of the various sections of interest of the data. The sample size was dictated by the presence of missing values in some sections of the data and also in the matching of patient from the various sections of the data. The missing values and the unmatched patient from the various sections were dropped in the merging process. Therefore the sample size used for the study is 300.

3.4 Logistic Regression

Regression methods have become an integral component of any data analysis concerning with describing the relationship between a response variable and one or more explanatory variables. Most often the outcome variable is discrete, taking on two or more possible values. According to Hosmer and Lemeshow 2000, the standard method of analysis over the last decade is logistic regression. The di erence between the logistic regression model and the linear regression is the outcome variable in logistics is binary or dichotomous. This di erence between the logistics and linear regression is seen in both the choice of parametric model and its assumptions.

3.4.1 Generalized Linear Model (GLMs) and Logistic Regression

The logistic regression model is an example of a broad class of models known as generalized linear models (GLMs). Example of GLMs are ANOVA, Poisson regression,

linear regression etc. There are three main component in GLMs, namely; random component which represent the probability distribution of response variable (Y), example binomial distribution of Y in the binary logistic

regression.

Systematic component:

This refer to the explanatory variables $(X_1, X_2, X_3, \ldots, X_k)$ as a combination of the linear predictors. Example $\beta_0 + \beta_1 x_1 + \beta_2 x_2$ in logistics regression.

Link function, η or $g(\mu)$: This speci es the link between the random and the systematic component. It is the expected values of the response that relate to the linear predictor of the explanatory variables. Example $\eta = \log it(P)$ for logistic regression or $g(\mu) = \log it(P)$ for logistic regression.

3.4.2 Binary Logistic Regression

Binary Logistic Regression analysis is a statistical tool use in analyzing data. A binary logistic regression analysis is used to predict categorical usually dichotomous variables from a set of predictor variables. A categorical dependent variable discrete function analysis is employed if all the predictors are continuous and nicely distributed. Logit analysis usually employed when all the predictor variables are categorical. Logistic regression is often used when the predictor variables are a mixture of continuous and categorical data.

Binary response variable depends on the set of explanatory variables, the random component Y is binomial distribution whereas systematic component Xs are explanatory variables which can be discrete, continuous or both and the parameters are linear, $\beta_0 + \beta_1 x_1 + \ldots + \beta_k x_k \ldots$

The link function: $\log it P$

$$P = \log it(P) = \log(\frac{P}{1-P}) \tag{3.1}$$

3.4.3 Logistic Regression with Single Independent Variable

The general relation for the logistic regression model with single variable is;

$$P(x) = \frac{\exp(\beta_0 + \beta_i x_i)}{1 + \exp(\beta_0 + \beta_i x_i)} \tag{3.2}$$

The transformation of P(x) is key to logistic regression which is a log*it* transformation. Here this transformation is de ned in terms of $P(x_i)$, as

$$g(x) = [\frac{p(x_i)}{1 - p(x_i)}] \tag{3.3}$$

$$g(x) = \ln[\frac{\frac{\exp(\beta_0+\beta_i x_i)}{1+\exp(\beta_0+\beta_i x_i)}}{1 - \frac{\exp(\beta_0+\beta_i x_i)}{1+\exp(\beta_0+\beta_i x_i)}}] \tag{3.4}$$

$$g(x) = \ln(\frac{\exp(\beta_0 + \beta_i x_i)}{1 + \exp(\beta_0 + \beta_i x_i)} \times \frac{1 + \exp(\beta_0 + \beta_i x_i)}{1})$$

$$g(x) = \ln(\exp(\beta_0 + \beta_i x_i))$$

$$g(x) = \log\exp(\beta_0 + \beta_i x_i)$$

$$g(x) = \beta_0 + \beta_i x_i \tag{3.5}$$

The relevant of this transformation is that $g(x)$ has many of the required properties of a linear regression model. The logit, $g(x)$ is linear in its parameters which may be continuous which may range from $-\infty to + \infty$ depending on the values of x.

3.4.4 Estimating the Single Regression Model

The method of estimation used in tting the logistic regression is the maximum likelihood. To use this technique we rst need to construct a function called likelihood function. This function shows the probability of observed data as a function of the unknown parameters.

The maximum likelihood estimators of these parameters are chosen to be those values that maximize this function. The resulting estimators are those which support closely with the observed data. However, we describe how to nd those values from the logistic regression model.

If Y is coded as 0 or 1, then the expression $p(x)$ given in equation (3.2) provided (for an arbitrary values of $\beta = (\beta_0,\beta_1)$, the vector of the parameters) the conditional probability that Y = 1 given x. This will be denoted as $P(Y = 1|x)$. It follows that a quantity $1 - P(x)$ gives the conditional probability that Y is equal to zero given x,$P(Y = 0|x)$. Thus for those pairs (x_i,y_i), where $y_i = 1$, the contribution to the likelihood function is $1 - P(x_i)$ and for those pairs where $y_i = 0$, the contribution to the likelihood function is $1 - P(x_i)$, where the quantity $p(x_i)$ denotes the values of $p(x)$ computed at x_i.

A way to express the contribution to the likelihood function for the pair (x_i,y_i) is through the expression

$$P(x_i)^{y_i}[1 - p(x_i)]^{1-y_i} \tag{3.6}$$

Since the observations are assumed to be independent, the likelihood function is obtained as the product of the terms given in equation (3.7) as

$$L(\beta) = \prod_{i=1}^{n} p(x_i)^{y_i}[1 - p(x_i)]^{1-y_i} \tag{3.7}$$

The principle of maximum likelihood states that we use as our estimate of β the value which maximize the expression in equation (3.7). However, nding the log of the equation (3.7), this expression the log likelihood is given as:

$$L(\beta) = \ln[l(\beta)] = \sum_{i=1}^{n} \{y_i \ln[p(x_i)] + (1 - y_i) \ln[1 - p(x_i)]\} \tag{3.8}$$

To nd the value of β that maximizes $L(\beta)$, we di erentiate $L(\beta)$ with respect to β_0,β_1 and partially expect the resulting expression equal to zero.

$$\frac{\partial \ln L(\beta)}{\partial \beta_0} = \sum_{i=1}^{n} [y - p(x)] = 0$$

and

$$\frac{\partial \ln L(\beta)}{\partial \beta_1} = \sum_{x_i} [y - p(x_i)] = 0$$

These equations, known as the likelihood equations:

$$\sum [y_i - p(x_i)] = 0 \tag{3.9}$$

and

$$\sum_{x_i} [y_i - p(x_i)] = 0 \tag{3.10}$$

3.5 Estimation Techniques

According to Gujarati (2002), the commonly used models when the dependent variable is dichotomous are the binary logit and probit models. The probit and logit models are indistinguishable from each other except for their tails in which the logit has fatter tails .The choice between logit and probit models is largely one of convenience and convention, since the substantive results generated are indistinguishable (Adu, 2015). For the purpose of this study the logit model is preferred because it is computationally simpler. The probit model was not used

because of the nature of the variables used in the study since it assumes cumulative normal distribution. To determine the probability that the ith individual is hypertensive, the functional form for the logit model can be

expressed as follows;

$$P_i = (y = 1|x_i) = \frac{\exp(\beta_i x_i)}{1 + \exp(\beta_i x_i)} \tag{3.11}$$

where

$\sum_{i=1}^{k} \beta_i x_i = \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_k x_k$

Based on equation(3.11), the probability that ^{ith} individual is not hypertensive can be stated as:

$$1 - P = \frac{1}{1 + \exp(x_i \beta_i)} \tag{3.12}$$

We can therefore write

$$\frac{P_i}{1 - P_i} = \exp(x_i \beta_i) \tag{3.13}$$

By taking the natural log of equation(3.13) I obtained the logistic function

$$L_i = \ln[\frac{P_i}{1 - P_i}] = \beta_0 + x_i \beta_i + \epsilon_j \tag{3.14}$$

Where ln = natural logarithms; P_i represents the probability that the i^{th} individual is hypertensive, $(1 - P_i) = i^{th}$ individual is not hypertensive; x_i is the vector of explanatory variables; β is the parameters to be estimated and $_i$ is the stochastic error term .

The stochastic error term component captures errors in model speci cation including omission of relevant variables and errors in data measurement.

According to Nketiah - Amponsah (2009), logistic regression enables researchers to predict a discrete outcome such as the hypertension status from a group of variables that may be continuous, discrete, and dichotomous or a combination of these. The

predictor variable in logistic regression can take any form because it makes no assumption about the distribution of the independent variables (they do not have to be normally distributed, linearly related or of equal variance within each group).

However, to determine the probability that an individual is hypertensive, the empirical model for binary logit model to be estimated is speci ed as follows:

$$P_{ij} = \beta_0 + \beta_1 Age_i + \beta_2 BMI_i + \beta_3 Educ_i + \beta_4 reg_i + \beta_5 sex_i + \beta_6 occu_i + \beta_7 Marital_i + \beta_8 Fatigue_i + \beta_9 Familyhistory_i + \beta_{10} alcoholintake_i + \beta_{11} smoking_i + \epsilon_i \quad (3.15)$$

Where: $P_{ij} = 1$ if an individual $^0i^0$ is hypertensive ($j = 1$) and equals zero otherwise ($j = 0$). $Age = age$ of the respondent, Educ = educational attainment of the respondent, BMI = body mass index of the respondent, Marital = marital status of the respondent, reg = the religious a liation of the respondent. gender = sex of the respondent, occu = occupation of the respondent

The commonly used technique for estimating models with binary dependent variable such as logit is the Maximum Likelihood Estimation (MLE). This technique is employed to estimate the parameters in our logistic regression
models.

The method of the maximum likelihood consists of estimating the unknown parameters in such a manner that the probability of observing the dependent variable is as high (maximum) as possible (Gujarati, 2006).
It is possible to show that unique maximum exist for the binary logit model. Pindyck and Rubin eld (1991) argued that Maximum Likelihood Estimation yields consistent parameter estimators. Thus, the MLE would produce the most likely value to the parameters given our sample data. The likelihood function

can be expressed as

$$L(\beta|y) = \prod_{i=1}^{Y}[F(X_i,\beta)]^{y_i}[1 - F(X_i\beta)]^{1-y_i} \tag{3.16}$$

where β is a vector of parameters of the model. The log-likelihood function is then written as

$$\ln L(\beta|y) = \prod_{i=}^{n}\{y_i \ln F(X_i\beta) + (1 - y_i)\ln[1 - F(Xi\beta)]\} \tag{3.17}$$

Maximization of the log-likelihood function yields the maximum likelihood estimator for the vector β. It is instructive to note that many statistical packages are available for the estimations of this model.

3.6 Marginal E ects

The marginal e ects of the explanatory variables on the dependent variable were determined after estimation of the parameters. These e ects would actually enable us to identify the variables that are associated with hypertension prevalence at the margin. Marginal e ects of the logit refer to the change in predicted probability associated with changes in the explanatory variables (Greene, 2003). Following Greene (2003) the marginal e ects for the logit model are given as

$$\frac{\partial E}{\partial x}[y|x] = (\beta, x)[1 - \lambda(\beta, x)]\beta \tag{3.18}$$

Where y is the choice variable; x is a vector of explanatory variables; β is a vector of parameter estimates and λ is the logistic distribution function. Equation (3.18) therefore is the procedure for nding the marginal e ects of the independent

variables in the logistic regression model.

3.7 De nition and Measurement of Variables

The variables to be measured would include: sex, age, religion, marital status, level of educational attainment, BMI and occupation.

Table 3.1: De nition and Measurement of Variables

Variable	De nition	Measurement
Dependent variable		
P_{ij}	Probability of the individual (i) being hypertensive	0 = not hypertensive 1 = hypertensive
Independent variables		
Age	Age of respondent	In years
Gender(Female dummy)	Sex of the respondent	0 = male, 1= female
BMI	Body mass index of respondent	weight over height squared
Marital Status	Marital Status of the respondent	0 = unmarried 1 = married
Edu	Level of schooling of respondent	0 = no formal education 1 = primary education 2 = JSS/JHS/Middle school 3 = SSS/SHS/Tec/Voc 4 = tertiary
Alcohol intake	whether the individual drinks alcohol	0 = no 1 = yes
Occupation	Respondent's occupation	0 = unemployed 1 = private sector worker 2 = government worker
Smoking	Whether the respondent smokes	0 = no 1 = yes

3.8 A Priori Expected Signs

To facilitate interpretation of the demand e ects of empirical values of the coe cients of the variables, this section discusses their expected signs, drawing upon past hypertension studies. The expected signs of the coe cients for the independent variables in equation (3.15) are presented in Table 3.2.

[0]Source: Computed from cardio clinic of the Komfo Anokye Teaching Hospital data

Table 3.2: A Priori Expectation of Estimated Coe cients

A priori expectations						
Equation (5)	$B_1>0$	$B_2>0$	$B_3<0$	$B_4>/<0$	$B_5>0$	
	$B_6>/<0$	$B_7>/<0$	$B_8>0$	$B_9>0$	$B_{10}>0$	$B_{11}>0$

Source: Author's construct, 2015

3.9 Method of Data Analysis

Data collected from cardio clinic of the Komfo Anokye Teaching Hospital (KATH) Kumasi was edited to ensure coherence and consistency of the information gathered. Data was already in excel format. The data was later transferred onto the stata data software for analysis. Respondents' characteristics were analyzed using descriptive statistics and presented on frequency tables. The factors associated with hypertension were analyzed using binomial logit. Analyzed data and parameter estimates from the models were presented using tables.

Chapter 4

RESULTS AND DISCUSSION

4.1 Introduction

This chapter of the study presents the empirical analysis of the factors in uencing hypertension status of an individual in Kumasi Metropolis. It begins with descriptive analysis of individual characteristics after which results of the study are presented and discussed in relation to the study. This is captured mainly in tables

4.2 Socio-Demographic Characteristics of Respondents

The analysis in this study is based on data taken from cardio clinic of the Komfo Anokye Teaching Hospital (KATH) Kumasi. After editing the data, 300 respondents were found to have the requisite information for the study.

Among these respondents, 180 (60%) were males and 120 (40%) were females. This shows that the study was fairly represented by the two sexes.For the age variable, the maximum age of the respondents was 88 years while the minimum age was 17 years. The mean age of the respondents was approximately 40 years with a standard deviation of 15.8. For the age categories of the respondents as shown in Table 4.1, 60 respondents were below 30 years representing 20 percent.

Between the ages of 30 and 39 years all inclusive, there were 80 respondents representing 26.67 percent. Between the ages of 40 and 49 years all inclusive, there were 70 respondents representing 23.33 percent of the respondents in that age group and between the ages of 50 and 59 years all inclusive, there were 50 representing 16.67%. Those 60 years and above were 40 representing 13.33
percent.

Table 4.1: Represents Age Categories of Respondent

Age Categories	Frequency	Percent
29 and below	60	20.00
30-39	80	26.67
40-49	70	23.33
50-59	50	16.67
60 and above	40	13.33
Total	300	100.00

The majority of the respondents, thus 140 (46.67%) had no formal education as presented in Table 4.2. Also, 72 (24%) respondents had attended primary education, 35 (11.67%) attended Junior Secondary School. With the senior secondary school, there were 30 (10%) while only 23 (7.67%) had obtained one

form of tertiary education.

Also Table 4.2 indicates that, out of 180 males interviewed, 60 (20%) had no form of formal education, 55 (18.33%) had attended primary education, while 30 (10%) attended Junior Secondary School. There were 20 (6.67%) males who attended secondary and 15 (5%) had obtained one form of tertiary institution.

Among the females, 80 (26.67%) out of 120 had no form of formal education, 17 (5.67%) obtained primary education, while 5 (1.67%) attended Junior Secondary School (or Middle School). There were 10 (3.33%) females who attended secondary and 8 (2.67%) had obtained one form of tertiary education.

[0]Source: Table computed from cardiac clinic of the Komfo Anokye Teaching Hospital data

Table 4.2: Represents Level of Education Attained by Respondents

	Male	Male	Female	Female
Educational Level	Frequency	Percent	Frequency	Percent
No Education	60	20.00	80	26.67
Primary	55	18.33	17	5.67
JSS/Middle School	30	10.00	5	1.67
SSS	20	6.67	10	3.33
Tertiary	15	5.0	8	2.67
Total	180	60.00	120	40.00

In terms of religious a liation, the majorities of the respondents 190 (63.34%) were Christians. There were 70 (23.33%) Traditional worshipers/ had no religion and 40 (13.33%) respondents were Muslims.

With regard to hypertension status of the respondents, out of 300 respondents, 144 representing 48 percent were hypertension patient and 156 representing 52 percent of the total sample used for the study were not hypertensive.

4.3 Factors in uencing Hypertension Status

Equation (3.15) in the previous chapter was estimated to determine the probability of an individual becoming hypertensive. The probability of an individual becoming hypertensive or not is hypothesized to depend on a number of socio-demographic characteristics and other factors. These socio-economic and other factors include age of the respondent, sex, educational attainment, fatigue, religious a liation, marital status, alcohol intake, BMI, family history, occupation. The logit regression model speci ed in chapter three was used to estimate the probability of an individual being hypertension patient. The result of the estimation is shown in Table 4.3.

[0]Source: Table computed from cardiac clinic of the Komfo Anokye Teaching Hospital data

Multicollinearity test was done to be sure that no two variables are linearly dependent. Multicollinearity in a regression framework refers to a situation where one of the predictors in the model is linearly dependent on other predictor. In logistic regression model, multicollinearity is a result of strong correlation between independent variables and it existence in ates the variances of the parameter estimates.

The correlation test of multicollinearity for this study as in Appendix A, shows that there is no problem of multicollinearity. This is because there was no coe cient value of up to 0.5 between any two variables. The implication is that the variables are independent of each other and can be included in the model. The results of multicollinearity test are presented in (appendix A). Coe cient estimates obtained from a discrete choice model can tell us the direction and signi cance of the relationship between the dependent and the independent variables but do not provide much meaningful interpretation by themselves; therefore, the estimated parameters were transformed into marginal e ects. The computed marginal e ects will

give us the magnitude of the change in the probability of an individual being hypertensive when the explanatory variable increases by 1 unit.

Table 4.3: Logit Estimation for Factors Associated with Hypertension

Variable	Marginal E ect	P-Value
Sex	0.0045	0.019 **
Age	0.4465	0.000 ***
Educational Attainment		
Primary Education	0.196	0.007 ***
JSS/Middle school	0.0156	0.643
SSS/Tech/Voc	-0.0295	0.457
Tertiary Education	-0.1073	0.007 ***
Smoking	0.006	0.331
Family History	0.033	0.003 ***
Marital	0.355	0.573
Occupation of Respondent's		
Private Sector Worker	0.0331	0.285
Government Worker	-0.078	0.375
BMI	0.147	0.000***
Religious A liation		
Muslim	-0.0612	0.093 *
Christian	-0.0113	0.779
Fatigue	0.0058	0.556
Alcohol Intake	0.1189	0.007 ***

Note: signi cant levels are *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Number of Observations = 300

Wald chi2(20) = 1137.4 Prob >

chi2 = 0.000

log pseudolikelihood = -1230.3032

Pseudo R2 = 0.1432

In all, a cross section of 300 respondents was used in this study and the Wald test statistic of the estimated model is signi cant at one (1) percent level. This suggests

[1] Source: Computed from cardio clinic of the Komfo Anokye Teaching Hospital data

that the explanatory variables taken together in uence or explains probability of an individual being hypertensive.

Pindyck and Rubinfeld (1981) show that an upper bound R2 for binary choice models is about 0.33, thus a Pseudo R2 of 0.1432 indicates a good t. HosmerLeme show test for goodness-of- t and link test were also passed.

Following from the rule that the number of dummies should be one less than the number of categories of the variable for which the dummy is being created, two dummies were introduced for religious denomination, two dummies for the occupation of the respondents and four dummies for education. The omitted group served as a base or reference category by which comparisons were made (Gujarati, 2002).

Table 4.3 shows the marginal e ects. Results in Table 4.3 suggest that sex, age, BMI, educational attainment, alcohol intake, family history and religious a liation of the respondents are signi cant in predicting the probability of an individual being hypertensive in KATH, Kumasi. Detailed discussion of the marginal e ects of each case-speci c variable on the probability of an individual being hypertensive is given below.

Table 4.3 shows that age of the respondents is signi cant in explaining the probability of an individual being hypertensive in KATH, Kumasi. It is signi cant at 1% level and has a positive correlation with probability of an individual being hypertensive. The positive coe cient of age of the respondent implies that the probability of an individual being hypertensive increases as his/her age increases. Thus the marginal e ect of 0.4465 indicates that when an individual attains one additional year, the probability of that individual being hypertensive increases by 44.65 percentage points. The age related rise in stostolic blood pressure is primarily responsible for an increase in both incidence and prevalence of hypertension with increasing age.

This nding is in consistent with Nieto et al.,(1995) and Wassertheil et al.,(2000). According to Nieto et al.,(1995), prevalence rate of hypertension in the United States is in uenced by age. People aged between 45-64 years revealed a prevalence rate of 35% in the years 1987-1989. A similar study by the women's Health Initiative in U.S in the years between 1993 and 1997 of a total population of 900,755 women aged 50-79 years revealed a prevalence rate of a total hypertension of 37.8% Wassertheil et al., (2000).

Body mass index was also found to be signi cant at one (1) percent and has a positive correlation with probability of being hypertensive. The positive coe cient of BMI of the respondent implies that the probability of an individual being hypertensive increases as his/her BMI increases. This can be attributed
to the fact that the more you weigh the more blood you need to supply oxygen and nutrients to your tissues. As the volume of blood circulated through your blood vessels increases, so does the pressure on your artery walls. Thus the marginal e ect of 0.147 indicates that when an individual BMI increases by 1, the probability of that individual being hypertensive increases by 14.7 percentage points. This is also consistent with the ndings of National Institute of Health (1998). According to them the normal BMI for an adult over 18 years is less than or equal to 18.5- 24.9 and so BMI that is
greater than this put one at risk of obesity related diseases as high blood pressure.

Sex, which in this case is a binary indicator for the female, has a positive and signi cant e ect on the probability of an individual being hypertensive. It is signi cant at ve (5) percent. The probability of a female compared to a male being hypertensive increases by0.45 percentage point. This is in consistent with

the ndings of Bakx et al., (1999). Bakx et al., (1999) study showed those women are at a higher risk of developing high blood pressure irrespective of age and body mass index.

Educational attainment of the respondent is a social factor found to be signi cant in in uencing the probability of an individual being hypertensive. Educational attainment was captured by four dummies with no formal education as the reference category. Two of the four dummy variables of educational attainment were statistically signi cant namely primary and Tertiary. The marginal e ect of a respondent with primary education is statistically signi cant at a one (1) percent level and has positive sign.

The implication is that those respondents with primary education are more likely to be hypertensive as compared with respondent with no formal education. The marginal e ect of 0.196 indicates that the probability of an individual with primary education being hypertensive as compared to an individual with no formal education increases by 19.6 percentage point. With Tertiary education, the marginal e ect has the expected negative sign and is also signi cant at one (1) percent level. This indicates that the probability of an individual with tertiary education being hypertensive as compared to an individual with no formal education decreases by 10.73 percentage point. This can be attributed to the fact that those who are educated know the risk factors associated with hypertension and also how to prevent hypertension.

Alcohol intake was also signi cant at one (1) percent. Alcohol intake has positive correlation with probability of one being hypertensive. The marginal e ect is 0.1189. It implies that the probability of an individual who drinks alcohol being hypertensive as compared to an individual who does not drink alcohol increases by 11.89 percentage points.

This is due to the fact that, the kidney and liver work extra hard and in getting rid of waste from the blood stream therefore, more pressure is exerted on the arteries.

Excessive alcohol intake can also increase the chance of other medical issues as obesity that may lead to an increase in blood pressure (Sheldon, 2011, Bakx et al., 1999). High consumption of alcohol has been related to the rise of blood pressure over the years (Mittal and Singh, 2010).

Religious a liation was captured by two dummies with traditional worshipper as the reference category. Only Muslim was statistically signi cant. It was signi cant at ten (10) percent and had negative sign. The marginal e ect is -0.0612 and it implies that the probability of a Muslim being hypertensive as compared to a traditional worshipper decreases by 6.12 percentage points. This can be attributed to the fact that Muslims do not drink alcohol which has been proved to be one of the causes of hypertension.

The study also found positive relationship between family history and probability of being hypertensive. Family history of a respondent was signi cant at one percent. This implies that the likelihood of an individual who has family member who is or was hypertensive as compared to an individual who has no family member who is or was hypertensive is high. This can be attributed to the fact that High blood pressure tends to run in families.

Chapter 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This nal chapter summarizes the major ndings of the empirical study

undertaken on factors associated with prevalence of hypertension in Kumasi Metropolis. The chapter is divided into three sections. Section one has a summary of the study, section two presents the conclusions of the study while in section three we make recommendations derived from the analysis of the available data.

5.2 Summary

Hypertension is one of the most important chronic non communicable diseases with increasing trend worldwide. According to Owusu et al (2012), hypertension topped the chart of cardiovascular risk pro le in Kumasi Metropolis and it had 48.4%. The purpose of this study was to examine the factors that are associated with hypertension prevalence in KATH Kumasi.

The analysis in this study was based on the data from cardiac clinic of the Komfo Anokye Teaching Hospital (KATH) Kumasi Ghana from January 2013 to December 2013. The respondents sampled were 300 patients who visited cardiac clinic of the Komfo Anokye Teaching Hospital (KATH) Kumasi and the unit of analysis was patient. A binary logit regression model was used for the study. The dependent variable was the hypertension status of the patient which is binary. Thus, whether the patient is hypertensive or not. The independent variables of the study were age, sex, educational attainment, fatigue, family history, BMI , marital status, alcohol intake, occupation, religious a liation. The statistical software, stata (version 12) was used for all estimations in the study.

The correlation matrix was closely examined and highly correlated variable was dropped to avoid the problem of multicolinearity even though STATA does that automatically. The link test and Hosmer-Leme show test for goodness-of- t were conducted and passed. The results of this research revealed many new ndings in addition to what is evidenced in the empirical literature. The study found out that

alcohol intake, gender, age, BMI, family history, religious a liation and educational attainment are key predictors of hypertension prevalence in KATH Kumasi. With their various probabilities 0.1189, 0.0045, 0.4465, 0.147, 0.033,
0.0612, 0.196(primary) and 0.1073(tertiary) respectively.

5.3 Conclusions

From the analysis and ndings of this study, the following conclusions are made. In the rst place, it was found out that the probability of one being hypertensive is explained by 0.1189 alcohol intake, 0.0045 sex, 0.4465 age, 0.147 BMI, 0.033 family history, 0.0612 religious a liation, 0.196 primary educational and 0.1073 tertiary education.

5.4 Recommendations

From the results and ndings of this study, a number of recommendations are made to policy makers of Ghana health Service and other stakeholders in the
health sector.

1. This study strongly recommends that the Ghana health Service should intensify it education on the consequence of obesity and how to reduce weight.

2. This study also recommends that Ghana Food and Drugs Board should regulate the rate at which alcoholic drinks are being advertised on our media and also use the media to educate the general public the side e ects
of alcoholic drinks.

3. There should be mass health education on the dangers, prevention and control of hypertension. The aim of such health education is to increase the level of

hypertension knowledge amongst females, people with primary education and no formal education.

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Appendix A

Correlation Coefficients of Explanatory Variables

	age	sex	educ	regel	marital	alcohol	occu	fatigue	BMI	F. history
Age	1									
Sex	0.01	1								
Educ	-0.08	0.03	1							
Regl	-0.04	-0.11	0.02	1						
Marital	0.07	0.08	-0.04	-0.11	1					
Alcohol	-0.01	-0.04	-0.03	-0.06	-0.04	1				
Occu	0.04	0.03	-0.08	-0.00	-0.00	-0.11	1			
Fatigue	-0.00	-0.04	-0.00	-0.03	0.05	0.07	0.02	1		
BMI	0.01	0.02	0.06	0.00	0.03	0.06	-0.00	0.05	1	
F. history	-0.03	0.12	0.00	-0.04	0.13	0.15	-0.02	0.02	0.04	1