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SCHOOL OF PUBLIC HEALTH

COLLEGE OF HEALTH SCIENCES

UNIVERSITY OF GHANA

HYPERTENSION AMONG HIV/AIDS PATIENTS ON HIGHLY ACTIVE ANTIRETROVIRAL DRUGS AT RIDGE REGIONAL HOSPITAL

BY

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DECLARATION

I hereby declare that the work herein presented is the outcome of my own original work except for the works of other people which have been duly acknowledged, and that this dissertation to the best of my knowledge has never been presented in whole or part for a degree in this or any other university.

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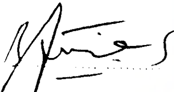

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DEDICATION

I dedicate this work to our father in heaven for His unending love and sustenance; and to my mum Aunty Lizzy, my loving wife Judith Antwi Boasiako and my darling boy Darren Nana Antwi Boasiako for their patience and endurance for this one year period of my studies.

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ABSTRACT

Background: With improved survival after the introduction of highly active antiretroviral therapy (HAART), non-AIDS-related morbidity and mortality have come to the forefront in the management of HIV patients. HAART has been linked to the development of several risk factors for cardiovascular disease including insulin resistance and hyperlipidemia, but its influence on hypertension requires further study.

The general objective of this study was to determine the prevalence of hypertension among HIV patients on highly active antiretroviral therapy.

Method: The study extracted electronic data stored on HIV/AIDS patients (262) in the DHIMNS-2 from the Ridge Hospital data base from the period 2010 to 2015. Data were analysed using appropriate analytical tools. The proportion of HIV/AIDS patients that developed hypertension while on antiretroviral was analysed using descriptive statistics. The Fisher's exact test was done to come out with the results (exact=0.678) for relationship between the HIV type and hypertension because the table had figures less than 5. The association between the class of antiretroviral and hypertension was also analysed using logistics regression with a significant level of 0.05

Results: The results showed that 63 patients out of the total 262 sample of HIV/AIDS patients who were on antiretroviral drugs from 2010 to 2015 at the Ridge Regional Hospital became hypertensive while on the antiretroviral drugs during that period. The females had a greater percentage of hypertensives whiles on the antiretroviral treatment than the males in the study, (62% and 38%) respectively.

The middle adult age category (31-45) had the highest proportion of patients being hypertensives thus 33 patients (52%). This was followed by the adult age category (41-60) with 23 patients (37%) and then the young adult's age category (18-35) which had 7 patients

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(11%) hypertensives. The age of participants was also significantly associated with hypertension among the HIV/AIDS patients on antiretroviral drugs. There was no relationship between the gender of the HIV/AIDS patients and the development of hypertension.

Also, there was no association between the HIV types and the development of hypertension among the patients on medication.

Conclusion

The prevalence of hypertension among the HIV/AIDS patients was 24%. But the prevalence among the various antiretroviral drugs from the study showed the following p-values AZT/3TC/EFV (p<0.34), AZT/3TC/NVP (p<0.14), AZT/3TC/NPC (p<0.75), TDF/3TC/NVP (p<0.07), D4T/3TC/NVP (p>0.02) and AZT/3TC (p<0.95). Hypertension was prevalent among patients on Stavudine/lamivudine/Niverapine class of antiretroviral drugs with a p-value p>0.02. Female participants also had the highest prevalence of hypertension (62%) of the total 63 hypertensives in the study. Also, middle age adults reported the highest proportion of hypertension (52%). Meanwhile the association between gender and the development of hypertension as well as HIV type and the development of hypertension among the patients on medication were not significant with p-values of p<0.135 and p<0.678 respectively. The study also showed a significant association between age groups and the development of hypertension among the HIV/AIDS patients in the study (p>0.001).

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LIST OF ABBREVIATIONS

3TC	Lamivudine
AIDS	Acquired Immuno-Deficiency Syndrome
ART	Antiretroviral Therapy
AZT	Zidovudine
BMI	Body Mass Index
BW	Body Weight
CD4	Cluster of Differentiation 4
CHD	Coronary Heart Disease
CK-MB	Creatine Kinase Muscle-Brain Fraction
CNS	Central Nervous System
CVD	Cardiovascular Disease d4T
Stavudine	
DAD Drugs Study Group	Data Collection on Adverse Events of AntiHIV
DBP	Diastolic Blood Pressure
DM	Diabetes Mellitus
DT	Duration of Therapy
EFV	Efavirenz
FBS	Fasting Blood Sugar
GDHS	Ghana Demographic Health Survey
HAART	Highly Active Anti-Retroviral Therapy
Hb	Haemoglobin
HC	Hip Circumference
HDLC	High Density Lipoprotein Cholesterol
HIV	Human Immunodeficiency Virus
HN	HAART naive

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MACS	Multicenter AIDS Cohort Study group
MI	Myocardial Infarction
NACP	National Aids Control Program
NNRTIs	Non-Nucleoside Reverse Transcriptase Inhibitors
NRTIs	Nucleoside Reverse Transcriptase Inhibitors
NVP	Nevirapine
OR	Odd Ratio
PIs	Protein Inhibitors
PPAR	Peroxisomal Proliferator - Activated Receptor
RNA	Ribonucleic Acid
S E	Standard Error of the Mean SBP
Systolic Blood Pressure	
STI	Sexually Transmitted Infection
TC	Total Cholesterol
TG	Triglyceride
UNAIDS	United Nations Programme on HIV/AIDS
WHO	World Health Organisation

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background

HIV/AIDS continues to be a major global public health issue since its emergence in early 1980s (UNAIDS, 2016). In 2015, an estimated number of 36.7 million people were living with HIV/AIDS (including 1.8 million children) and globally HIV prevalence rate was at 0.8%. The vast majority of these numbers of people lived in low- and middle- income countries (WHO, 2015). In the same year, 1.1 million people died of AIDS-related illnesses. Since the start of this epidemic, it is projected that about 78 million people have become infected with the HIV disease and again about 35 million people have died of AIDS-related illnesses such as tuberculosis, candidiasis (thrush), herpes zoster (shingles), etc. (UNAIDS, 2016). In the year 2015, Sub Sahara Africa had about 2.5 million people living with HIV/AIDS. The vast majority of about 19 million were found in eastern and southern part of Africa (UNAIDS, 2016).

Like other countries, HIV/AIDS continues to be a major health concern in Ghana. As at 2013, an estimated number of 224,488 people were living with HIV/AIDS. The prevalence rate was at 1.3% with 189,931 adults and 34,557 children living with HIV/AIDS in Ghana. Also there were about 10,074 AIDS deaths being 2,248 in children 0- 14 years and 7,826 adults were recorded on that same year (NACP, 2014).

The government of Ghana introduced free antiretroviral drugs for all clients diagnosed of HIV/AIDS in 2003 (NACP, 2012).The introduction of antiretroviral drugs have brought about a massive reduction in deaths of people living with HIV/AIDS and so they have an increase in life expectancy (Dimalla et al, 2016).

But the prolong intake of HAART has increasingly been associated with metabolic complications such as dyslipidemia and hypertension (Dimalla et al, 2016). As such there is

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more global concern about an increased prevalence of hypertension (HPT) and cardiovascular diseases (CVD) in HIV/AIDS patients on HAART. However, multiple differences have been observed between the USA and European countries (Njekelela et al, 2016). The introduction of highly active antiretroviral therapy (HAART) greatly reduced the morbidity and mortality due to HIV/AIDS, with patients experiencing longer and healthier lives (Dimalla et al, 2016). These increases in life expectancy and quality of life have however coincided with the epidemiological transition characterized by an increase in non-communicable diseases including cardiovascular diseases (CVD). Despite the limited data on CVD in people living with HIV in Africa, a recent study estimated the prevalence of self-reported CVD risk factors in HIV in Africa at 12% (Dimalla et al, 2016). Further studies from Uganda indicated that as many as 18% of HIV-infected adults in the study were found to have sub-clinical atherosclerosis, which could be predictive of CVD disease (Ssinbulya et al, 2014).

Furthermore, Bloomfield et al. (2014) published literature suggested that in Low and Middle Income countries cardiovascular diseases such as heart failure, hypertension, coronary artery diseases and stroke amongst others are common and appear to be more frequent in the HIV infected population. Mateen et al. (2013) also after their study of 5,563 patients initiating HAART in Uganda found out that as many as 27.9% were hypertensive. Despite the prevalence of cardiovascular disease including hypertension among HIV patients on antiretroviral therapy, there is drastic increase in the number of patients on the treatment especially countries in Sub-Sahara Africa (UNAIDS, 2016). Globally about 17 million with HIV patients were receiving antiretroviral treatment (ART) as at December 2015, meanwhile there were 7.5 million people receiving antiretroviral drugs in 2010 and so this showed an increase of the number to 15.8 million people in June 2015(WHO, 2016). This also indicated that 46% of all adults and 49% of all children living with HIV were receiving treatment (UNAIDS, 2016)

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This study determined the prevalence of hypertension among HIV patients receiving ART at the Ridge Hospital in Ghana.

1.2 Problem statement

The introduction of antiretroviral drugs has brought about a massive reduction in mortality and an increase in life expectancy of people living with HIV/AIDS (PLHIV) (Dimala et al, 2016). Globally HIV/AIDS patients on HAARTs are recording an increased prevalence of cardiovascular diseases (CVD) including hypertension after prolong intake of the drug (Dimala et al, 2016). Begovac et al (2014) stated that an increased in CVD exist in HIV/AIDS patients from Croatia and Serbia. Baker et al (2011) also confirmed that cardiovascular diseases were now the leading cause of death among people living with HIV after prolong period of the antiretroviral treatment which had come to boost the health situation and increased the life expectancy among people living with HIV/AIDS.

Bloomfield et al., (2011) found that hypertension and obesity were highly prevalent among HIV positive patients in Western Countries on HAARTs. A study from Dimala et al (2016) primarily compared the prevalence of hypertension in HIV/AIDS patients on HAART and HIV/AIDS patients not on HAART in Limbe, Cameroon; and secondly they again assessed other socio-demographic and clinical factors associated with HPT in these population after they realised most of the patients on HAARTs were also recording hypertension.

Mutede et al. (2015) also concluded in their research among HIV patients in Zimbabwe that the prevalence of hypertension was common (34.9%) among ART patients in Makonde where the research was conducted and it was equal to risk of hypertension in the general population. They also established that being on ART for more than two years exposed the patients in the study to hypertension.

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Another research in Uganda by Mateen et al., (2013) found that as many as 27.9% HIV patients were hypertensive. Ghana National AIDS Commission in its effort to curb deaths caused by HIV/AIDS also introduced the antiretroviral therapy in 2003 (NACP, 2012). With the improved survival after the introduction of the active antiretroviral therapy, non AIDS related morbidity and mortality had come to the forefront in the management of HIV/AIDS patients in Ghana. Report by Fianko, (2011), indicated that, among HIV people in Kumasi there was an increased in hypertension and diabetics as a result of their exposure to the HAART.

Prevalence of hypertension in HIV is still not well documented in Ghana although about 3 million adults are currently hypertensive while 236,000 adults are living with HIV/AIDS (Bosu, 2013). Even though metabolic conditions are common among HIV clients accessing retro clinic globally, there is the need to determine if there is prevalence of hypertension among HIV/AIDS patients on antiretroviral drugs in the Ghanaian setting since most clients have been on the antiretroviral treatment for over a decade now.

1.3 Research question

In relation to the research objectives the research questions of this study are;

1. What is the proportion of HIV/AIDS patients who developed hypertension while on ARTs at the Ridge Hospital?

2. What is the relationship between HIV types and hypertension occurrences among patients?

3. What is the association between the class of ARTs and hypertension?

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1.4 General objectives

To determine the prevalence of hypertension among HIV patients on highly active Antiretroviral therapy.

1.4.1 Specific objectives

1. To determine the proportion of HIV/AIDS patients who developed hypertension while on ARTs at Ridge Hospital.

2. To determine the relationship between HIV type and the occurrence of hypertension among the patients while on ART.

3. To determine the association between the class of ARTs and hypertension.

1.5 Justification of study

Globally, HIV/AIDS patients are experiencing normal way of life since the introduction of the antiretroviral drugs in the treatment. The increased in life expectancy is faced with an increased in cardiovascular conditions and other systemic conditions. The motivations for this study therefore stems from the issues of increasing rate of CVDs which includes hypertension among the HIV/AIDS patients who are receiving antiretroviral drugs (Balloca et al, 2016). And against the background that there is paucity of data on hypertension among HIV/AIDS patients who are receiving antiretroviral drugs in Ghana.

1.6 Conceptual framework

Miller et al. (2014) in their conceptual framework had various factors which could independently and significantly lead to hypertension among people living with HIV. These factors were the risk factors, antiretroviral factors and the infection factors. The risk factors

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on the conceptual framework includes smoking, age of patient, family history of hypertension ,alcoholism and body mass index of patient which could independently lead to hypertension in individuals or could be an effect on HIV infected patients or even have an effect on HIV clients who are on the active antiretroviral drugs. Prolong intake of highly active antiretroviral drugs could independently lead to hypertension or its tendency to cause hypertension could be as a result of smoking behaviour, family history of hypertension or aging among patients (traditional factors) or CD4 level among patients on the antiretroviral drug could be a factor to cause hypertension among patients. In the same vein, the antiretroviral factors can also influence the other factors.

Finally, the infection factor which also includes those infected with the disease and their CD4 levels can independently lead to hypertension among the patients. And at the same time it can also have an effect on the prolong intake of antiretroviral and the factors of the traditional risk group

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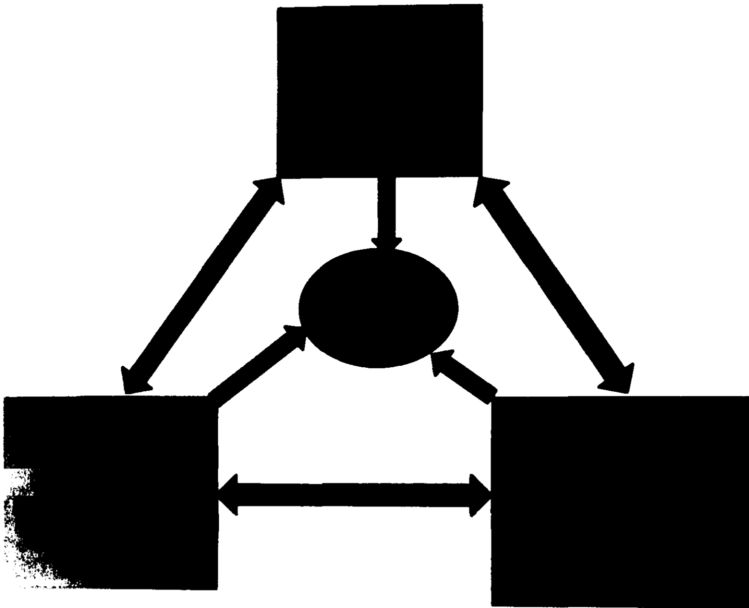
CONCEPTUAL FRAMEWORK



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CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 HIV and AIDS

Human Immunodeficiency Virus and Acquired Immune Deficiency Syndrome (HIV/AIDS) have been a major public health concern in the world since it emerged in the early 1980s. It has had great devastating effect not just on health but also on social and economic aspects of life of its affected individuals.

Its profound effect has caused for the reduction in child survival, reduction in life expectancy and an increased in indisposition leading to the weakening of the health system to cope with endowment of good health care and services to people living with the disease (UNAIDS, 2008). Its melodramatic effects in the social characteristic includes, increasing number of orphans as a result of their parents dying of the disease and stigmatization of people living with the disease. The economic factors are as a result of a slowdown in economic development and an increase in domestic poverty due to a reduction in workforce caused by severe illnesses and deaths (UNAIDS 2008).

Estimate shows that globally 36.7 million people were living with HIV/AIDS (including 1.8 million children) and internationally HIV prevalence rate was at 0.8% (UNAIDS, 2016). The vast majority of these numbers live in low- and middle- income countries. In this same year, about 1.1 million people died of AIDS-related illnesses and since the start of the epidemic, an estimate of 78 million people have become infected with HIV and 35 million people have died of AIDS-related illnesses such as tuberculosis, candidiasis (thrush), herpes zoster (shingles), etc. (UNAIDS 2016). Again in 2015, there were roughly 2.1 million new HIV infections, 150,000 of which were among children. Most of these children live in SubSaharan Africa and were infected through their HIV-positive mothers during pregnancy, childbirth or breastfeeding. Though there is a decline in AIDS deaths partly due to scaling up of

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antiretroviral therapy (ART) services, AIDS remains a leading course of death worldwide and a primary cause of death in Sub-Saharan Africa (UNAIDS, 2014).

2.2 Hypertension global view

Guwatudde et al (2015) reported that hypertension which is the most common cardiovascular disorder affecting approximately one billion people globally, remains the leading single contributor to global burden of disease and mortality accounting for approximately 9.4 million deaths annually. In 2000, there were an estimated 972 million people with hypertension, 65 % of whom lived in the developing world, with the number predicted to grow to 1.5 billion by 2025(Guwatudde et al,2015).

Cardiovascular disease (CVD) which includes hypertension was also mentioned as the leading cause of death in developing countries where it causes nearly as many deaths as HIV, malaria and tuberculosis (Kayima et al, 2013)

The World Health Organization has estimated that high blood pressure causes one in every eight deaths, making hypertension the third leading killer in the world. Globally, there are one billion hypertensives and four million people die annually as a direct result of hypertension (WHO, 2005)

WHO (2013) also reported that hypertension globally has killed nearly 9.4 million people prematurely and its death rate keeps increasing rapidly. It is also reported that about 1 billion people are currently living with high blood pressure. In 2008, the prevalence of high blood pressure among people from aged 25 and above was around 40% globally.

Although strong public health policies which included a multi sectoral preventive action and widely available diagnosis and treatment have led to a reduction in the prevalence of hypertension in the developed world, the disease burden has been at its peak in most developing countries

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The United Kingdom like other developed nations is not exempted from the dangers posed by Hypertension which also leads to some complications such as ischaemic and haemorrhagic stroke, myocardial infarction, heart failure, chronic kidney disease, cognitive decline and premature death.

Bharati(2009) also indicated that hypertension is a major public health problem and a leading cause of death and disability in developing countries. One-quarter of the world's adult population has hypertension, and this is likely to increase to 29% by 2025. Modeled projections indicate an increase to 1.15 billion hypertensive patients by 2025 in developing countries There is variability in the global prevalence of hypertension: hypertension is present in ~35% of the Latin American population, 20%-30% of the Chinese and Indian population, and ~14% in Sub-Saharan African countries

2.3 Hypertension in Sub Saharan Africa and Ghana

Echouffo-Tcheugui et al (2015), stated that uncontrolled blood pressure (BP), along with abuse of tobacco and high body fat are some of the adaptable risk factors for hypertension in SSA For the past 2 decades, there have been a rapid increased in hypertension cases in SSA of about 67%, and it has also led to the death of about 500,000 people in the region. It is also recorded that the prevalence of hypertension in some SSA countries are among the world's highest A recent review showed that hypertension prevalence varies between 15% and 70%, with an average of 30%, among SSA countries. Furthermore, in SSA between 44% and 93% of people with hypertension are unaware of their hypertensive status and are ignorant about its management Essuoma et al (2017) also wrote that hypertension, which was once rare in traditional African societies and was seen as the disease of the rich has now become a major public health problem because of its increased in prevalence opposing with low prevention, treatment and control measures. This high prevalence of hypertension in Africa is attributed to both urbanisation and a shift towards western lifestyles such as smoking, high intake of alcohol unhealthy diets with excess salt and fat intake, lack of physical activity and significant increase of adipose tissues.

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Kayima et al (2013) The management of the complications of hypertension which includes heart failure. Kidney failure, cardiomegaly and deaths is difficult to sustain in sub-Saharan countries where resource-intensive care is not very feasible. There is also a lack of adequate resources to sufficiently diagnose and treat the condition of hypertension among patients leading to an increased in morbidity and mortality in Africa.

Echouffo-Tcheugui et al (2015), also stated that only about 18% of individuals diagnosed with hypertension in Africa receive treatment for the condition and even out of that, only 7% are able to achieve required BP control levels. The cost of treatment for hypertension and its complications is so expensive, leading to a huge economic burden on individuals and national healthcare systems in most African countries (Echouffo-Tcheugui et al, 2015).

Kayima et al(2013) indicated that currently, the age specific mortality rates from CVDs which includes hypertension are much higher in younger age groups (30 and above) in both genders in Sub Saharan Africa than in the developed world.

BOSU, (2010) wrote that due to the lack of adequate prevention, control and treatment measures, there has being a high prevalence of hypertension in most African countries including Ghana. Several epidemiological studies have been conducted in Ghana over the past 60 years A survey conducted in a village about 60 miles from Accra in 1950 found that 5.5% of the 255 village inhabitants had hypertension (Bosu, 2010). Nearly one quarter of the deaths in Mamprobi, Accra over the 1975-1980 period was due to hypertension.

The number of reported new cases of hypertension in outpatient public health facilities in Ghana increase more than ten-fold from 49,087 in 1988 to 505,180 in 2007 [9]. Over the same period, hypertension relative to the total reported outpatient diseases increased from 1.7% to 4.0% in all ages.

2.4 Proportion of HIV patients who developed hypertension while on HAARTs

The highly active antiretroviral (HAART) drugs which were introduced have led to a massive change in the life of people living with HIV/AIDS enabling them to live longer and a normal life style as long as they complied to the drug regimen (Dimilla et al, 2016).

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However, the improvement in lifestyle and health status of HIV infection have been faced with an increase in non-communicable diseases such as hypertension and other cardiovascular conditions among patients on antiretroviral drugs. Notwithstanding the inadequacy of data on cardiovascular diseases on HIV/AIDS patients in Africa, a recent study appraised the prevalence of self-reported CVD risk factors in HIV in Africa at 12% (Dimalla et al, 2016). And also in Uganda, atherosclerosis which as a type of CVD was about 18% among People living with HIV (PLWHIV) (Bloomfield, 2014).

Bloomfield et al. (2014) in their literature indicated that in Sub Saharan Africa, cardiovascular diseases such as hypertension and the others were found to be more numerous in the HIV-infected population. Also Mateen et al.(2013) in their study of 5,563 patients who started HAART in Uganda indicated that as many as 27.9% were hypertensive out of the total sample size. The debate on the association of the HAART with the development of several metabolic complications such as dyslipidaemia, dysglycaemia and hypertension still go on. As the trend of diseases shifts from communicable to non-communicable, global health experts should be concern about tackling this same problem among the people with the communicable conditions and may develop the non-communicable ones like the increased in HTN and cardiovascular diseases (CVD) in HIV/AIDS patients on HAART.

Furthermore, hypertension was present among 254 HIV-1-infected (48.2%) and 188 HIV uninfected individuals (36.4%; OR HIV, 1.63; 95% CI, 1.27–2.09; $P < .001$)**(Arruda et al,2010).** The prevalence of hypertension was higher in HIV-1-infected individuals across the entire age range. HIV-1-infected patients received significantly more antihypertensive treatment (22.8%) compared with HIV uninfected individuals (13.9%; $P < .001$) and had a comparable rate of hypertension control. SBP did not differ between groups, whereas DBP was higher in HIV-1-infected patients. (Arruda et al, 2010)

Although some studies on blood pressure in HIV infected patients show conflicting results concerning the increased prevalence of hypertension among these patients while on HAART.

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Van Zoest et al, (2016) after their study also reported that 13% to 49% of the HIV 1 patients of their study became hypertensive while on HAART.

2.5 Duration of HAARTs and the onset of hypertension

The introduction of antiretroviral drugs have brought massive change in the life expectancy of people living with HIV. But the prolong intake of the antiretroviral drugs has been associated with metabolic condition (Cairns, 2014).

Some early studies suggested that protease inhibitors, a type of ART can be associated with elevated BP (Okello et al, 2016). A literature reviewed under the D: A: D study, found that the relationship between antiretroviral and elevated blood pressure was as a result of confounders such as age, race, increased BMI and family history of hypertension among patients (Factor et al, 2013). Another study by MACS suggested that prolong intake of antiretroviral drugs thus two years and above will lead to hypertension among HIV patients, (Currier et al, 2008).

Currier et al (2008), also recorded a dramatic decline in deaths among the HIV population in a research at veterans Affairs healthcare during the initial periods that HAART was introduced. The research further indicated that there were decreased cases of cardiovascular condition among the population for that period. So their research goes to confirm that HAART has a positive effect on the patients over a short period since it does not lead to risk for CVD and other conditions such as hypertension.

In Zimbabwe, the prevalence rate of hypertension was 56.4% and 40% after patients were administered Zidovudine and Stavudine for a period of 24months which indicated an increase in hypertension among (PLWHIV) (Mutede et al, 2015).

Medina-Torne et al, (2011) in their multivariate model indicated that a longer duration of 24months on HAARTs could lead to hypertension among HIV patients.

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2.6 Association between the class of HAART and hypertension

Blood pressure levels are usually considered in studies of cardiovascular disease risk in populations of HIV-infected patients, the prevalence of hypertension, the attention of this study has received little consideration, and data are debatable. Possible clarifications for these discrepant results include differences in study design, methodological aspects, the cut values for hypertension and differences in the population studied. Using the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7) criteria,19 (25.6%) of 958 patients with HIV/AIDS are hypertensive, a proportion similar to that found in the region, and in Brazil as a whole, in uninfected individuals. The comparison between HIV/AIDS, non-hypertensive and hypertensive patients showed that traditional risk factors were associated with the presence of hypertension, such as older age, male gender, overweight/obesity, family history of hypertension, and increased levels of triglycerides. Lipodystrophy was not associated with the presence of hypertension. The duration of HAART exposure was associated with hypertension and the levels of CD4 lymphocytes below 200 cells/mm3 showed a tendency to be protective against hypertension in univariate analysis; nevertheless, none of them remained in the final model. The type of antiretroviral schema was not associated with the onset of hypertension. The findings of this study emphasise the hypothesis that HIV/AIDS and antiretroviral therapy, despite significantly increase in the risk of atherosclerosis and cardiovascular disease do not appear to have a significant impact on the prevalence of hypertension compared with the factors traditionally associated with the disease, which is in agreement with the findings of Arruda et al (2010) research .

Dimala et al. (2016) in their literature stated that there is massive reduction in morbidity and mortality among HIV/AIDS patients as a result of the introduction of the highly active antiretroviral treatment which has also been associated with increased metabolic complications and cardiovascular diseases. Data on the association between HAART and hypertension (HTN) in Africa are scarce. . Prolong intake of HAART has progressively been linked with the development of metabolic complications such as dyslipidaemia, dysglyacemia and hypertension. There is more global concern about non communicable conditions posing

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health hazards to majority with an increased prevalence of HTN and other cardiovascular diseases (CVD) in HIV/AIDS patients on HAART being common. However, multiple differences have been observed between the USA and European countries and Cameroon (and other African settings) in the epidemiology of HIV, its demographics and the availability of antiretroviral drugs, amongst others.

Mutede et al. (2015) indicated that clients on Zidovudine and Stavudine drugs saw prevalence rate of hypertension to be 56.4% and 40% respectively, these shows a rise with increased duration thus for about 24months in their research in Zimbabwe .

Fianko, (2011) also concluded in his research among HIV people in Kumasi that there was an increased hypertension and diabetics among them as a result of their exposure to the HAART.

Junior et al, (2010) indicated that renal failure and vasculopathy were the conditions associated to HIV before HAART was introduced, but the period after HAART has brought about increased blood pressure among HIV patients which are as a result of hardening of the vessel wall in the victims.

Junior et al, (2010) stated after their analysis that the use of antiretroviral drug such as protease inhibitors in treatment of HIV do not have any association with hypertension.

Medina-Torne et al, (2011) also stated that age and other traditional risk factors were independently and significantly associated with hypertension among PLWHIV but not the intake of HAART.

Another literature reviewed on protease inhibitors which is a type of antiretroviral drug indicated that clients on the drug recorded equal weight and equal blood pressure reading like the general population hence the research stated that there is no association between that type of antiretroviral drug and hypertension (Bloomfield et al, 2011).

2.7 Alcohol consumption and hypertension among HIV patients

Alcohol use disorder is a prevalent concomitant of human immunodeficiency virus (HIV) infection. Studies based on HIV clinic attendees (Cook et al., 2001) report significant alcohol

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use in upwards of 63% of HIV patients, where as an analysis of a national probability sample (Galvan et al., 2002) reported that only 8% of patients with HIV infection reported heavy alcohol consumption. Alcoholism contributes significant comorbidity in the HIVinfected patient (Cook et al., 2001), increases risk behaviours associated with acquisition of HIV infection, and reduces medication compliance (Braithwaite et al., 2005). Mechanisms of alcohol's untoward effect on HIV disease include accelerated progression of the infection by contributing to immune suppression (Wang et al., 2002),diminished effectiveness of therapeutic regimens and potentiation of the neurotoxicity of retroviral proteins shed by the HIV virus during glial infection (Chun et al., 2005).

2.8 Aging among people living with HIV/AIDS

The introduction of HAART treatment has brought a longer and healthier lives span among HIV patients and most deaths among them are not historically related to HIV infection but associated with aging among PLWHIV. (Balloca et al 2016). Cardiovascular disease (CVD) is now a major health issue among HIV patients. This was confirmed in Sackoffs review of New York City death certificates, came out with findings that in HIV patients aged 55 years or older experiences CVD and it's the greatest cause of mortality among them and again also cardiovascular diseases which includes hypertension are common among younger ages of HIV/AIDS infected people when compared to the general population.

Bloomfield et al 2014, also stated that hypertension was the common cause of mortality among people living with HIV (PLWHIV) as they age, hence policy makers in SSA should gear their attention to address the care of non-communicable diseases among patients. Kwarisiima et al, (2016) also stated in their research that Sub-Saharan Africa records the highest prevalence of hypertension among adults in the world at approximately 46%. A review of literature by Van Zoest el al, (2016) indicated that age and other common risk factors could independently lead to a higher prevalence rate of hypertension among HIV infected individual on antiretroviral drugs.

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Junior et al, (2010) also found out that age greater than 40years and other biological factors could independently be associated with hypertension among people living with HIV.

Research has indicated that females and people older than 45 years among (PLWHIV) were at higher risk of developing hypertension than those who do not fall within those margins. (Mutede et al, 2015) Medina-Torne et al, (2011) also associated age as a contributing factor to hypertension in their multivariate model.

Bloomfield et al (2011) however also stated that individual cardiovascular risk is usually determined by a combination of several risk factors including age, family history, smoking, hypertension, overweight, diabetes and dyslipidemia.

Finally Hypertension is said to be also common among young HIV Patients on antiretroviral therapy (Bloomfield et al, 2011).

2.9 Body mass index among HIV patients

Peck et al (2014) stated that Sub Saharan Africa (SSA) is the most affected continent in the world with 69% of the total number of HIV infected persons. Half of the eligible HIV infected persons in SSA are on antiretroviral therapy (ART) as of 2010. Therefore, the infection-related mortality rates have begun to decline and life expectancy has increased, and so more cardiovascular disease mortality among HIV-infected adults is likely to be seen as already happening in developed countries (Peck et al, 2014). On a population level, in regions with high HIV prevalence, ART-related weight gain among large numbers of HIV-infected adults could lead to an „unmasking" of an epidemic of hypertension and an overall increase in the prevalence of cardiovascular disease (Peck et al, 2014).

Junior et al, (2010) stated in their literature that increased body mass index is associated with hypertension among HIV patients.

A literature by Mutede et al, (2015) stated that B.M.I above 25 kg/m2 and an increased waist to hip ratio among HIV women were associated to hypertension.

Meanwhile Bloomfield et al, (2011) cross sectional study indicated that overweight among HIV women is not strongly related to hypertension.

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2.10 Smoking among HIV patients

Calvo-Sánchez et al, (2012) stated that a high prevalence of tobacco and illicit drug consumption are contributing factors to the development of cardiovascular diseases including hypertension among people living with HIV.

Mutede et al, (2015) in their literature revealed that smoking is a significant life style which leads to the development of hypertension among HIV patients on HAART.

These studies coupled with numerous others suggest the prevalence of hypertension among HIV/AIDS clients receiving highly active antiretroviral therapy is a critical issue that needs further scientific investigation. Therefore the present study is designed to examine the prevalence of hypertension among HIV/AIDS clients receiving highly active antiretroviral therapy at Ridge hospital.

2.11 CD4 cell count among HIV patients

Gunda et al,(2017) on assessing the factors associated with infection and antiretroviral treatment, they observed that CD4-lymphocyte count less than 200 cells/mm3,from the time the patient was diagnosis of HIV infection over a period on antiretroviral drugs could lead to hypertension.

Bloomfield et al (2011), further stated that there is a relationship between higher CD4 count and higher prevalence of hypertension especially among young men than the older age groups in their study.

Meanwhile WHO (2015) launched new treatment guidelines in September recommending that treatment for people living with HIV can commence immediately they are diagnosed, regardless of CD4 cell load among patient.

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CHAPTER THREE

METHODOLOGY

3.1 Study design

The study involved a retrospective chart review of medical records of HIV/AIDS patients on antiretroviral therapy at Ridge Hospital.

3.2 Study setting

The study was conducted at the Ridge Hospital in the Greater Accra Region of Ghana. The study area was chosen because the Greater Accra region where the hospital is located is now recording a very high number of people living with HIV/AIDS currently in a survey by the Ghana AIDS Commission in 2015. Ridge Hospital was also chosen because it is the regional hospital which doubles as a referral centre where a lot of cases are referred to from health facilities in Greater Accra and beyond. Ridge hospital operates an ART treatment centre with an enrolment of about four thousand (4,000) patients with about two thousand (2,000) patients actively on treatment and about seventy patients being attended to on each clinic day. The HIV/AIDs clinic at Ridge Hospital is one of the pioneer special care centres for HIV patients. It provides services such as counselling and testing for HIV, CD4 count testing and also prevention and treatment of other STIs.

3.3 Study population

The study population consisted of all HIV positive patients who were tested and registered on the antiretroviral drugs after diagnosis from the years 2010 to 2015 at the ART centre of the Ridge Hospital. They were not hypertensive before commencing the antiretroviral drugs and also took the drugs consistently for at least a year or more.

The study participants also had their demographic and any other data needed for the study correctly documented and also their blood pressure checked consistently over the period

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using the manual sygpmomanometer and a stethoscope from either the left or right brachial region of the arm. The entire study sample also had good records on their blood pressure over the period and the readings were within the normal ranges (systolic 100-140, diastolic 60-90mmhg) before commencing with the treatment.

3.4 Inclusion criteria

1. HIV/AIDS patients between the ages of 18 to 60 years.

2. Patients who were on the highly active antiretroviral therapy consistently for at least one within the period 2010 to 2015

3. Patient should not be hypertensive before commencing ART treatment. Thus initial blood pressure checked shouldn't record systolic greater than 140mmgh and diastolic not greater than 90mmgh

4. Hypertension was diagnosed when the patients' blood pressure checked along the line recorded figures greater than 140/90mmhg for at least three consecutive periods or more on different occasions or visit days.

3.5 Exclusive criteria

1. HIV patients who were already diagnosed with hypertension before commencing the antiretroviral treatment.

2. Also patients who fell below 18 years and were above 60 years were also excluded from the study.

3. Patients who were on the highly active antiretroviral treatment for less than a year were not included in the study.

4. Again, patients whose blood pressures were not checked consistently over the period didn't qualify to be part of the study.

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5 Patients who do not have accurate records documented on their demographic characteristics such as ID numbers, age , sex, date of birth and date of commencing the treatment.

3.6 Sampling procedure

For this study, no definite sample size was calculated but instead all the total population of 1395 HIV/AIDS patients who were registered on the highly active antiretroviral drugs from 2010 to 2015 were extracted but only 262 patients satisfied the conditions for inclusive criteria to be part of the study.

3.7. Variables

Outcome variables

- Hypertension

EXPOSURE VARIABLES

- HAART
- Weight
- CD4 Counts
- Age

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VARIABLES EXTRACTED FROM THE DHIMNS-2 FOR THE STUDY

Systolic blood pressure	Weight
Diastolic blood pressure	Type of ART
Age	Viral load/ CD4 count
Sex	Smoking state
Height	Alcoholism
Duration of ART	Other medications
HIV type	Other conditions

Patients' data including age, sex, CD4 cell count, duration of HIV infection and blood pressure checked over the period were extracted from the electronic storage data on clients at Ridge hospital

The blood pressure (BP) of each participant measured consistently using the manual sphygmomanometer and stethoscope from the right upper arm that were recorded over the period before commencing the treatment and in the course of the treatment were analysed. Hypertension (the outcome variable) was diagnosed when their systolic blood pressure read more than 140mmhg and diastolic blood pressure also read more than 90mmhg in any of the patients for at least three consecutive times their blood pressure was checked on different continuous visit times over their period on the HAARTS.

3.8 Data analysis

The data were extracted from the Ridge Hospital data base and exported to Stata version 14 software for analysis.

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Chi square test and descriptive analysis was used to measure the relationship and proportion of people who developed hypertension while on HAARTs

Fisher's exact test was used to determine association between HIV type and the onset of hypertension occurrences among patients on antiretroviral. Logistic regression test was also used to measure the strength of the association between the class of ARTs and hypertension. Significance level was set at $p < 0.05$ at 95% confidence interval.

3.9 Ethical consideration

Ethical approval was obtained from the Ghana health service Ethical Committee with an approval number GHS-ERC:151/02/2017. Site approval was also obtained from the management of the Ridge Hospital and the heads of the antiretroviral therapy centre of the hospital. Consent of patients was not obtained under this study since the data that were extracted from the data base excluded their names and so no patient could be linked with any information used for the study. But strict confidentiality was observed and the data have been used solely for its purpose.

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CHAPTER FOUR

RESULTS

4.1 Introduction

This chapter presents the results on the prevalence of hypertension among HIV/AIDS patients on highly active antiretroviral drugs at Ridge Regional hospital. The study saw a total population of 1393 patients who were registered on the antiretroviral drugs at Ridge Regional Hospital form the year 2010 to 2015. Out of the total population of 1393 patient's data stored in the DHIMS2 of the hospitals database, 262 patients (63 hypertensive patients) met the inclusive and exclusive criteria for the study. This was as a result of incomplete data entry and loses to follow ups since most HIV/AIDS patients after been diagnosed and treatment commenced on the antiretroviral drugs in one facility closer to them decides to move to a distal facility to continue the care due to stigmatization.

4.2 Socio- demographic characteristics of patients showing proportion of age distributions based on gender

The ages of the study participants were from the ages of 18 to 60 years .The ages were also categorised into young adult (18 -30), middle adults (31-45) and adults (46-60) (Table 4.1) Also among the various age categories, the middle adult group had the highest frequency of 134 (51%) patients of which 93 were females and 41 males. The young adults' age category also had 70 (27%) patients of which 61 were females and then the adult age group also recorded 58 (22%) patients of which 30 were males.

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Table 4.1. Showing the proportion of age distributions based on gender

Demographic variables	Male (%)	Female (%)	Total (%)
Age categories			
18-30	9(4%)	61(23%)	70(27%)
31-45	41(16%)	93(35%)	134(51%)
46-60	30(11%)	28(11%)	58(22%)

4.3 Socio-demographic characteristics showing proportion of HIV/AIDS patients on antiretroviral drugs that developed hypertension.

The mean age of patients of the study was 37.7 (SD= 9.6) (Table 4.2). Among the various age categories, 199 patients were not hypertensive hence had a good control of the blood pressure over the period The young adults had 63 people (32%) while the middle adults and adult ages had 101 (51%) and 35(17%) respectively. But 63 of the patients were categorised as hypertensive in this study. 7 (11%) out of the total 70 under the young adult age group were hypertensives, 33(52%) of the hypertensive group were also found within the middle adult ages then 23(37%) of the hypertensive patients were also finally categorised under the adult age group. The Chi square test of association was found to be statistically significant (p<0.001, Chi 2= 15.3).

Also the gender ratio of the total sample size of 262 used for the study had 182 of them being females while 80 of them were males. The male portion represented 31% while the female portion represented 69%. But in relation to hypertension among the 262 HIV/AIDS patients, out of 63 patients who became hypertensive, 39 of them were females representing 62% of the sample diagnosed with hypertension. The Chi square test for this relation also showed (p-

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value=0.135) which indicates that there is no association between gender and development of hypertension.

The average weight of the HIV/AIDS patients on antiretroviral drugs which were recorded had a mean value of 64.5 and a standard deviation of 13.6 and the minimum value of 39 and a maximum value 126. These are shown in the table below.

Table 4.2 Socio-demographic characteristics showing proportion of HIV/AIDS patients on antiretroviral drugs that developed hypertension.

CHARACTERISTICS	HPT (%)	NON HPT (%)	fisher's exact	*P*VALUE
*Age categories (years)			15.3	>0.001*
Young adult (18-30)	7 (11%)	63 (32%)		
Middle adult (31-45)	33 (52%)	101 (51%)		
Adult age (46-60)	23 (37%)	35 (17%)		
*Gender			2.236	<0.135
Male	24 (38%)	56 (28%)		
Female	39 (62%)	143 (72%)		
*Average weight (mean/SD)		64.5 / SD= 13.6		<0.663

4.4 Association between HIV types and hypertension while on antiretroviral drugs

The HIV types 1, type 2 and both type 1and 2 were recorded among the patients. There were 199 non-hypertensive patients. 194(97%) of the non-hypertensive were found under HIV 1 type while 4(2%) were having HIV 2 and 1(0.50%) patient had both HIV1 and 2. But among the hypertensive, all the 63 patients were found under HIV 1 group (Table 4.3). In all, the total number of patients with HIV 1 were 257(98%) while the total for HIV 2 and HIV 1 and 2 were 4(1.53%) and 1 (0.38) respectively. Below is the table showing the various

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proportions of hypertensive and non-hypertensive among the various HIV types in the study participants.

4.3 Table showing bivariate analysis between HIV type and hypertension

HIV TYPES	HPT (%)	NO HPT (%)	TOTAL
HIV 1	63 (100)	194 (97)	257 (98.08)
HIV 2	0	4 (2.49)	4 (1.54)
HIV 1&2	0	1(0.51)	1(0.38)
TOTAL	63 (100)	199(100)	262 (100)

Fisher's exact = 0.678

4.3 Determine the association between the class of ART and hypertension

The table below, (Table 4.4) showed no association between hypertension and the class of ART variables except for D4T/3TC/NVP (p>0.02) which showed an association with hypertension. The p-values for AZT/3TC/EFV (p<0.34), AZT/3TC/NVP (p<0.14), AZT/3TC/NPC (p<0.75), TDF/3TC/NVP (p<0.07) and AZT/3TC (p<0.95) reveals that at the 0.05 level of significance there is no statistically significant effect on association between the variables and hypertension. Also for the various classes of ARTs, the percentages of hypertensives and non-hypertensives are as follows, TDF/3TC/EFV 8 hypertensives out of the total 51 patients on the drug, AZT/3TC/EFV also had 19 hypertensives out of 82 patients on the drug, AZT/3TC/NVP also had 24 hypertensives out of 92 patients who took the drug, AZT/3TC/NPC also had 1hypertensive out of 3 patients on the drug, TDF/3TC/NVP had 3 hypertensives out of 18 HIV/AIDS patients who took that drug, D4T/3TC/NVP had 7 hypertensives out of the 13 HIV/AIDS patients on that drug. Finally the AZT/3TC class also

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had 1 hypertensive out of the 3patients who took that drug. All these are shown in the table below.

Table 4.4 Logistic regression summary table

Antiretroviral drugs	HPT (%)	NO HPT (%)	Odds ratio	[95% Conf. Interval]		*p*-value
TDF/3TC/EFV	8(16.7)	43(83.3)	001			
AZT/3TC/EFV	19(23.2)	63 (76.8)	1.56	.625396	3.884282	<0.34
AZT/3TC/NVP	24(26.4)	68(73.6)	1.96	.8087563	4.744947	<0.14
AZT/3TC/NPC	1(33.3)	2(66.67)	2.63	.2119023	32.51794	<0.75
TDF/3TC/NVP	3(16.7)	15(83.3)	5.25	.8943194	30.81953	<0.07
D4T/3TC/NVP	7(54)	6(47)	7	1.308472	37.44826	>0.02*
AZT/3TC	1(27)	2(66)	1.05	.245813	4.485116	<0.95

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CHAPTER FIVE

DISCUSSION

5.0 Proportion of people who became hypertensive while on antiretroviral drugs.

The first objective of this study showed that proportion of 63(24%) of the HIV/AIDS patients who were on the antiretroviral drugs became hypertensive. With regards to the ages of HIV/AIDS patients on antiretroviral drugs, it ranged between 18 years to 60 years minimum and maximum respectively. This range is similar to T.A. Adedeji et al (2015) research age range on prevalence and pattern of chronic kidney disease in antiretroviral naïve patients with HIV in 2015 which had a range of 18 to 59years. The patient"s ages were also categorised into young adult, middle adults and adults. These age categorizations are in line with Ogunmola et al, (2014) research in a rural Tertiary Health Centre in Nigeria which shares similarities in terms of their demographics with our settings because both countries (Ghana and Nigeria) are found in West Africa. Also among the various age categories, the middle adult group had the highest proportion of patients (134 representing 51%). These age group category recorded the highest number of HIV/AIDS probably because most people become sexually active during the young adult stage and might have been exposed to several relationships and multiple partners before their middle adult age hence increasing their chance of getting infected during the middle adult group leading to the increased in their number.

Among the various age categories of the total population (262), 199 patients were not hypertensive over the period. But 63 of the patients who had a bad control of their blood pressure and were categorised as hypertensive in this study had the middle adult ages(31-45) recording the highest percentage (52%). This was followed by the adult age categories and then the young adult age recording the list in percentage (37% and 11%) respectively. Also the analysis of age significant value (p>001) indicated an association between age and the development of hypertension among HIV/AIDS patients on

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antiretroviral drugs. This is slightly different from Ogunmola et al (2014) research which demonstrated that age of hypertensive in their study arose from the middle age of 30 – 39 years and got to the peak at age 40-49years and the differences might be due to the differences in the age categorizations. But the similarities in this case is that the highest percentage of people that developed hypertension while on antiretroviral drugs were within the middle adult group followed by the adult age group and then finally to the young adult ages. Again prevalence of hypertension due to age among HIV/AIDs patients on antiretroviral drugs were confirmed in Sackoffs review of New York City death certificates, which came out with findings that in HIV patients aged 55 years or older, CVD was the greatest cause of mortality and also cardiovascular diseases which includes hypertension were common among younger age when compared to the general population.

Bloomfield et al (2014), also stated that hypertension was the common cause of mortality among people living with HIV (PLWHIV) as they age.

Kwarisiima et al, (2016) also stated in their research that Sub-Saharan Africa records the highest prevalence of hypertension among adults in the world at approximately 46%. Van Zoest et al, (2016) also stated that age and other common risk factors could independently lead to a higher prevalence rate of hypertension among HIV infected individual on antiretroviral drugs.

Junior et al, (2010) also found out that age greater than 40years and other biological factors could independently be associated to hypertension among people living with HIV. Research by Mutede et al, (2015) also indicated that females and people older than 45 years among PLWHIV were at higher risk of developing hypertension than those who do not fall within those margins. They in one way or the other confirmed that age has an association with hypertension among HIV/AIDS patients although their age category for hypertensives differs from what pertained in this research.

Medina-Torne et al, (2011) also associated age as a contributing factor to hypertension in their multivariate model. But on the contrary, Bloomfield et al (2011) pronounced that Hypertension was common among young HIV patients on antiretroviral therapy.

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In relation to gender distribution, majority of the patients studied were females while a smaller proportion were males. These differences may be as a result of the general population of females being greater than that of males in Ghana. (GDHS, 2015). In the same sense, the hypertension pattern among the gender groups saw a higher percentage of hypertensive among the females than among the males. The result of this study showed no significant difference between male and female HIV/AIDS patients and the development of hypertension among them while on antiretroviral drugs. The difference in proportion could be as a result of the female gender being more than the male gender in this study. But Mutede et al (2015) indicated that females and people older than 45 years among PLWHIV were at higher risk of developing hypertension than those who do not fall within those margins.

The average weight of the HIV/AIDS patients on antiretroviral drugs which were recorded also had a mean value of 64.5 and a standard deviation of 13.6 and the minimum value of 39 and a maximum value 126. The p value from the analysis of weight showed no association between their average weight and the development of hypertension among HIV/AIDS patients on antiretroviral in the study. Body Mass Index which was measured by Junior et al (2010) and indicated its association with hypertension among HIV/AIDS patients on antiretroviral drugs could not be calculated for the patients in this case because data were not collected on their heights. . Also research by Mutede et al, (2015) stated that B.M.I above 25kg/m2 and an increased waist to hip ratio among HIV women were associated with hypertension.

Meanwhile Bloomfield et al, (2011) cross sectional study supports our findings because they indicated that overweight among HIV women is not strongly related to hypertension.

5.1 Association between the type of HIV and hypertension while on antiretroviral drugs.

The HIV disease was categorized into the three types. Thus the type 1, type 2 and both type 1and 2 were recorded among the patients Majority of the study participants were found under

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the HIV type 1 group which is the commonest in our setting and also they recorded the highest prevalence of hypertension. This was followed by the HIV type 2 and then both HIV 1 and 2 which was the third category, recording the least in number and least prevalence of hypertension among the various types. The statistical analysis for this study showed no statistical evidence or association between the various HIV/AIDS types and the prevalence of hypertension among the patients on the various antiretroviral drugs.

5.3 Association between the class of antiretroviral drugs and hypertension.

The antiretroviral prescribed for the patients over the period 2010 to 2015 are the WHO recommended drugs for the management of HIV/AIDS patients. They were Stavudine (d4T), Lamivudine (3TC), Efavirenz (EFV) , Zidovudine (ZDV), Nevirapine (NVP), Tenofovir Disoproxil Fumarate (TDF) which were also combined into various groups as follows TDF/3TC/EFV, AZT/3TC/EFV, AZT/3TC/NVP, AZT/3TC/NVP, TDF/3TC/LP, D4T/3TC/NVP and AZT//3TC for the patients. These classes of antiretroviral drugs are similar to the groupings of antiretroviral in a research by Robert A. Ngala and Klutse Fianko"s (2013). The results from our research showed no association between the class of drugs and hypertension except for the Stavudine/lamivudine/Nevirapine class of drugs which had a p value greater than 0.02. This showed that there is an association between the Stavudine/lamivudine/Nevirapine class of ARVs and hypertension.

This is contrary to Arruda et al (2010) findings which indicated that there is no association between the class of antiretroviral drugs and hypertension. Other research findings such as that of Junior et al, (2010) also indicate that the use of antiretroviral drug such as protease inhibitors in the treatment of HIV do not have any associated with hypertension.

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Medina-Torne et al, (2011) also stated that age and other traditional risk factors were independently and significantly associated with hypertension among PLWHIV but not the intake of HAART.

Another literature reviewed on protease inhibitors which is a type of antiretroviral drug indicated that clients on the drug recorded equal weight and equal blood pressure reading like the general population hence the research stated that there is no association between the drug and hypertension (Bloomfield et al, 2011).

But other researchers like Mutede et al, (2015) revealed that clients on Zidovudine and Stavudine drugs saw prevalence rate of hypertension to be 56.4% and 40% respectively.

Fianko, (2011) also concluded in his research among HIV people in Kumasi that there is an increased hypertension and diabetics among them as a result of their exposure to the HAART.

Junior et al, (2010) indicated that renal failure and maculopathy were the conditions associated to HIV before HAART was introduced, but the period after HAART has brought about increased blood pressure among HIV patients which are as a result of hardening of the vessel wall in the victims.

These differences in results could be as a result of differences in the geographical setting of the various researches and their demographics as well as other factors that could alter the results

5.4 Limitations of the study

This study had limitations that need to be considered when interpreting findings. These are:

1. This study was cross-sectional and the findings cannot be generalized.
2. The study was also based on secondary data collected from the patients over the period during their visits to the hospital and so poor data collection and entry could have affected the outcome or any of its findings.

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3. Most patients data such as start of treatments and duration of the antiretroviral treatment were not properly documented making it difficult to include them in the study and also to assess them base on their duration of treatment.
4. Although patient's weight and ages were properly documented, their heights were not captured to enable the analysis of their body mass index to be carried out in this study even though other related studies have confirmed the association between BMI and hypertension among HIV/AIDS patients on antiretroviral drugs. .

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CHAPTER SIX

6.0 Conclusion

The prevalence of hypertension among the HIV/AIDS patients was 24%, while on the various antiretroviral drugs bases from the study, the p-values were AZT/3TC/EFV ($p<0.34$), AZT/3TC/NVP($p<0.14$), AZT/3TC/NPC ($p<0.75$), TDF/3TC/NVP($p<0.07$), D4T/3TC/NVP($p>0.02$) and AZT/3TC ($p<0.95$). There association between the class of antiretroviral drug and hypertension was prevalent in Stavudine/lamivudine/Niverapine class of antiretroviral drugs. Female participants also had the highest prevalence of hypertension (62%) of the total 63 hypertensives in the study. Also, middle age adults reported the highest proportion of hypertension. There was also an association between age and the development of hypertension among the HIV/AIDS patients on the antiretroviral drugs. It was also analysed that the association between gender and the development of hypertension as well as HIV type and the development of hypertension among the patients on the various classes of the antiretroviral medications were not significant

6.1 Recommendations

The findings of this study have important implications on the health of people living with HIV/AIDS in Ghana. Since age is significantly associated with hypertension among HIV/AIDS patients on antiretroviral drugs in this study, regular blood pressure checks should be encouraged to detect, diagnose and treat hypertension early enough among patients who have been on prolong treatments for HIV/AIDS. Secondly, the Stavudine/lamivudine/Niverapine class of antiretroviral drugs which have shown an association with the development of hypertension among HIV/AIDS patients should be accessed properly before being prescribed to the patients.

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