PREVALENCE OF AND RISK FACTORS FOR HYPERTENSION AMONG HIV-POSITIVE WOMEN OF REPRODUCTIVE AGE ON ANTIRETROVIRAL THERAPY IN MERU COUNTY, KENYA

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H57/69852/2013

A DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF THE DEGREE OF MASTER OF PUBLIC HEALTH IN THE DEPARTMENT OF PUBLIC AND GLOBAL HEALTH OF THE UNIVERSITY OF NAIROBI

2022

DECLARATION

I, the undersigned, declare that this dissertation is my original work and has never been presented for an award of a degree in any other university, and that all information from other scholars has been referenced.

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DEDICATION

This dissertation is dedicated to my dear wife Lynet Kagwiria, children: Felix Muriki, Evans Murithi, Emma Kendi, my late parents: M'Anampiu M'Lintari, and Rebecca Ciomucheke M'Anampiu, and my in-laws: Mr. Stevenson Mbaya and the late Florence Nkuene Mbaya. Through them I recognize and cherish the past, present and future foundations of my life.

ACKNOWLEDGEMENT

I am extremely grateful to Dr. Jacqueline Chesang and Dr. Peter Njoroge for their excellent supervision and guidance during proposal development, data collection and analysis, and dissertation writing. I especially thank Dr. Chesang for her exceptional analytical and editing skills that contributed immensely towards the design and execution of the entire study. To my employer, the National Council for Population and Development who cleared me to enroll and attend the course work sessions of the degree program, I shall ever remain grateful. Sincere gratitude goes to the study respondents for sparing their invaluable time to voluntarily participate in the study. I salute them all. I would also in a special way appreciate the County Health Department of Meru and the management of the three hospitals namely Meru Teaching and Referral Hospital, Consolata Hospital Nkubu, and Maua Methodist Hospital for their support and cooperation throughout the entire data collection period. Special appreciation also goes to the research assistants namely Ms. Carol Mukui, Ms. Mercy Makena, and Ms. Erica Kanana, for their professionalism and excellent assistance during data collection at the Consolata Hospital Nkubu, Meru Teaching and Referral Hospital, and Maua Methodist Hospital, respectively. The quality of the data for this study could largely be attributed to them. Besides, special recognition goes to Mr. Muricha Ekandi for ensuring due diligence during data entry and preliminary analysis. Finally, but not least my sincere gratitude goes to my wife Lynet Kagwiria, for her support, patience and love during the entire study period.

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LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
AOR	Adjusted Odds Ratio
ART	Antiretroviral Therapy
BMI	Body Mass Index
BP	Blood Pressure
cART	Combined Antiretroviral Therapy
CCCs	Comprehensive Care Clinics
CD4	Transmembrane protein found on helper or inducer T-cells
CHD	Coronary Heart Disease
CI	Confidence Interval
COR	Crude Odds Ratio
COR	Crude Odds Ratio
CVD	Cardiovascular Diseases
DBP	Diastolic Blood Pressure
DM	Diabetes Mellitus
DVT	Deep Vein Thrombosis
ERC	Ethics Research Committee

GBV	Gender Based Violence
HAART	Highly Active Antiretroviral Therapy
HC	Hip Circumference
HIV	Human immunodeficiency Virus
HTN	Hypertension
KES	Kenya Shillings
KNBS	Kenya National Bureau of Statistics
KNH	Kenya National Hospital
MeTRH	Meru Teaching and Referral Hospital
mm Hg	Millimetres of Mercury
mmHG	Millimetres of Mercury
MOH	Ministry of Health
NASCOP	National AIDS and Sexually Transmitted Infections Control Programme
NCD	Non-communicable Diseases
PHDP	Post Health Dignity and Prevention
PHQ	Patient Health Questionnaire
PLWHIV	People living with HIV
RAs	Researcher Assistants

SBP	Systolic Blood Pressure
SMEs	Small and Micro Enterprises
SPSS	Statistical Package for Social Sciences
Ssa	Sub Saharan Africa
UoN	University of Nairobi
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist Hip Ratio
WHR	Waste Hip Ratio
WRA	Women of Reproductive Age

ABSTRACT

Background: The introduction of antiretroviral therapy (ART) in Kenya has improved the life expectancy for persons living with HIV. However, the emergence of non-communicable chronic diseases such as hypertension is threatening the gains made in reducing morbidity and mortality from HIV-related complications. Evidence shows that hypertension and associated adverse health outcomes is common among HIV-infected adults on ART in Kenya. Despite the increasing burden of hypertension in HIV-positive patients, there is still insufficient understanding of its prevalence and risk factors particularly among HIV-infected women of reproductive age (WRA) on ART in Kenya.

Objective: To estimate the prevalence of hypertension and assess the associated risk factors in HIV-positive WRA on ART in Meru County, Kenya.

Methodology: This was a health facility-based cross-sectional study. The study was conducted in three health facilities in Meru County, Kenya. The selected facilities include, Meru Teaching and Referral Hospital (MeTRH); Consolata Hospital Nkubu; and Maua Methodist Hospital. The study involved 310 participants identified using repeated systematic sampling technique. Data were collected through interviewer-administered questionnaires, physical measurements and a review of patient health records. Data collection took 47 days between September 2021 and January 2022. Data were entered, cleaned, coded, stored, and analysed using version 25 of the Statistical Package for Social Sciences (SPSS) software. Both descriptive and inferential statistics were used for data analysis. Frequency tables were used to describe the sociodemographic characteristics of the study population. Bi-variable and multivariable logistic regression analyses were used to examine the risk factors for hypertension among the study population.

Results: The prevalence of hypertension was 23.9% (95% CI: 19.2 – 29.0; $p < 0.001$). This means that six in 25 WRA on ART in Meru County were hypertensive. Bivariable logistic regression analysis showed that older age, ever use of contraceptives, having a family history of hypertension, and abdominal obesity (WHR≥0.85) had statistically significant positive association with the risk of hypertension (crude odds ratio [COR] = 2.84, 95% CI: 1.53-5.30, for those who were 35-49 years old compared to the 18-34 years old; COR = 3.05, 95% CI: 1.05-8.88; COR = 3.29, 95% CI: 1.92-5.65; and COR = 1.77, 95% CI: 1.01-3.09, respectively). Non-statistically significant positive associations were observed between hypertension and longer duration since HIV diagnosis ($p < 0.38$), longer duration on ART ($p < 0.33$) and being on highly active ARVs ($p < 0.17$). Multivariable logistic regression analysis indicated that participants who had ever smoked cigarettes had a statistically significant higher risk of hypertension relative to never smokers (adjusted odds ratio [AOR] = 12.537, 95% CI: 2.369-66.344). A weaker, non-statistically significant association was observed in the bivariable analysis. Participants who were overweight (BMI = 25.0-29.9 kg/m^2) had a statistically significant positive association with the risk of hypertensive relative to those who were of normal weight (AOR = 6.69, 95% CI: 2.78-16.09). Obesity (BMI ≥30.0 kg/m^2) was associated with a non-statistically significant higher risk of hypertension (AOR = 1.39, 95% CI: 0.48-4.03). A positive association between obesity and hypertension was also observed in the bivariable analysis. Participants who had a family history of hypertension had a fourfold higher risk of hypertension (AOR = 4.46, 95% CI: 2.04 – 9.75). A threefold higher risk of hypertension among those with a family history of hypertension was observed in bivariable analysis.

Conclusion: The findings show that the prevalence of hypertension among WRA on ART is similar to the global estimates of the risk of hypertension among PLWHIV on ART and that of the general adult population in Kenya. Cigarette smoking, being overweight, and having a family history of hypertension were associated with the risk of hypertension among the study population. The study findings provide a firm basis for the integration of regular screening and management of hypertension and associated risk factors into the routine HIV and AIDS care for improved health and survival of HIV-positive patients especially WRA on ART. The current evidence provides critical information that could inform the implementation of relevant policies, strategies and guidelines in the Country such as the Kenya Health Policy 2014-2030, Kenya Community Health Policy 2020-2030, the 2018 Kenya National Guidelines for Cardiovascular Diseases Management, and the 2016 Guidelines on Use of Antiretroviral Drugs for Treating and Preventing HIV Infections in Kenya. Early diagnosis, prevention and control of hypertension and associated adverse health outcomes would significantly improve not only the quality of life for the HIV-positive patients but also that of the general population.

DEFINITION OF OPERATIONAL TERMS

Body mass index (BMI): It is determined by dividing a person's weight in kilograms (kg) by height in meters squared (m^2).

Cardiovascular Diseases (CVD): are a group of disorders of the heart and blood vessels. They include coronary heart disease (CHD), cerebrovascular diseases (CVD), peripheral arterial disease (PAD), rheumatic heart diseases; congenital heart disease, deep vein thrombosis (DVT), and pulmonary embolism.

Chronic hypertension: Elevated blood pressure for a period exceeding four months.

Comorbidity: presence of more than one disease or condition in a person at the same time.

Diastolic blood pressure (DBP): is the pressure in the arteries when heart rests between beats.

Epidemiologic Transition: refers to the shift in cause of death patterns that comes with the overall decline of death rates.

Hypertension: repeatedly elevated blood pressure exceeding systolic blood pressure of 140 and diastolic blood pressure of 90 mmHg.

Mortality rate (crude): refers to number of deaths occurring among a population of a given geographic area during a given year divided by mid-year total population of the given geographic area during the same year, multiplied by 1000.

Non-communicable diseases (NCD): group of diseases that are not transmissible from one person to another.

Normotensive: having normal blood pressure.

Obesity: Body mass index (BMI) $\geq$30 Kg/M^2.

Risk factor: Is a characteristic, condition or behaviour that increases the likelihood of getting a disease or injury.

Systolic blood pressure (SBP): It refers to the amount of pressure in the arteries during contraction of the heart muscle.

Women of Reproductive Age: age during which a woman can become pregnant, defined as 15-49 years.

CHAPTER ONE: BACKGROUND

1.1 Introduction

This section presents the background information of the study. It provides a global, regional and national situation of hypertension as well as the study purpose.

1.2 Background

Cardiovascular risk factors such as high blood pressure are often overlooked in human immunodeficiency virus (HIV) seropositive individuals in Sub Saharan Africa (Bloomfield et al. 2014). Non-communicable diseases (NCDs), including hypertension (HTN), are increasingly recognized as important causes of morbidity and mortality among people living with HIV (PLHIV) in resource-limited settings (Benzekri et al. 2018). Though the prevalence of HIV is highest in sub-Saharan Africa, HIV-related cardiovascular risk research is largely derived from developed country settings (Bloomfield, et al. 2011). Hypertension is the single most vital risk factor for cardiovascular diseases. Globally 22% of people aged 18 years and above were hypertensive in 2014 (WHO, 2016). Every year, stroke, heart disease, diabetes, cancers, and chronic respiratory diseases, and other NCDs cause tens of millions of deaths with many of them recorded in the most productive years of life (WHO, 2016). NCDs lessen economic output and prevent people from living healthy lives. One of the global targets on NCDs (WHO, 2010) is to decrease the occurrence of raised blood pressure by 25% by 2025.

The Kenya National Guidelines on Use of Antiretroviral Drugs for Treating and Preventing HIV infections in Kenya (NASCOP, 2016) recommends that all PLHIV must get a comprehensive package of services in promoting health, improving the quality of life, preventing further transmission of HIV, and preventing HIV disease development and mortality. Specifically, the guidelines recommend the integration of screening and management of diabetes mellitus, hypertension, dyslipidemia, chronic kidney disease, mental health, alcohol and drug use, and depression in the routine HIV and AIDS care.

Evidence shows that with the longer lifespans that antiretroviral therapy programs have made possible, NCDs are occurring due to a mix of chronic immune activation, medication side-effects, coinfections and the aging process itself (Narayan et al. 2014). Access to treatment for HIV/AIDS has turned the disease into a chronic disorder; joining the ranks of the emerging epidemics of NCDs, and therefore, raising an important concern of the coexistence of HIV with NCDs (Haregu et al. 2012). The Kenya HIV treatment program has grown exponentially, with improved survival among people living with HIV (Achwoka et al. 2019). Infection with HIV and some antiretroviral (ARVs) drugs have been associated with the risk of hypertension and CVD (Lundgren, et al., 2008). WHO (2016) recommends that the major NCDs and comorbidities, including hypertension, should be assessed at HIV diagnosis or initiation of ART.

Globally 23.6% of PLWHIV are hypertensive (Bigna et al. 2020). About 23.8 % of adult Kenyans aged 18-69 years are hypertensive (KNBS et al. 2015). Evidence shows that hypertension is common among HIV-infected patients in Kenya (Achoka et al. 2019; Bloomfield et al. 2014; Njeru, 2009). Despite the increasing burden of hypertension in the Kenyan HIV-infected patients, there is limited empirical evidence on its risk factors especially among HIV-positive women of reproductive age (WRA) on ART. The purpose of this study is to examine the prevalence of hypertension and associated risk factors to inform the design and implementation of appropriate policies and programmes. Subsequent chapters include literature review and conceptual framework; methodology; study findings; discussion, conclusion and recommendations.

CHAPTER TWO: LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

2.1 Introduction

This section presents a review of theoretical and empirical evidence on the prevalence of hypertension and associated risk factors in HIV-positive patients on ART. A conceptual framework that guided the study is also presented.

2.1.1 Prevalence of Hypertension in HIV-positive Women on ART

A review of evidence shows an apparent knowledge gap on hypertension in HIV-infected WRA on ART. A hospital-based cross-section study on hypertension among HIV-infected patients on ART in Kenya (Njeru, 2009) established that 18% of the patients were hypertensive. An investigation into the frequency of hypertension and its risk factors in HIV-infected patients on ART in Harare, Zimbabwe (Chireshe, et al., 2019) found a higher prevalence in men (31.6%) than women (28.1%). The authors established that age was considerably related to hypertension. A national population-based survey on the risk factors for NCDs in Kenya (KNBS et al., 2015) established that 23.8% of adult Kenyans (18 – 69 years) were hypertensive. A related study on prevalence of selected NCDs and HIV infection, and NCD risk factors in Southern Uganda and North-western Tanzania (Kavishe, et al. 2015) established that across strata, the prevalence of hypertension ranged from 16% (95% CI: 12-22) to 17% (95% CI: 14-22) in Tanzania, and from 19% (95% CI: 14-26) to 26% (95% CI: 23-30) in Uganda. Furthermore, a huge burden of hypertension was reported in both rural and urban areas affecting several youthful participants. Male sex, old age, lower education, divorced/widowed, and higher BMI were found to be related to hypertension. A study on the epidemiology of hypertension in WRA in the United States (Bateman et al. 2012) observed that hypertension occurs in about 8% of the women.

While examining the prevalence of hypertension and related risk factors amongst Nigerians on Combined ART (cART) (Bello, et al., 2017) established that there is a higher frequency of hypertension in individuals on cART than cART –naïve. The study findings called for constant hypertension screening in people with HIV to avert cardiovascular complications. In an analysis on the occurrence of hypertension in individuals on HAART (Dimala. et al, 2016) revealed that the risk of hypertension among patients on HAART was twice (38%; 95% CI: 28.5–48.3) that of the HAART-naïve patients (19%; 95% CI, 11.8–28.1). The authors established that hypertension was linked to male gender and old age in the HAART category and with BMI-defined overweight in the HAART-naïve cluster. Olack et al. (2015) analysed the risk factors for hypertension among adults aged 35–64 years living in an urban slum in Nairobi, Kenya. They found that the prevalence of hypertension in the overall sample was 27.4 % (95 % CI 25.2–29.6). The age standardized prevalence was estimated at 29.4 %, among females 32.5 % (95 % CI 29.1–35.8) and among males 27.8 % (95 % CI 24.3–31.2). The prevalence of hypertension was found to increase linearly with age peaking at 55–64 years.

2.1.2 Socioeconomic Risk Factors for Hypertension

A cross-sectional study on hypertension history among WRA in Ghana (Nyarko, et al. 2016) found an overall history of hypertension amongst the 7.5% of respondents with huge disparities within most of the sociodemographic groups. Educational level, work, marital, and wealth status, were among factors found to have a significant relationship with hypertension. Women, who were highly educated, ever married, not working, and from rich families, had higher hypertension risks. The study recommended targeting of the psychosocial and medical hypertension interventions to women in the higher-risk categories in Ghana. In a study among the tribal women in Visakhapatnam district, Andhra Pradesh, India (Naidu et al. 2016) established significant differences in hypertension by ethnicity.

2.1.3 Demographic Risk Factors for Hypertension

A study in a city slum in Nairobi, Kenya (Olack, et al. 2015) established that hypertension is a public health challenge in slums that affects at least 1 in 3 adults of 35-64 years of age. Marital status was also established as an important hypertension risk factor. Being a widow [AOR=1.7; (95 % CI, 1.1–2.6)], belonging to the highest wealth index [AOR=1.6; (95 % CI, 1.1–2.5)], obesity [AOR=1.8; (95 % CI, 1.1–3.1)] and moderate physical activity [AOR=1.9; (95 % CI, 1.2–3.0)], were significantly associated with hypertension. A study on hypertension among women in the United States, (Bateman, et al. 2012) showed that older age was one of the significant risk factors for hypertension among the study population.

2.1.4 Behavioural Risk Factors for Hypertension

A study on hypertension among ART patients in a largely rural Zimbabwean setting (Mutede, *et al.* 2015) established that smoking (OR = 5.06; 95% CI: 2.20-11.60), sedentary recreation (OR =3.16; 95% CI: 1.69-5.85) and high salt intake (OR= 2.67- 95% CI: 1.56- 4.59) were the main risk factors for hypertension. Hypertension was found to be widespread among ART patients even though it was not screened routinely in Makonde ART care settings.

2.1.5 Psychosocial Risk Factors for Hypertension

Evidence shows that depression is 2-3 times more widespread in PLWHIV than in the broad population in both well-resourced and resource-limited settings (Bernard, et al. 2017). In a study on hypertension amongst Indonesian adults (Peltzer, et al. 2018), sociodemographic variables, health behaviour, weight status, and psychosocial stress, were associated with hypertension. The study showed that use of tobacco and depressive symptoms among men was linked with hypertension. Moreover, women's lower subjective economic status was associated with hypertension.

2.1.6 Biomedical/clinical Risk Factors for Hypertension

A study on hypertension, and awareness and control of hypertension in adults with HIV and the general Ugandan population (Kwarisiima, et al, 2016) established that HIV-negative status was found to be autonomously linked to higher hypertension odds (COR 1.2: 95% CI: 1.1–1.4), while viral suppression considerably did not predict hypertension in HIV-infected patients. Hypertension burden was found to be extensive and poorly controlled in both HIV-infected patients and the larger population. The study recommends that HIV screening in Sub-Saharan Africa should offer counselling, testing, and treatment for hypertension.

A review of universal evidence on hypertension in HIV positive patients (Nguyen et al., 2015) established that hypertension is associated with genetic and lifestyle factors. The reviewers, however, concluded that HIV and its disease management could have a substantial role. Recent evidence indicates that diabetes, hypertension, obesity, and smoking were widespread in a South African HIV Clinic among extremely adherent, ART-experienced PLWHIV (Hyle et al., 2019). An analysis of the risk factors for hypertension (Medina-Torne, et al., 2012) found a general prevalence of 31% and was similar in people getting and not getting HAART (32% vs. 29%, p = 0.47). Advanced age, longer HIV duration, diabetes, and higher BMI were associated with hypertension. A high level of hypertension frequency and its relationship with HIV infection duration, virally-mediated endothelial changes, or immune activation also play a major role. High BMI at ART initiation, older age, and higher levels of triglycerides have been linked to a higher risk of hypertension (Diouf, et al., 2012). The widespread diabetes and hypertension among HIV-positive individuals on ART confirmed the link between the period of ART and diabetes. The evidence supports the need to execute prevention of cardiovascular risk factors programs in HIV positive individuals from resource-constrained settings.

A study on the risk of CVD among HIV-positive persons on ART in Malawi established that NCDs including hypertension was a major burden, with high occurrence of hypercholesterolemia in all participants and particularly acute diabetes load among older HIV infected patients (Rucker., et al. 2018). A study on CVD risk profile of the HIV cohort and how HAART affects people in the United Kingdom (Aboud, et al., 2010) showed that cholesterol, and duration on HAART, were the main determinants of CVD risk. Body composition, has been associated with higher prevalence of hypertension in HIV-1-infected people (Zoest, et al., 2016). Hypertension in HIV/AIDS patients is partly correlated with sex and age in Pernambuco/Brazil (De Arruda Junior et al., 2010).

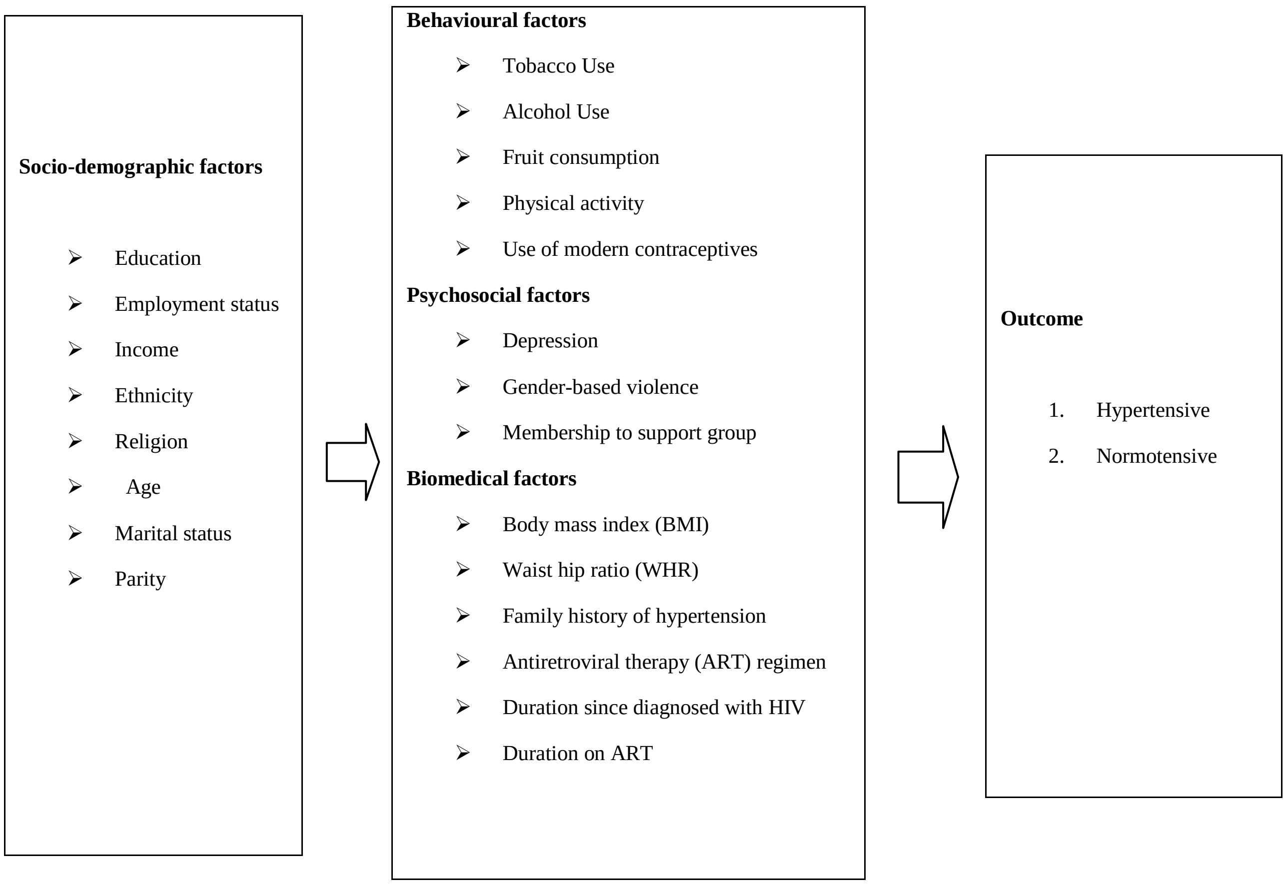
While analysing the prevalence and risk factors of hypertension in Ethiopia (Asresahegn et al. 2017) found that the prevalence of hypertension was 28.3%. Family history of hypertension [AOR=5.7; 95% CI: 2.9-10.9], having high level of income [AOR= 3.1; 95% CI: 1.5-6.3], being male [AOR= 2.4; 95% CI: 1.3-4.3], being above grade 12 [AOR= 2.2; 95% CI:1.2-3.9], and having BMI ≥ 25 [AOR= 2.0; 95% CI: 1.1-3.5] were significantly associated with hypertension. The authors called for community based screening programs for hypertension and its risk factors as well as routine screening for hypertension for those overweight or obese, low level educational status, those with positive family history of hypertension and high level of income, as they have an increased likelihood of developing hypertension.

In summary, the review shows that the increasing burden of hypertension among HIV-positive patients has raised considerable research attention not only in Kenya, but also elsewhere in the world. However, there is paucity of current data and information on the prevalence of hypertension and its associated risk factors among HIV-positive WRA on ART. Evidence further reveals significant gender differences in the burden of hypertension among patients on ART (Chireshe, et al. 2019), but gender-specific studies are largely lacking. Evidence indicates that a number of studies have been carried out to establish the principal risk factors for hypertension among HIV-positive patients, but the findings are largely inconclusive. Education attainment, employment status, wealth status index, ethnicity, male sex, advanced age, and marital status have been widely associated with the risk of hypertension (Kavishe et al. 2015; Olack et al. 2015; Nyarko et al. 2016; Naidu et al. 2016; Bateman et al. 2012, Medina-Tome et al. 2012). Some behavioural predictors of hypertension have been established. These include smoking, sedentary living, physical inactivity, and high salt intake (Mutende et al. 2015, Peltzer et al. 2018). Psychosocial factors have also been associated with the risk of hypertension. For instance, psychosocial stress is 2-3 times more common in PLWHIV than the general population in both well-resourced and resource-limited settings (Bernard et al. 2017, Peltzer et al. 2018). The risk of hypertension among HIV-positive patients on ART has been essentially associated with biomedical factors. Duration since diagnosed with HIV, being diabetic, being overweight, being obese, higher levels of triglycerides, cholesterol, duration on HAART, genetic factors, and family history of hypertension have been linked with the risk of hypertension (Kwarisiima et al. 2016, Nguyen et al. 2015, Medina-Tome et al. 2012, Diouf et al. 2012, Aboud et al. 2010, and Asresahegn et al.2017). Strengthening of both community and health facility-based to enhance screening of hypertension among high risk populations has been highlighted (Asresahegen et al. 2017). The review of evidence, therefore, provides a firm basis for the investigation of the burden of hypertension among WRA on ART as well as the associated risk factors to inform relevant policies and programmes in Kenya.

2.3 Conceptual Framework

This study is based on the WHO (2010) conceptual framework for action on social determinants of health. The framework has been distinguished from other frameworks because of its emphasis on the socioeconomic, cultural and political context and structural determinants of health inequity. The framework hypothesizes that the economic, social, and political systems give rise to several socioeconomic levels in which, populations are stratified according to education, income, gender, occupation, and race/ethnicity to describe a person's socioeconomic level in hierarchies of power, access to resources and prestige. The framework identifies various intermediary health determinants of disparity such as psychosocial, material circumstances, behavioural and/or biomedical factors; and the health system. Among the psychosocial circumstances are the psychosocial stressors, stressful living conditions and relationships, and coping styles and social support (or the lack thereof). The behavioural factors include physical activities, nutrition, consumption of tobacco, and alcohol spread in a different way amongst dissimilar social groups. Ultimately, the framework recognizes the biomedical factors such as genetic and medical factors. According to the framework the socioeconomic factors operate through the various intermediary/proximate health determinants to influence health outcomes as presented in Figure 1, below.

Figure 2.1: Conceptual Framework for the Study of the Prevalence of and Risk Factors for Hypertension among HIV-positive WRA on ART in Meru County, Kenya



Source: Adapted from World Health Organization (2010): A Conceptual Framework for Action on the Social Determinants of Health

2.3 Problem Statement

The introduction of antiretroviral therapy (ART) in Kenya has improved the life expectancy for persons infected with HIV. However, the emergence of non-communicable chronic diseases such as hypertension is threatening the gains made in reducing morbidity and mortality from HIV-related complications. Evidence shows that hypertension and associated adverse health outcomes is common among HIV-infected adults on ART in Kenya. Despite the increasing burden of hypertension in HIV-infected patients, there is still insufficient understanding of its prevalence and risk factors particularly among HIV-infected women of reproductive age (WRA) on ART in Kenya. Hypertension is recognized as the single most vital risk factor for CVD. Every year, stroke, heart disease, diabetes, cancers, and chronic respiratory diseases, and other NCDs cause tens of millions of deaths with many of them recorded in the most productive years of life (WHO, 2016). Globally 23.6% of PLWHIV are hypertensive, translating to nearly 8.9 million (Bigna et al., 2020). About 23.8% of adult Kenyans aged 18-69 years are hypertensive (KNBS et al. 2015).

Notwithstanding hypertension being the leading risk factor for CVD in HIV-infected patients on ART (MoH, Kenya, 2016) current evidence on its magnitude and risk factors is largely lacking. Given the widely observed distinctions in the levels of hypertension between HIV-positive men and women, there is need for current and gender-specific empirical evidence to inform the appropriate interventions. Evidence shows that in 2014 Meru County was ranked 25th highest burden of HIV with 1090 new adult HIV infections (MoH,Kenya, 2014). Similarly, the County was ranked 26th in number adults living with HIV (20,200) among the 47 counties in Kenya. In the same period, ART adult coverage, was above the national average (82%) ranking among 18 best performing counties in the Country. Noteworthy, the HIV prevalence in the County has remained disproportionately high among women (4.1%) relative to adult men (1.8%). This, therefore, poses both a challenge and an opportunity in addressing the welfare of PLWHIV in the County, especially WRA on ART. The purpose of this study is to examine the prevalence of hypertension and associated risk factors among WRA on ART.

2.4 Justification

Since hypertension as well as other CVD risk factors have largely been overlooked in HIV seropositive individuals in sub Saharan Africa (Bloomfield et al. 2014) there is, therefore, need for current context-specific evidence to inform policy and program interventions. NCDs, including hypertension (HTN), have increasingly been recognized as important causes of morbidity and mortality among PLHIV in resource-limited settings across the world (Benzekri et al. 2018). Evidence shows that owing to the widespread use of highly active antiretroviral therapy, morbidity and mortality patterns of PLHIV has shifted from AIDs-related opportunistic infections towards age-related chronic diseases, including hypertension, diabetes, dyslipidemia, and CVD. This, therefore, means that to significantly improve the quality of life of PLWHIV attention on NCD risk factors such as hypertension is needed. Since hypertension has been identified as the single most important risk factor for CVD among HIV patients, priority action on the disease is needed. For instance, every year, stroke, heart disease, diabetes, cancers, and chronic respiratory diseases, and other NCDs cause tens of millions of deaths with many of them recorded in the most productive years of life (WHO, 2016). Evidence shows that blood pressure level among HIV positive patients in Kenya is related to mortality (Bloomfield et al. 2014). Although screening and management of hypertension and other NCDs as part of routine care for HIV-positive patients is recommended (MoH, Kenya, 2016), the practice is yet to be fully embraced. The relatively higher burden of HIV among adult women (4.1%) than adult men (1.8%) calls for generation of current and gender-specific data to inform the design and implementation of appropriate policies and strategies to optimize the quality of life of HIV-positive patients especially WRA on

ART. Besides, the observed high adult ART coverage provides a special opportunity for integration of NCDs especially hypertension into the routine care for PLWHIV in the County. Furthermore, the findings of such a study could open up new research frontiers on hypertension and associated risk factors.

2.5 Research Questions

i. What is the prevalence of hypertension in HIV-positive WRA on ART in Meru County, Kenya?
ii. What are the risk factors for hypertension among HIV-positive WRA on ART in Meru County, Kenya?

2.6 Broad and Specific Objectives

2.6.1 Broad Objective

To estimate the prevalence of hypertension and assess the associated risk factors in HIV-positive WRA on ART in Meru County, Kenya.

2.6.2 Specific Objectives

Among HIV-positive women of reproductive age receiving ART in Meru County, Kenya to:

1. Estimate the prevalence of hypertension.
2. Determine the sociodemographic, behavioral, psychosocial, and biomedical risk factors for hypertension.

CHAPTER THREE: METHODOLOGY

3.1 Study Design

This is a hospital-based cross-sectional study. The choice of the design is deemed appropriate because one of the specific study objectives sought to estimate the prevalence of hypertension in the population under study. The design also allows for the determination of risk factors for hypertension, a key focus of this study.

3.2.0 Study Site

This study was carried in Meru County. Evidence shows that in 2014 Meru County was ranked 25th among 47 counties with highest burden of HIV in the Country. At the same time, the county had 1090 new adult HIV infections. Furthermore, the County was ranked 26th in number adults living with HIV (20,200) among the 47 counties in Kenya. Noteworthy, the HIV prevalence in the County has remained disproportionately high among adult women (4.1%) relative to adult men (1.8%). Evidence shows in 2014, adult ART coverage, was above the national average estimated at 79% and 82%, respectively, ranking among 18 best performing counties in the Country. The County was, therefore, purposively selected due to the relatively high burden of disease especially among adult women and the impressive Adult ART coverage.

The study was conducted in three purposively selected outpatient-based comprehensive care clinics (CCCs) in Meru County, Kenya. The sites included the three outpatient based CCCs at the Consolata Nkubu Hospital, Meru Teaching and Referral Hospital (MeTRH), and Maua Methodist Hospital. The three facilities are located in southern, central and northern regions of the county, respectively. The sites are purposively selected to represent the socioeconomic and cultural diversity of the County. The three facilities have also been selected because they have an adequate number of clients on ART, specifically women of reproductive age.

The southern region of the county is typically inhabited by the Imenti sub-ethnic group tribe of the Meru. The main economic activity of the community is both cash and food crop farming. The main cash crops include coffee, tea, and more recently bananas. The MeTRH is located in the urban cosmopolitan region of the county. The main economic engagement for the urban residents is business including the small and micro enterprises (SMEs). Maua Methodist Hospital is located in the northern region of the county, typically inhabited by the Igembe and the Tigania sub tribes of the Meru. Both Nkubu and Maua hospitals are faith-based health facilities; managed by the Catholic and Methodist churches, respectively. MTRH on the other hand, is owned and managed by the County Government of Meru, Kenya.

The county is located east of Mt. Kenya. The County borders five counties; to north it borders Isiolo, to the east Tharaka-Nithi, to the south west Nyeri, and to the west Laikipia Counties. The population distribution in the urban areas where the selected health facilities (study sites) are situated are as follows: Meru Town has a population of 85,289 people consisting of 42,036 males and 43,252 females. Nkubu Town has a population of 16,691 comprising 8,441 males and 8,280 females. Maua Town on the other hand, has a population of 37,966 people comprising 18,855 males, and 19,112 females

3.3 Study Population

The study targeted HIV-positive women aged between 18 and 49 on ART in Meru County, Kenya. This population was chosen mainly because data and information on hypertension among HIV-positive WRA on ART are largely lacking in Kenya. Furthermore, evidence on the magnitude of hypertension and its risk factors in this population is too inconclusive to inform relevant intervention measures.

Evidence shows that previous studies on hypertension have largely focused on either HIV-patients on ART in general or the general population. This has resulted in the masking of the plight of the vulnerable and special segment of the population such as the HIV-positive WRA. By targeting this population, the study seeks to generate much-needed age and gender-specific data and information for decision–making to inform interventions for optimal care of such populations. In this study, HIV-positive WRA are considered as vulnerable because of their relative susceptibility to opportunistic infections or conditions owing to their relatively low immunity compared to those that are HIV–negative. HIV-positive patients especially women are also more likely to experience gender-based violence, stigma, and discrimination in most societies than HIV-positive men due to cultural and socioeconomic reasons. Furthermore, CVD risk factors such as high blood pressure has been associated with increased mortality among HIV-positive patients.

3.3.1 Inclusion Criteria

This study included:

i. HIV-positive women aged 18 and 49 years on ART who provided informed consented to participate. This age category is deemed appropriate because they are above the age of maturity and can make decisions regarding their participation in the study.

ii. HIV-positive women on follow up visit to the ART clinic. This category of patients was included because it allowed the investigator to verify and confirm some vital information from the existing patient records, such as blood pressure, and the type of ARVs the patients have been receiving.

3.3.2 Exclusion Criteria

This study excluded:

i. HIV-positive women aged less than 18 years because they are below the age of consent

ii. HIV-positive women who are too sick or unwilling to participate: to conform to ethical standards and requirements.

iii. Women who are currently pregnant: to avoid the confounding effect of pregnancy-induced hypertension.

iv. Women on their first visit to the CCC: because they lack patient records for verification of vital measures such as CD4 counts.

v. Women who are in their postpartum period: to avoid the confounding effect of postpartum morbidities such as hypertension and haemorrhage.

3.4 Sample Size Determination

Fisher et al. (1991) formula was used to calculate the minimum sample size for the study. The investigator assumed a prevalence of hypertension of 28% in the study group, and a significance level of 0.05. The prevalence assumption of 28% is based on a descriptive study conducted in Zimbabwe in 2019 (Chireshe et al. 2019), that established that 28% of women patients receiving HAART were hypertensive.

The sample size for the current study was determined as follows:

Sample (n) = $\mathbf{Z^2 P (1-P)/d^2}$

$= 1.96\times1.96\times0.28\times0.72/0.05^2$

= 309.786624

= 310

Where; n = Sample size

P = Estimated prevalence of hypertension

d = deviation from the estimated prevalence

Z = Z-score at 95% CI

3.5 Sampling Procedure

This study utilized a repeated systematic sampling technique to randomly select proportionate samples from three sampling frames of active ART outpatient clients receiving care at three purposively selected health facilities in Meru County. The number of participants recruited from each of the three study sites was determined by dividing the number of eligible ART clients receiving care at a particular site by the total number of eligible ART clients from the three sites (sampling fraction) multiplied by the estimated study sample (Table 3.1). Upon arrival at the clinic, patients were assigned identification numbers. The first participant was randomly selected from the first 10 patients. Every third patient was subsequently selected and requested to take part in the study after being taken through the informed consent process. Those who decline to participate and those who were previously interviewed on an earlier date were to be excluded from the study. However, all the eligible participants consented and there was no case of double recruitment.

Table 3.1: Sample Selection Criteria

S/No	**Name of Facility**	**No. of Clients on ART (18-49)**	**Sample Size Determination**	**Percent**
1.	Meru Teaching and Referral (MeTRH**)**	1,450	(1450/4161)310 = 108	35
2.	Maua Mission Hospital	1,570	(1570/4161)310 = 117	38
1.	Consolata Hospital, Nkubu	1,141	(1141/4161)310 = **85**	27
	Total	**4,161(N)**	**310(n)**	**100**

3.6 Study Variables

Table 3.2 presents a list of variables by their measurement and respective rating scales.

Table 3.2: Study Variables

Name of Variable		**Measurement**	**Rating Scale**
I. Dependent Variable			
Blood Pressure		1. Hypertensive 2. Normotensive	Interval
II. Independent Variables			
A. Socioeconomic			
1.	Name of Health Facility	1. Meru teaching and Referral 2. Maua Methodist Hospital 3. Consolata Hospital Nkubu	Nominal
2.	Education Attainment	1. No education 2. Primary 3. Secondary4. Post-secondary	Nominal
3.	Occupational Status	1. Wage employment 2. Self employed 3. Unemployed	Nominal
4.	******Estimated monthly income in Kenya shillings (KES)	1. < 24,000 2. ≥ 24,000	Interval
5.	Annual household income (KES)	1. < 200,000 2. ≥ 200,000	Interval
6.	County of residence		Nominal

B. Sociocultural			
7.	Ethnicity	1. Meru 2. Other, specify-	Nominal
8.	Religion	1. Christian (catholic) 2. Christian (Protestant) 3. Muslim 4. Other, specify	Nominal
C. **Behavioral**			
9.	Cigarette smoking	1. Yes 2. No	Nominal
10.	Alcohol consumption	1. Yes 2. No	Nominal
11.	Fruit Consumption	1. Yes 2. No	Nominal
12.	Physical activity	1. Yes 2. No	Nominal
Name of Variable		**Measurement**	**Rating Scale**
D. Demographic			
13.	Age in complete years	1. 18-24 years 2. 25-34 years 3. 35-49 years	Ordinal
14.	Marital Status	1. Never. 2. Married 3. Separated 4. Divorced 5. widowed	Nominal
15.	Ever use of contraception	1. Yes 2. No	Nominal
16.	Currently using contraception	1. Yes 2. No	Nominal
17.	Parity	1. None 2. 1-2 children 3. 3-4 children 4. ≥ 5 children	Interval
E. Psychosocial			
18.	Depression score	1. PHQ score <10 2. PHQ Score ≥10	Interval
19.	Gender-based violence	1. Yes 2. No	Nominal
20.	Membership to a support group	1. Yes 2. No	Nominal
F. Biomedical/Clinical			
21.	Body Mass Index (BMI)	1. < 18.5 2. 18.5 – 24.9 3. 25.0 – 29.9 4. ≥ 30	Ratio
22.	Waist-hip Ratio (WHR)	1. ≤ 0.85 (Ref.) 2. > 0.85	Ratio
23.	Family history of hypertension	1. Yes 2. No	Nominal

24.	Duration with Known HIV	1. < 5 Years 2. ≥ 5 years	Interval
25.	Type of ARV drugs	1. Highly Active 2. Less Active	Nominal
26.	Duration on highly ART	1. < 10 years 2. ≥ years	Interval
27.	Random blood sugar	1. < 11.1 mmol/l 2. ≥ 11.1 mmol/l	Interval

****: This Government of Kenya has recognized the people earning < 24,000 KES as a lower income group. For instance, during the Covid-19 pandemic this group was excepted from taxation.**

3.7 Data Collection Procedures

This section describes recruitment and consenting of study participants; questionnaire administration; and physical measurements. The principal investigator recruited and trained three research assistants (RAs) to carry out data collection in the three selected health facilities. The minimum qualification for a research assistant was a certificate in nursing and above. In addition, each of the candidates had to have a valid licence of practice and at least two years of relevant professional experience in a busy health facility. Upon recruitment the RAs were trained on administration of the informed consent, the study questionnaire, physical measurements, and review of patient health records.

3.7.1 Recruitment and Consenting of Study Participants

Upon obtaining clearance from the county department of health services and the participating health facilities, the RAs, in consultation with the principal investigator and local health care providers, identified eligible participants from patient records and daily ART client attendance register at the selected health facilities. Patient health records formed the primary point of reference during the identification and selection of potential participants for the study. The target population was HIV-positive WRA visiting the health facilities for ART. At each site, RAs selected several smaller systematic samples on each day of the study period, each with a different random starting point on the daily lists of eligible clients until the targeted study sample was obtained. The RAs were assigned an identification number to each of the selected respondents to avoid multiple recruitments of an individual participant in the study. The RAs thereafter administered informed consent to potential respondents before starting the interview exercise.

To ensure confidentiality during data collection, each RA ensured that data collection was conducted in a private place and all dully completed forms were stored in a safe place immediately after each interview to avoid information leakage. Each RA was required to make a daily summary report of completed interviews to the principal investigator for review and feedback. Data were collected using interviewer-administered questionnaires, physical measurements, and review of patient health records as presented in the following sections.

3.7.2 Questionnaire Administration

A structured interviewer-administered questionnaire was used to gather data from the HIV-positive women on ART at the selected outpatient CCCs. The main variables in the questionnaire included; age, parity, use of contraception, usual place of residence, county of birth, education attainment, employment status, income, religion, ethnicity, smoking, alcohol use, physical activity, diet, history of raised blood sugar, history of raised blood pressure, recent experience of gender-based violence (GBV), social networking, and symptoms of depression.

3.7.3 Physical Measurements

This section describes the measurements of waist circumference (WC); hip circumference (HC); waist–hip ratio (WHR); weight and height; blood pressure; blood sugar; and review of patient records.

3.7.3.1 Waist Circumference (WC)

A non-stretchable tape was used to carry out WC measurements for all the participants. WC was acquired by measuring the distance around the smallest area below the rib cage and above the umbilicus (belly button) in centimetres whilst participants are standing and breathing normally.

3.7.3.2 Hip Circumference (HC)

HC was taken at the point yielding maximum distance (circumference) in centimetres over the buttocks with the tape in a horizontal plane, touching but not compressing the skin.

3.7.3.3 Waist Hip Ratio (WHR)

WHR was established by dividing mean WC in centimetres (cm) to HC in cm.

3.7.3.4 Weight, Height and Body Mass Index Measurements

Weight was assessed using a digital clinic scale and height was measured using a wall-mounted tape measure. The BMI was calculated by dividing the weight in kilograms (kg) by height in square meters (m^2).

3.7.3.5 Blood Pressure Measurement

Measurement for blood pressure was administered as follows:

i. Patients had not smoked or ingested caffeine beverages in the previous 30 minutes.

ii. Patients were seated, back supported, arm bared and arm supported at the level of the heart.

iii. Patients were allowed to sit quietly for 3-5 minutes before commencing measurement.

iv. Research assistants used the correct cuff size.

v. The lower edge of the cuff was not placed 3 cm above the inner crease of the elbow.

vi. The cuff bladder was centred over the brachial artery (approximately midway between the shoulder and the elbow crease).

vii. RAs took three readings 1-2 minutes apart

viii. Blood pressure was measured three times for each participant by use of a calibrated automated sphygmomanometer machine (a mercury column sphygmomanometer) after the participant had rested for at least five minutes in a quiet room. The average of the last two blood pressure readings was used for the analysis. The first reading was ignored in the calculation to avoid the confounding effect of the white coat hypertension that usually occurs for some patients at the initial interaction with a health worker at a health facility. A participant was categorized as hypertensive if already on treatment for hypertension, with a history of hypertension since being diagnosed with HIV, and/or whose systolic blood pressure (SBP) measurement was ≥140 mm Hg and/or a diastolic blood pressure (DBP) measurement was ≥ 90 mm Hg.

3.7.3.6 Blood Sugar Measurement

It is recommended that HIV-infected patients are screened for type 2 diabetes at HIV diagnosis or before initiating ART and annually after that if initial screening was normal. However, it has been noted that patients with type 1 diabetes show severe diabetes symptoms and noticeably high blood glucose levels. In many cases, they are diagnosed after the onset of hyperglycaemia. For the current study, a random blood sugar test was used for screening of all participants whose diabetic status is unknown. Those found (newly diagnosed) with a random blood sugar of ≥11.0 mmol/l, known diabetics, and/or on treatment were classified as diabetics.

3.7.3.7 Review of Patient Health Records

Some of the data that were obtained or confirmed through a review of the patient health records include CD4 count, history of hypertension, diabetes status, HIV status, type of ARV drugs, and type of contraception.

3.8 Administration of Patient Health Questionnaire (PHQ-9) Tool

The PHQ-9 was used to assess level of depression among the study participants. The tool was adopted from Spitzer et al. (1999). The tool has one general question and 9 items with four common response categories. The PHQ-9 score ranges from 0 to 27, because each of the 9 items can be scored from 0 (“not at all”) to 3 (“nearly every day”). The reference period for each of the 9 items (depression symptoms) is past two weeks before the date of interview. After the respondents were systematically taken through each of the items, the interviewer, calculated the total for each of the columns: A, B, C and D. The PHQ scores for each participant, were obtained by summing up the column score (A+B+C+D). The cut off point for the study was <10=Not depression; ≥ 10 Depressed (Appendix 4, PP. 87).

3.9 Quality Assurance Measures

The following measures were used to ensure study quality:

a. Recruitment and training of RAs on the study objectives, interviewing techniques, review of patients' records and administration of informed consent.

b. RAs had a minimum qualification of Certificate in Nursing with two years' professional experience. Priority was accorded to those already working in the selected health facilities (study sites) for easier creation of rapport with the clients on ART and the general staff working at the selected CCCs.

c. Piloted the study tools and data collection procedures before embarking on the actual data collection.

d. Randomly selected study participants to avoid biases and ensure representativeness.

e. Used a standardized questionnaire for all participants to avoid bias.

f. Closely monitored and supervised RAs during data collection and field editing.

3.10 Ethical Issues

The principal investigator obtained ethical clearance from the Kenyatta National Hospital (KNH)-University of Nairobi (UoN) Ethics and Research Committee (KNH-

UoN ERC, Appendix 4). The investigator obtained further research clearance from the Meru County Department of Health the selected health facilities. Written informed consent was also obtained from each of the study participants. The participants were assured that their information would only be used for research purposes and that published study results would not expose their identity. The respondents were also informed that participation in the study did not attract any financial or material gain though the study would be beneficial to the individual participant by fostering appropriate lifestyle change for better health outcomes. However, those newly diagnosed as diabetic, or obese were referred to the outpatient diabetic and nutrition support clinics, respectively, for further checkup and management. Besides, participants were informed that the findings would provide a basis for hypertension interventions in Kenya. The participants were also assured that taking part in the study is voluntary, and were free to withdraw from the research should they decide not to take part; and it would not affect their future access to the hospital information and services in whatever way.

Following the outbreak of Covid-19 pandemic and the need to reduce the risk of Covid-19 disease transmission, the Principal Investigator (PI), RAs as well as the study participants had to fully abide by the prevailing MoH Covid-19 containment measures namely wearing of facemasks, regularly washing hands with soap, and hand sanitizing, and keeping safe social distance of at least 1.5 meters during interviews. At the end of the data collection exercise, the investigator provided verbal feedback to the County Department of Health. The findings of this study will be shared with the Meru County Department of Health and the management of the selected study sites.

3.11 Data Management and Dissemination

This section presents data entry, cleaning, storage, analysis, and dissemination.

3.11.1 Data Entry, Cleaning and Storage

Data cleaning entailed consistency and completeness checks. Data were entered and analysed using version 25 of Statistical Package for Social Sciences (SPSS).

3.11.2 Data Analysis

The SPSS software was used to summarize and analyse data. Data were entered, cleaned, coded, stored, and analysed using version 25 of the Statistical Package for Social Sciences (SPSS) software. Descriptive and inferential statistics were used for data analysis. Frequency tables were used to describe the characteristics of study population in terms of prevalence of hypertension and other background characteristics. Bi-variable and multivariable logistic regression techniques were conducted to determine the risk factors for hypertension. To ensure confidentiality of information provided by the respondent, unique codes were used in the questionnaires and no identifying information was included in the analysis.

3.11.3 Dissemination of Findings

The findings this study will be published in peer-reviewed journals. The final report (dissertation) will also be uploaded to the University of Nairobi website. The researcher will also share the findings of this study with the management of the KNH/ UoN ERC upon approval by the University management.

CHAPTER FOUR: RESULTS

4.0 Introduction

This chapter presents the main findings of the study. Specifically, the chapter presents the sociodemographic characteristics of participants; prevalence of hypertension; and the sociodemographic, behavioral, psychosocial, and biomedical factors associated with hypertension among HIV-positive WRA on ART in Meru County, Kenya.

4.1 Sociodemographic Characteristics of Study Participants

This section presents a description of the sociodemographic characteristics of study participants (Table 4.1). The mean age of the participants was 37 years with a standard deviation of eight. Majority of the participants (63.2%) were 35-49 years old. This was followed by participants who were 25-34 (29%) and those who were 18-24 (8%) years old.

The findings show that 50.6% of the participants had attained primary school level of education, while only 9.4% of the participants had attained post-secondary level of education. Notably, 11.6% of the participants had never gone to school. The findings show that 16.1% of the participants were on wage employment. The rest of the participants, 65.8% and 18.1%, were self-employed and unemployed, respectively. A majority of the participants (87.9%) had a monthly income of less than 24,000 Kenya shillings (KES), with 84% of the participants reporting an income of less than KES 200,000 per annum.

Almost all participants (95.5%) belonged to Meru ethnic identity. In terms of religion, majority of participants (74.4%) were protestants (Christian protestants), while 23.6% were Catholics. As regards marital status, 48.1% of the participants reported that they were married. A significant proportion of the participants (38.5%) reported that they were either separated, divorced, or widowed. The rest of the participants (13.3%) were never married. Majority of participants (51.6%) had given birth to 1-2 children, 33.5% reported having given birth to 3-4 children and 8.4% had never given birth.

The findings show that 37.7% of the participants were selected from Maua Methodist Hospital. An almost equal proportion of participants was selected from the Meru Teaching and Referral (34.8%) Hospital while the rest were drawn from the Consolata Hospital Nkubu (27.4%). These estimates are consistent with the sampling plan (Table 3.1). Majority of the participants (65.2%) were selected from facilities managed by faith-based organizations. The rest of the participants were drawn from a facility managed by the County Government of Meru.

Table 4.1: Characteristics of the Study Participants, Meru County, Kenya

Characteristic	Number	Percentage
Age (n = 310)		
18-24	25	8.1
25-34	89	28.7
35-49	196	63.2
Education attainment (n = 310)		
No education	36	11.6
Primary	157	50.6
Secondary	88	28.4
Post-secondary	29	9.4
Employment Status (n = 310)		
Wage employment	50	16.1
Self-employed	204	65.8
Unemployed	56	18.1
Individual monthly Income (n = 298)		
Less than 24,000	262	87.9
24,000 - 50,000	33	11.1
51,000 – 100,000	2	0.7
Average annual household income (KES, n = 294)		
<200,000	247	84.0
≥200,000	47	16.0
Ethnicity (n = 310)		
Meru	296	95.5
Other ethnic group	14	4.5
Religion (n = 309)		
Christian (Catholic)	73	23.6
Christian (Protestant)	230	74.4
Muslim	2	0.6
Other	4	1.3
Marital Status (n = 310)		
Never	41	13.3
Married	149	48.1
Separated/Divorced/Widowed	119	38.5
Parity (n = 310)		
Nulliparous	26	8.4
1-2 children	160	51.6
3-4 children	104	33.5
5 and above	20	6.5
Study site (n = 310)		
Meru Teaching & Referral	108	34.8
Maua Methodist Hospital	117	37.7
Nkubu Consolata Hospital	85	27.4
Facility Managing Authority (n = 310)		
Public	108	34.8
Faith based	202	65.2

4.2 Prevalence of Hypertension among HIV-positive WRA on ART in Meru County, Kenya

The first objective of the study was to estimate the prevalence of hypertension among the study population. The findings show that 74 out of the 310 study participants were hypertensive (23.9%; 95% CI: 19.2% – 29.0%; $p < 0.001$). This means that six in 25 HIV-positive WRA on ART in the county were hypertensive.

4.3 Bivariable Analysis of Risk Factors for Hypertension among HIV-positive WRA on ART

This section presents the bivariable logistic regression analysis of the sociodemographic, behavioural, psychosocial, and biomedical risk factors for hypertension among the study population.

4.3.1 Sociodemographic Risk Factors for Hypertension

Variables included in the analysis are the study site, managing authority of the health facility, education attainment, occupation, individual income, average annual household income, religion, age, marital status, and parity. The findings (Table 4.2) show that older age was associated with a statistically significant higher risk of hypertension (crude odds ratio [COR] = 2.84, 95% CI: 1.53-5.30, for those who were 35-49 years old compared to the 18-34 years old). Similarly, the study site was positively associated with the risk of hypertension. Participants receiving ART in Maua Methodist Hospital had a statistically significant higher risk of hypertension compared to those receiving care in MeTRH (COR = 2.17, 95% CI: 1.15-4.07), while those receiving care at Consolata Hospital Nkubu also had a non-statistically significant higher risk of hypertension (COR = 1.26, 95% CI: 0.61-2.58). Participants receiving ART from the faith-based health facilities had a higher risk of hypertension compared to those receiving ART from the public health facility (COR = 1.75, 95% CI: 0.98-3.14), but this association was not statistically significant.

Compared to those on wage employment, participants who were unemployed and those who were self-employed had a higher risk of hypertension (COR = 2.05, 95%CI: 0.85-4.90; and COR = 1.13; 95% CI: 0.53-2.44, respectively). However, these associations were not statistically significant. A non-statistically significant higher risk of hypertension was observed among those who were formerly in a marital relationship (that is, separated, divorced or widowed) and among those who were married compared to the never married (COR = 2.19, 95%CI: 0.89-5.40). No statistically significant association was observed between hypertension and level of education.

Belonging to the protestant Christian religious affiliation was associated with a 20% higher risk of hypertension compared to belonging to non-protestant faiths (that is, Catholic, Islam, and others). However, the association between religion and the risk of hypertension was not statistically significant (COR = 1.20, 95% CI: 0.65-2.22). Participants who earned a monthly income of KES 24,000 and above were less likely to be hypertensive compared to those with a monthly income below KES 24,000 (COR = 0.60, 95% CI: 0.24-1.51). Similarly, participants with ≥ KES 200,000 annual average household income were less likely to be hypertensive compared to those with < KES 200,000 (COR = 0.66, 95% CI: 0.30-1.45). However, these associations were not statistically significant.

Regarding parity, the findings show that the risk of hypertension among the study participants increased with parity (OR = 2.23, 2.83 and 4.13, for 1-2, 3-4 and ≥5 children, respectively). The observed associations were not statistically significant.

Table 4.2: Sociodemographic Risk Factors for Hypertension among HIV-positive WRA on ART

Variable	**Hypertensive**		**Normotensive**		**Crude Odds Ratio (COR)**	**95%CI**		**P-value**
	No.	%	No.	%		**Lower**	**Upper**	
Age	***(n=74)***		***(n=236)***					
18 – 34	15	20.3	99	41.9	**1.00**			
35 – 49	59	79.7	137	58.1	2.84	1.53	5.30	<0.001
Study Site	***(n=74)***		***(n=236)***					
Meru Teaching & Referral Hospital	19	25.7	89	37.7	**1.00**			
Maua Methodist Hospital	37	50.0	80	33.9	2.17	1.15	4.07	0.016
Consolata Hospital Nkubu	18	24.3	67	28.4	1.26	0.61	2.58	0.531
Facility managing authority	***(n=74)***		***(n=236)***					
Public	19	25.7	89	37.7	**1.00**			
Faith based	55	74.3	147	62.3	1.75	0.98	3.14	0.060
Education attainment			***(n=236)***					
No education	9	12.2	27	11.4	**1.00**			
Primary	34	45.9	123	52.1	0.83	0.36	1.93	0.664
Secondary+	31	41.9	86	36.4	1.08	0.46	2.55	0.858
Employment status	***(n=74)***		***(n=236)***					
Wage employment	10	13.5	40	16.9	**1.00**			
Self-employed	45	60.8	159	67.4	1.13	0.53	2.44	0.752
Unemployed	19	25.7	37	15.7	2.05	0.85	4.99	0.112
Individual monthly income (KES)	***(n=73)***		***(n=224)***					
< 24,000	67	91.8	195	87.1	**1.00**			
≥ 24,000	6	8.2	29	12.9	0.60	0.24	1.51	0.281
Average annual household income (KES)	***(n=71)***		***(n=220)***					
<200,000	65	91.5	182	82.7	**1.00**			
≥ 200,000	6	8.5	38	17.3	0.66	0.30	1.45	0.302
Religion	***(n=74)***		***(n=235)***					
Non Protestant	17	23.0	62	26.4	**1.00**			
Protestant	57	77.0	173	73.6	1.20	0.65	2.22	0.558
Marital status	***(n=74)***		***(n=235)***					
Never	7	9.5	34	14.5	**1.00**			
Married	30	40.5	119	50.6	1.22	0.50	3.03	0.662
Separated/divorced/widowed	37	50.0	82	34.9	2.19	0.89	5.40	0.088
Parity	***(n=74)***		***(n=236)***					
Nulliparous	3	4.1	23	9.7	1.00			
1-2 children	36	48.6	124	52.5	2.23	0.632	7.84	0.213
3-4 Children	28	37.8	76	32.2	2.83	0.79	10.15	0.112
5+ children	7	9.5	13	5.5	4.13	0.91	18.76	0.066

4.3.2 Behavioural Risk Factors for Hypertension

The behavioural factors included in the analysis are alcohol consumption, cigarette smoking, fruit consumption, physical activity (walking/cycling) and ever use of contraceptives. The findings (Table 4.3) indicate that ever use of contraception had a statistically significant positive association with hypertension (COR = 3.05, 95% CI: 1.05-8.88).

Ever-use compared to never-use of alcohol was associated with a non-statistically significant higher risk of hypertension (COR = 1.36, 95%CI: 0.76-2.33). Similar findings were observed among current users compared to non-users. Participants who had ever smoked cigarettes had a higher risk of hypertension compared to those who had never smoked (COR=2.36; 95% CI: 0.73-7.69). There was no association between time spent walking/cycling and hypertension.Table 4.3: Behavioral Risk Factors for Hypertension among HIV-positive WRA on ART

Variable	**Hypertensive**		**Normotensive**		**Crude Odds Ratio (COR)**	**95%CI**		**P-value**
	No.	%	No.	%		**Lower**	**Upper**	
Ever use of alcohol	***(n=74)***		***(n=236)***					
Never	52	70.3	180	76.3	**1.00**			
Ever	22	29.7	56	23.7	1.36	0.76	2.43	0.300
Current use of alcohol	***(n=69)***		***(n=177)***					
No	57	82.6	152	85.9	**1.00**			
Yes	12	17.4	25	14.1	1.28	0.60	2.72	0.520
Ever smoked cigarettes	***(n=73)***		***(n=232)***					
No	68	93.2	225	97.0	**1.00**			
Yes	5	6.8	7	3.0	2.36	0.73	7.69	0.153
Daily fruit consumption	***(n=74)***		***(n=236)***					
≥ 3 fruit Servings	10	13.5	26	11.0	**1.00**			
< 3 fruit servings	64	86.5	210	89.0	0.79	0.36	1.73	0.559
Time spent walking/cycling	***(n=70)***		***(n=233)***					
≥30 Minutes	39	55.7	126	54.1	**1.00**			
< 30 minutes	31	44.3	107	45.9	0.94	0.55	1.60	0.809
Ever used contraceptives	***(n=74)***		***(n=236)***					
No	4	5.4	35	14.8	**1.00**			
Yes	70	94.6	201	85.2	3.05	1.05	8.88	0.041

4.3.3 Psychosocial Risk Factors for Hypertension

The psychosocial factors included in this section are depression; experience of gender-based violence; and membership to a social support group. The findings (Table 4.4) show that being depressed (PHQ-9 score ≥10) was associated with a higher risk of hypertension (COR = 1.63, 95% CI: 0.96-2.78). Similarly, participants who had experienced GBV were more likely to be hypertensive (COR = 1.40, 95% CI: 0.74-2.66). However, these associations were not statistically significant.

Table 4.4: Psychosocial Risk Factors for Hypertension among HIV-positive WRA on ART

Variable	Hypertensive		Normotensive		Crude Odds Ratio (COR)	95%CI		P-value
	No.	%	No.	%		Lower	Upper	
Depression (PHQ-9 Score)	***(n=74)***		***(n=236)***					
Not depressed (PHQ-9 score < 10)	41	55.4	158	66.9	**1.00**			
Depressed (PHQ-9 score ≥10)	33	44.6	78	33.1	1.63	0.96	2.78	0.072
Recent experience of GBV	***(n=74)***		***(n=236)***					
No	33	44.6	127	53.8	**1.00**			
Yes	41	55.4	109	46.2	1.45	0.86	2.45	0.167
Membership to a support group	***(n=70)***		***(n=235)***					
Yes	15	21.4	65	27.7	**1.00**			
No	55	78.6	170	72.3	1.40	0.74	2.66	0.300

4.3.4 Biomedical Risk Factors for Hypertension

The biomedical factors included in the analysis are the body mass index (BMI); family history of hypertension; duration since being diagnosed with HIV; duration on ART; type of ARV; and duration on highly active ARV. Duration on ART refers to the time in years since the client has been on treatment with either highly active ARVs or less active ARVs, after testing HIV positive, while HAART refers to time since the client was put on highly active ARVs given the viral load. Evidence shows that patients on highly active ART are at a higher risk of hypertension than those on the less active ART regimen. In this study, participants on HAART were a subset of the study population since not all were on the medication. A study on CVD risk profile of the HIV cohort and how HAART affects people in the United Kingdom (Aboud, et al., 2010) showed that cholesterol, and duration on HAART, were the main determinants of CVD risk. The findings of the current study (Table 4.5) show a threefold higher risk of hypertension among those with a family history of hypertension (COR = 3.29, 95% CI: 1.92-5.65) and about twofold higher risk for those with abdominal obesity (COR = 1.77, 95% CI: 1.01-3.09). Similarly, being obese (BMI = ≥30.0 kg/m^2) compared to being of normal weight (BMI = 18.5-24.9 kg/m^2) was associated with a higher risk of hypertension (COR = 2.19, 95% CI: 0.97-4.92). Non-statistically significant positive associations were observed between hypertension and longer duration since HIV diagnosis (p = 0.38), duration on ART (p = 0.33), type of ARVs (p = 0.17) and duration on highly active ART.

Table 4.5: Biomedical Risk Factors for Hypertension among HIV-positive WRA on ART

Risk Factor	**Hypertensive**		**Normotensive**		**Crude Odds Ratio (COR)**	**95%CI**		**P-value**
	No.	%	No.	%		**Lower**	**Upper**	
Body mass index (BMI)	***(n=73)***		***(n=229)***					
Normal (18.5 -24.9 kg/m^2)	24	32.9	134	58.5	**1.00**			
Under weight (< 18.5 kg/m^2)	6	8.2	23	10.0	0.49	0.22	1.09	0.079
Overweight (≥25.0 - 29.9 kg/m^2)	31	42.5	39	17.0	0.72	0.24	2.19	0.559
Obese (≥30.0 kg/m^2)	12	16.4	33	14.4	2.19	0.97	4.92	0.059
Family history of hypertension	***(n=74)***		***(n=235)***					
No	32	43.2	168	71.5	**1.00**			
Yes	42	56.8	67	28.5	3.29	1.92	5.65	<0.001
Waist hip ratio (WHR)	***(n=72)***		***(n=236)***					
< 0.85 (Normal)	23	31.9	107	45.3	**1.00**			
≥ 0.85 (abdominal obesity)	49	68.1	129	54.7	1.77	1.01	3.09	0.045
Duration since diagnosed with HIV	***(n=74)***		***(n=236)***					
< 5 yeas	16	21.6	63	26.7	**1.00**			
≥ 5 years	58	78.4	173	73.3	1.32	0.71	2.46	0.383
Duration on ART	***(n=74)***		***(n=236)***					
< 5 years	15	20.3	61	25.8	**1.00**			
≥ 5 years	59	79.7	175	74.2	1.37	0.73	2.59	0.332
Type of ARV	***(n=74)***		***(n=236)***					
Less Active ARV	37	50.0	127	53.8	**1.00**			
Highly Active ARV	37	50.0	109	46.2	1.17	0.69	1.97	0.567
Duration on highly active ARV	***(n=33)***		***(n=113)***					
< 10 years	25	75.8	71	62.8	**1.00**			
≥ 10 years	8	24.2	42	37.2	1.85	0.77	4.47	0.173

4.4 Multivariable Analysis of Risk Factors for Hypertension among HIV-Positive WRA on ART

The multivariable logistic regression analysis was applied to determine the independent effect of each of the study variables. The variables included in the analysis are the study site, education, employment status, income, religion, marital status, age, parity, history of alcohol use, fruit consumption, physical activity, history of cigarette smoking, use of contraception, gender-based violence, membership to a social support group, depression, BMI, family history of hypertension, waist hip ratio, duration since one was diagnosed with HIV, duration on ART and type of ART. These factors were included because they have been empirically established as predictors of the risk of hypertension in previous similar studies. It is also widely established that effects of some variables have to operate through a given set of intervening/proximate variables (causal mechanisms of influence) to predict an outcome of interest (Figure 1.1). Findings from such an analysis are, therefore, expected to be more conclusive compared to findings of a model factoring in only variables that are found to be statistically significant at the bivariable level of analysis.

4.4.1 Sociodemographic Risk Factors for Hypertension among HIV-positive WRA on ART

The findings (Table 4.6) show that older participants (35-49) had a higher risk of hypertension relative to those who were 18-24 years (adjusted odds ratio [AOR] = 1.93, 95% CI: 0.75-4.96). Compared to those receiving care at MeTRH, participants receiving ART in Maua Methodist Hospital were 53% more likely to be hypertensive (AOR =1.53, 95%CI: 0.38-6.12), while those receiving care at Consolata Hospital Nkubu were 28% more likely to be hypertensive (AOR=1.28, 95% CI: 0.273-6.02). These findings were similar to those observed in bivariable analysis. In contrast to the findings in bivariable analysis where no association was observed between hypertension and level of education, in multivariable analysis participants with secondary level of education and above were more than three times likely to be hypertensive relative to those with no education (AOR = 3.63, 95% CI: 0.89-14.77). However, this association was not statistically significant.

Participants who were unemployed were about four times more likely to be hypertensive relative to those on wage employment (AOR=3.702, 95% CI: 0.74-18.63). Almost similar findings were observed in bivariable analysis. The findings indicate that participants who were formerly in a marital relationship (that is, separated, divorced or widowed) were two times more likely to be hypertensive relative to those who had never married (AOR = 2.00, 95% CI: 0.47-8.48). This observation is similar to that of bivariable analysis. Christian protestants had a 44% higher risk of hypertension compared to non-protestants (AOR = 1.44, 95% CI = 0.58-3.54). Positive statistically non-significant association was also reported in bivariable analysis. Similar to the observation in bivariable analysis, those who had a monthly income of KES 24,000 and above were 66% less likely to be hypertensive compared to those had an income of less than KES 24,000 (AOR = 0.44, 95% CI: 0.13-1.54).

Similar to the findings in multivariable analysis, increase in parity was associated with a higher risk of hypertension (OR = 0.94, 1.22 and 1.3, for women with 1-2 children, 3-4 children and more than five children, respectively compared to the nulliparous). However, the observed relationships were not statistically significant.

Table 4.6: Sociodemographic Risk Factors for Hypertension among HIV-positive WRA on ART

Variable	Hypertensive		Normotensive		Adjusted Odds Ratio (AOR)	95%CI		P-value
	No.	%	No.	%		Lower	Upper	
Sociodemographic								
Study site	***(n=74)***		***(n=236)***					
Meru Teaching & Referral Hospital	19	25.7	89	37.7	**1.00**			
Maua Methodist Hospital	37	50.0	80	33.9	1.53	0.38	6.12	0.550
Consolata Hospital Nkubu	18	24.3	67	28.4	1.28	0.27	6.02	0.754
Education attainment	***(n=74)***		***(n=236)***					
No education	9	12.2	27	11.4	**1.00**			
Primary	34	45.9	123	52.1	1.04	0.29	3.70	0.956
Secondary+	31	41.9	86	34.4	3.63	0.89	14.77	0.072
Employment status	***(n=74)***		***(n=236)***					
Wage employment	10	13.5	40	16.9	**1.00**			
Self-employed	45	60.8	159	67.4	0.90	0.26	3.09	0.956
Unemployed	19	25.7	37	15.7	3.70	0.74	18.63	0.072
Individual monthly income (KES)	***(n=73)***		***(n=224)***					
<24,000	67	91.8	195	87.1	**1.00**			
≥ 24,000	6	8.2	29	12.9	0.44	0.13	1.54	0.201
Religion	***(n=74)***		***(n=235)***					
Non Protestant	17	23.0	62	26.4	**1.00**			
Protestant	57	77.0	173	73.6	1.44	0.58	3.54	0.433
Age	***(n=74)***		***(n=236)***					
18 - 24	15	20.3	99	41.9	**1.00**			
25 -49	59	79.3	137	58.1	1.93	0.75	4.96	0.174
Marital status	***(n=74)***		***(n=235)***					
Never	7	9.5	34	14.5	**1.00**			
Married	30	40.5	119	50.5	1.12	0.26	4.82	0.880
Separated/divorced/widowed	37	50.0	82	35.0	2.00	0.47	8.48	0.348
Parity	***(n=74)***		***(n=236)***					
Nulliparous	3	4.1	23	9.7	**1.00**			
1-2 children	36	48.6	124	52.5	0.94	0.13	6.90	0.950
3-4 Children	28	37.8	76	32.2	1.22	0.15	10.05	0.851
5+ children	7	9.5	13	5.5	1.39	0.12	16.16	0.793

4.4.2 Behavioral and Psychosocial Risk Factors for Hypertension among HIV-positive WRA on ART

The behavioural factors included in the analysis are alcohol consumption, cigarette smoking, fruit consumption, physical activity (walking/cycling) and ever use of contraceptives. The findings (Table 4.7) show that participants who had ever smoked cigarettes had a statistically significant higher risk of hypertension relative to never smokers (AOR = 12.54, 95% CI: 2.37-66.34). A weaker, non-statistically significant association was observed in bivariable analysis. Ever use of contraception had a positive non-statically significant association with the risk of hypertension (AOR = 1.35, 95% CI: 0.32-5.63). A stronger statistically significant positive association was observed in bivariable analysis.

As regards psychosocial factors, no association was observed between hypertension and being depressed, whereas recent experience of gender-based violence was associated with a statistically non-significant lower risk of hypertension (AOR = 0.81, 95% CI: 0.30-2.17). These are in contrast to the observations in bivariable analysis where positive non-statistically significant associations were observed. However, there were overlaps in the confidence intervals of the findings of bivariable and multivariable analysis. This implies that the differences in findings at both levels of analysis were not statistically significant.

Table 4.7: Behavioral and Psychosocial Risk Factors for Hypertension among HIV-positive WRA on ART

Variable	Hypertensive		Normotensive		Adjusted Odds Ratio (AOR)	95%CI		P-value
	No.	%	No.	%		Lower	Upper	
Behavioural factors								
Ever consumed alcohol	*(n=74)*		*(n=236)*					
No	52	70.3	180	76.3	**1.00**			
Yes	22	29.7	56	23.7	0.70	0.28	1.73	0.440
Ever smoked cigarettes	*(n=73)*		*(n=232)*					
No	68	93.2	225	97.0	**1.00**			
Yes	5	6.8	7	3.0	12.54	2.37	66.34	0.003
Daily fruit servings	*(n=74)*		*(n=236)*					
≥ 3 fruit Servings	10	13.5	26	11.0	**1.00**			
< 3 fruit servings	64	86.5	210	89.0	0.78	0.25	2.42	0.668
Time spent walking/cycling	*(n=70)*		*(n=233)*					
≥30 minutes	39	55.7	126	54.1	**1.00**			
< 30 Minutes	31	44.3	107	45.9	1.22	0.52	2.88	0.642
Use of contraceptives	*(n=74)*		*(n=236)*					
Never used	4	5.4	35	14.8	**1.000**			
Ever used	70	94.6	201	85.2	1.35	0.32	5.63	0.679
Psychosocial factors								
Depression (PHQ-9 Score)	*(n=74)*		*(n=236)*					
PHQ-9 Score < 10	41	55.4	158	66.9	**1.00**			
PHQ-9 Score ≥10	33	44.6	78	33.1	0.91	0.38	2.19	0.835
Recent experience of GBV	*(n=74)*		*(n=236)*					
No	33	44.6	127	53.8	**1.00**			
Yes	41	55.4	109	46.2	0.81	0.30	2.17	0.669
Member of a support Group	*(n=70)*		*(n=235)*					
Yes	15	21.4	65	27.7	**1.00**			
No	55	78.6	170	72.3	1.69	0.70	4.12	0.246

4.4.3 Biomedical Risk Factors for Hypertension among HIV-positive WRA on ART

The biomedical factors included in the analysis are the BMI; family history of hypertension; duration since being diagnosed with HIV; duration on ART; and type of ARV. The findings (Table 4.8) indicate that Participants who had a family history of hypertension had a fourfold higher risk of hypertension (AOR = 4.46, 95% CI: 2.04 –

9.75). A threefold higher risk of hypertension among those with a family history of hypertension was observed in bivariable analysis.

The Participants who were overweight (BMI = 25.0-29.9 kg/m^2) were more likely to be hypertensive relative to those who were of normal weight (AOR = 6.69, 95% CI: 2.78-16.09). Obesity (BMI ≥30.0 kg/m^2) was associated with higher risk of hypertension though not statistically significant (AOR = 1.39, 95% CI: 0.48-4.03). A positive association between obesity and hypertension was also observed in bivariable analysis. Participants with a higher WHR had a higher risk of hypertension, but not statistically significant (AOR = 1.67, 95% CI: 0.72-3.89). This is similar to what was observed in bivariable analysis. Similar to bivariable analysis non-statistically significant positive associations were observed between hypertension and, longer duration since HIV diagnosis and type of ARVs.

Table 4.8: Biomedical Risk Factors for Hypertension among HIV-positive WRA on ART, Meru County, Kenya

Variable	**Hypertensive (n = 74)**		**Normotensive (n = 236)**		**Adjusted Odds Ratio (AOR)**	**95%CI**		**P-value**
	No.	%	No.	%		**Lower**	**Upper**	
Body mass index (BMI)	***(n=73)***		***(n=229)***					
Normal (18.5 -24.9 kg/m^2)	24	32.9	134	58.5	**1.00**			
Under weight (< 18.5 kg/m^2)	6	8.2	23	10.0	1.63	0.44	6.05	0.468
Overweight (≥25.0 - 29.9 kg/m^2)	31	42.5	39	17.0	6.69	2.78	16.09	0.001
Obese (≥30.0 kg/m^2)	12	16.4	33	14.4	1.39	0.48	4.03	0.549
Family history of hypertension	***(n=74)***		***(n=235)***					
No	32	43.2	168	71.5	**1.00**			
Yes	42	56.8	67	28.5	4.46	2.04	9.75	0.001
Waist hip ratio (WHR)	***(n=72)***		***(n=236)***					
< 0.85 (Normal)	23	31.9	107	45.3	**1.00**			
≥ 0.85 (abdominal obesity)	49	68.1	129	54.7	1.67	0.72	3.89	0.233
Duration since diagnosed with HIV	***(n=74)***		***(n=236)***					
< 5 yeas	16	21.6	63	26.7	**1.00**			
≥ 5 years	58	78.4	173	73.3	3.74	0.09	156.43	0.489
Duration on ART	***(n=74)***		***(n=236)***					
< 5 years	15	20.3	61	25.8	**1.00**			
≥ 5 years	59	79.7	175	74.2	0.24	0.01	10.09	0.454
Type of ARV	***(n=74)***		***(n=236)***					
Less Active ARV	37	50.0	127	53.8	**1.00**			
Highly Active ARV	37	50.0	109	46.2	1.55	0.50	4.78	0.444

CHAPTER FIVE: DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

This chapter presents a discussion of findings, conclusions and recommendations.

5.1 Discussion

The aim of this study was to examine the prevalence of hypertension and associated risk factors among HIV-positive WRA on ART in Meru County, Kenya. This is the first study to examine the prevalence of hypertension and associated risk factors among HIV-positive WRA on ART in Kenya. The findings are largely consistent with previous related evidence. The first study objective was to estimate the prevalence of hypertension in the study population. The findings show that the prevalence of hypertension was 23.9% (95%CI: 19.2 – 29.0). The findings are comparable with findings of previous related studies. A study among adult HIV-positive men and women (≥18 years) receiving ART in Northeast Ethiopia found that 29.7% (95% CI: 25.3-35.0) were hypertensive (Temesgen et al. 2019). The authors established that a lower proportion of women (24.9%) than men (39.3 %) were hypertensive. A recent global analysis found that 23.6% (95% CI: 21.6-25.5) of PLWHIV were hypertensive (Bigna et al. 2020). National estimates show that 23.8% of Kenya's general adult population (18-69 years) is hypertensive (KNBS et al. 2015). Globally 22% of the general adult population aged ≥18 years is hypertensive (WHO, 2016). The observed differences in the prevalence of hypertension across the studies would be due to differences in age distribution among the respective study populations, sampling design, health characteristics, and scope. The current study findings show that the prevalence of hypertension among WRA on ART is similar to global estimates of hypertension among PLWHIV and that of the general adult population in Kenya.

The second specific objective of this study was to examine the sociodemographic, behavioral, psychosocial, and biomedical risk factors for hypertension among HIV-positive WRA on ART in Meru County, Kenya. The analysis included the sociodemographic, behavioural, psychosocial, and biomedical factors. The findings show that among the sociodemographic factors study site, primary and above level of education attainment, being unemployed, belonging to the protestant Christian faith, currently or formally married, older age, and having three or more children were positively associated with the risk of hypertension. However, participants who were self-employed, earning a higher monthly income and having 1-2 children were less likely to be hypertensive. These findings confirm results of previous studies. For instance, education attainment, employment status, wealth status index, ethnicity, advanced age, and marital status have been widely associated with the risk of hypertension though not conclusively (Kavishe et al. 2015; Olack et al. 2015; Nyarko et al. 2016; Naidu et al. 2016; Bateman et al. 2012, Medina-Tome et al. 2012). While analysing the prevalence and risk factors of hypertension in Ethiopia (Asresahegn et al. 2017) found that family history of hypertension [AOR = 5.7; 95% CI: 2.9-10.9], having high level of income [AOR = 3.1; 95% CI: 1.5-6.3], being male [AOR = 2.4; 95% CI: 1.3-4.3], being above grade 12 [AOR = 2.2; 95% CI:1.2-3.9], and having BMI $\geq$ 25 [AOR= 2.0; 95% CI: 1.1-3.5] were statistically significantly associated with hypertension. These findings indicate that the risk of hypertension is a function of multiple factors and, therefore, should be addressed through a multi-sectoral approach, beyond the health sector.

As regards the behavioural factors, cigarette smoking, inadequate physical activity and ever use of contraceptives were positively associated with hypertension. In contrast, alcohol consumption was not statistically significantly associated with the risk of hypertension. Similarly, consumption of less than three fruit servings in a day was inversely associated with the risk of hypertension. These findings are reflective of previous evidence linking behavioural factors with risk of hypertension (Mutende et al. 2015, Peltzer et al. 2018). Notably, history of cigarette smoking, being overweight, and having a family history of hypertension were associated with a statistically significant higher risk of hypertension. Participants who had ever smoked cigarettes had a statistically significant higher risk of hypertension relative to never smokers (AOR = 12.54, 95% CI: 2.37-66.34). A weaker, non-statistically significant association was observed in the bivariable analysis. These findings are consistent with similar previous evidence. A study on hypertension among ART patients in a largely rural Zimbabwean setting established that smoking (OR = 5.06; 95% CI: 2.20-11.60), was one of the main risk factors for hypertension (Mutede, *et al.* 2015).

The findings indicate that among the psychosocial factors membership to a social support group was positively associated with the risk of hypertension. Being depressed, and having experienced GBV were negatively associated with hypertension. These associations were, however, not statistically significant. These findings are inconsistent with some of the available evidence. For instance, a study on hypertension amongst Indonesian adults (Peltzer, et al. 2018), shows that sociodemographic variables, health behaviour, weight status, and psychosocial stress, were positively associated with hypertension. Moreover, women's lower subjective economic status was associated with hypertension. The inconsistencies in findings on psychosocial and behavioural characteristics could be as a result of desirability biases during data collection whereby respondents tend to align their responses to what is socially acceptable or the norm, hence concealing the reality.

Among the biomedical factors, being underweight, being overweight, being obese, having a family history of hypertension, abdominal obesity, and being on highly active ART were positively associated with the risk of hypertension. However, a longer duration on ART (five or more years) had a protective effect against the risk of hypertension. The participants who were overweight (BMI = 25.0-29.9 kg/m^2) had a statistically significant positive association with hypertensive relative to those who were of normal weight (AOR = 6.69, 95% CI: 2.78-16.09). Obesity (BMI $\geq$30.0 kg/m^2) was associated with a non-statistically significant higher risk of hypertension (AOR = 1.39, 95% CI: 0.48-4.03). A positive association between obesity and hypertension was also observed in the bivariable analysis. These findings are consistent with previous related evidence. A Tanzanian study concluded that overweight and obesity is the single most important modifiable risk factor for both pre-hypertension and hypertension among HIV patients (Msemo, et al., 2018). A retrospective chart review in Uganda, showed that patients with a BMI of 35–39 kg/m^2 had 3.93 times the odds of the risk of hypertension compared with those with a BMI <25 kg/m^2 (Kalyesubula, et al. 2016).

Participants who had a family history of hypertension had a fourfold higher risk of hypertension (AOR = 4.46, 95% CI: 2.04 – 9.75). A threefold higher risk of hypertension among those with a family history of hypertension was observed in bivariable analysis. These findings are comparable with those of previous studies that have established a family history of hypertension as a predictor of hypertension in HIV-positive patients (Maryanne et al. 2001)). A study on the influence of family history of hypertension on disease prevalence and associated metabolic risk factors among Sri Lankan adults found that the prevalence of hypertension among adults was significantly higher in patients with a family history of hypertension than those without (Ranasinghe et al. 2015). The authors observed that family history of hypertension significantly increased the risk of hypertension (OR=1.29: 95% CI: 1.13-1.47), which presents an opportunity for early interventions and improved control of hypertension. A family history of hypertension is a significant risk factor for obesity, and hyperlipidaemia (Maryanne et al. 2001). Besides, the authors found that subjects with a family history of hypertension had higher diastolic BP, BMI, and higher cholesterol and uric acid concentrations, as well as an increased risk of obesity.

5.2 Strengths and Limitations of the Study

5.2.1 Study Strengths

The strengths of this study is in the type of study population, types of data sources and use of multiple study sites.

5.2.1.1 Study Population

This is the first study on hypertension in Kenya to have specifically targeted HIV-positive WRA on ART. The observed findings, therefore, provide evidence to inform the design and implementation of appropriate policies and programmes.

5.2.1.2 Multiple Sources of Data

This study was based on data generated from three sources namely questionnaire administration, physical measurements and review of patient health records. This type of triangulation served very well in ensuring that the data were verifiable, accurate and credible.

5.2.1.3 Use of Multiple Study Sites

Data for this study were generated from three health facilities located in unique socioeconomic contexts of the County thus enhancing generalizability of the findings.

5.2.2 Study Limitations

Purposive selection of the study sites, age-restriction of the participants and, recall and desirability biases were some of the notable limitations of this study.

5.2.2 .1 Purposive Selection of Study Sites

This study was based on data and information collected from HIV-positive WRA on ART in three health facilities. This site selection criterion might not have fully reflected the actual distribution of health facilities in the entire county, thus affecting generalizability. However, the study findings are comparable to the findings of previous similar studies.

5.2.2.2 Age Restriction of Respondents

This study was restricted to HIV-positive WRA age 18-49 years, but not the usual age 15-49 years. This approach, therefore, excluded potential participants of ages 15 – 17 years because they were below age of consent. However, hypertension is known to increase with age, there is no difference in the ARVs administered to those 15-17 years and those 15-49 years old, and both age groups are treated and live in the same context. It is, therefore, expected that the findings of this study are also applicable to those who are 15-17 years of age.

5.2.2.3 Desirability Bias and Reliance on Recall

This study was largely retrospective; therefore, the quality of data was partly dependent on the participants' ability to fairly report without overestimating or underestimating past events. To mitigate this, similar data collection tools with uniform content and procedures were used for all participants. Besides, the multiple data sources enabled the Research Assistants to cross-examine the accuracy of information provided by the participants. Besides, desirability bias could have occurred when respondents tend to report only information that is contextually acceptable or desirable as opposed to actual experiences. This type of bias could have largely affected the quality of data on behavioural and psychosocial characteristics of the study population.

5.2 Conclusion

The findings show that the prevalence of hypertension among WRA on ART is similar to the global estimates of the risk of hypertension among PLWHIV on ART and that of the general adult population in Kenya. Cigarette smoking, being overweight, and having a family history of hypertension were associated with the risk of hypertension among the study population. The study findings provide a firm basis for the integration of regular screening and management of hypertension and associated risk factors into the routine HIV and AIDS care for improved health and survival of HIV-positive patients especially WRA on ART. The current evidence provides critical information that could inform the implementation of relevant policies, strategies and guidelines in the Country such as the Kenya Health Policy 2014-2030, Kenya Community Health Policy 2020-2030, the 2018 Kenya National Guidelines for Cardiovascular Diseases Management, and the 2016 Guidelines on Use of Antiretroviral Drugs for Treating and Preventing HIV Infections in Kenya. Early diagnosis, prevention and control of hypertension and associated adverse health outcomes would significantly improve not only the quality of life for the HIV-positive patients but also that of the general population.

5.3 Recommendations

The findings revealed that the prevalence of hypertension among WRA on ART is relatively and similar to the global estimates of the risk of hypertension among PLWHIV on ART and that of the general adult population in Kenya. The findings call urgent integration of regular screening of hypertension into the routine care for PLWHIV especially WRA.

The study found that cigarette smoking was had a statistically significant association with the risk of hypertension among the study population. This calls for integration of smoking cessation sessions at HIV diagnosis and initiation of ART among PLWHIV. The sessions should include the dangers of cigarette smoking and innovative smoking cessation strategies. Such programmes would enhance the health and wellbeing of PLWHIV through appropriate lifestyle modification.

The findings revealed that being overweight was associated with the risk of hypertension among the study population. This calls for integration of weight measurement at HIV diagnosis and initiation of ART to provide a basis for early lifestyle modification. Care for PLWHIV should, therefore, prioritize context specific strategies on weight reduction not only for WRA on ART but for the entire population ART care to minimize the health dangers of excess weight. Innovative physical activities and dietary change should be promoted among PLWHIV on ART.

Further research is needed to enhance the understanding of risk factors for hypertension among HIV-positive patients on ART especially WRA. A study targeting

HIV-positive WRA and HIV-negative WRA is also needed to better understand the contribution of HIV status to the risk of hypertension. Having a family history of hypertension was associated with the risk of hypertension among the study population. Participants who had a family history of hypertension had a fourfold higher risk of hypertension (AOR = 4.46, 95% CI: 2.04 – 9.75). These findings call for regular collection of family history of NCDs at HIV diagnosis and initiation of ART. Evidence of family history of disease such as hypertension, would provide an early opportunity for the service providers to promote lifestyle modification before development of CVD risk factors such as hypertension.

Generally, the entire findings of this study call for urgent implement of the relevant guidelines such as the the 2018 Kenya National Guidelines for Cardiovascular Diseases Management, and the 2016 Guidelines on Use of Antiretroviral Drugs for Treating and Preventing HIV Infections in Kenya to optimize quality of life for the entire population of PLWHIV in the Country. Further research is needed to enhance the understanding of risk factors for hypertension among HIV-positive patients on ART especially WRA. A study targeting HIV-positive WRA and HIV-negative WRA would enhance the understanding of the contribution of HIV infection to the risk of hypertension.

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APPENDICES

Appendix 1: Study Questionnaire

Questionnaire Number:

FACILITY AND INTERVIEWER IDENTIFICATION, AND DATE OF INTERVIEW		**RESPONSE**	**INTERVIEW INSTRUCTION**
F.1	**Write down the facility name**	**Name: --------------------------**	
F. 2	**Write down name of sub-county**	**Name:---------------------------**	
MA.3	**Indicate the Managing Authority of the facility**	1. **Public** 2. **Private** 3. **Faith-based** 4. **Other (specify)**	
I.4	**Name of Interviewer**	**Name:-------------------- ------------**	
D.5	**Date of Completion of Interview**	**Day: Month: Year: ------------ ---------**	
Main Language of Interview		**Record main language:** 1. **Kimeru** 2. **Kiswahili** 3. **English**	
C.1	**Consent has been read out to**	1. **Yes** 2. **No**	**IF NO, END INTERVIEW**

	participant?		
C.2	**Consent has been read and obtained (Verbal and Written)**	**1. Yes** **2. No**	**IF NO, END INTERVIEW**
Reproductive Information			
Q. 1	What is your date of birth?	Day: Month: Year:	
Q. 2	How old are you now?	Age in Complete Years:	
Q. 3	Have you ever been married?	1. Never 2. Married 3. Living together 4. Separated 5. Divorced 6. Widowed	
Q. 4	Have you ever been pregnant?	1. Yes 2. Never	**IF NEVER, GO TO: Q.6**
Q.5 How many times have you been pregnant?			
	Number/Birth order	Duration of pregnancy (months)	Outcome 1. Live birth 2. Still births 3. Miscarriage
	1^{st}		
	2^{nd}		

	3rd		
	4th		
	5th and above		
Q.6 Have you ever used any modern method of contraception to avoid or delay a pregnancy?		1. Yes 2. No	
Type of contraceptives	Age at first use	Duration of use	Age at last use
1. Combined oral contraceptives			
2. Progestin – only pills			
3. Emergency contraceptive pills			
4. Progestin-injectable			
5. Monthly injectable			
6. Implants			
7. Intrauterine Device			
8. Combined vaginal ring			
9. Female sterilization (BTL)			

10. Spermicides and diaphragms			
11. Other, specify---------------			
Socioeconomic and Cultural Information			
Q. 7	What is your county of residence?	1.Meru 2. Other, Specify --------------------------------	
Q.8	In the past five years, for how long have you continuously lived in this county?	Number of years:	
Q.9	What is your county of birth?	1.Meru 2.Other, Specify : ------------------	
Q. 10	What is your highest level of education completed?	1. No education 2. Primary 3. Secondary 4. College/University	
Q. 11	Which of the following best describes your work status?	1. Wage employment 2. Self-employment 3. Unemployed	
Q.12	What is your estimated monthly	1. < 24,000 2. 24,000 – 50,000 3. 51,000 – 100,000	

	income in Kenya shillings (KES)	4. > 100,000	
Q. 13	During the past year, what was the average earnings of your household?	Ksh. per annum:------------------------	
Q. 14	What is your religious affiliation?	1. Christian, Catholic 2. Christian, Protestant 3. Muslim 4. No religion 5. Other, specify-----	
Q. 15	What is your ethnicity?	1. Meru 2. Other, specify----	
Behavioral Measurements			
NOW I AM GOING TO ASK YOU SOME QUESTIONS ABOUT VARIOUS HEALTH BEHAVIORS. THIS INCLUDES THINGS LIKE SMOKING, DRINKING ALCOHOL, EATING FRUITS AND VEGETABLES, AND PHYSICAL ACTIVITY.			
Tobacco Use			
Q.16	Have you ever been a regular smoker of one or more cigarettes:	1. Yes 2. No	**IF NO, GO TO: Q.21**
Q. 17	When did you start smoking?	Month: ---Year: …..	
Q. 18	Do you	1. Yes	

	currently smoke cigarettes?	2. No	
Q. 19	What is the average number of cigarettes that you smoke/smoked per day?	Number: -------	
Q. 20	**If no in Q19 above**, when did you stop smoking?	Month: ---Year: ---	
Alcohol Consumption			
Q.21	Have you ever taken alcohol?	1. Yes 2. No	
Q.22	Are you currently taking alcohol?	1. Yes 2.No	
Q. 23	Which of the following alcoholic drinks do you regularly consume? Would you say: beer, wine, spirits, or traditional brews?	1. Beer 2. Wine 3. Spirits 4. Traditional brew, specify--- 5. None	

Q. 24	In the past 12 months, how frequently have you consumed an alcoholic drink?	1. Daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-3 days per week 5. 1-2 days per month 6. Less than once per month 7. Never	
Q. 25	**For those who regularly consume beer, wine, or spirits in Q23 above;** on average, how many alcoholic drinks do you consume in one day?		
	Type of alcoholic drink	Unit of measure	Amount in a day
	a. Beer	Bottle	
	b. Wine	Glasses	
	c. Spirits	Glasses	
Q. 26	Have you ever consumed any alcohol such as beer within the past 30 days?	1. Yes 2. No	
Q. 27	In the past 12 months, on how many days did you consume two or more beers in a single day?	Number:------------------------------------	
Diet			
Diet: Fruits			

Q. 28	In a typical week, on how many days do you eat fruits?	1. < 7 days 2. 7 days	
Q. 27	How many servings of fruit do you eat in a day?	1. < 3 servings 2. ≥3 servings	
Diet: Vegetables			
Q.28	In a typical week, on how many days do you eat vegetables?	1. < 7 days 2. 7 days	
Q.29	How many times do you eat vegetables in a day?	1. < 3 times 2. ≥ 3 times	
Physical Activity			
Work			
Q.30	Does your work involve vigorous – intensity activity that causes large increases in breathing or heart rate like [carrying or lifting heavy	1. Moderate intensity activity 2. Vigorous intensity activity	

	loads or construction work] for at least 10 minutes continuously or moderate-intensity activity that causes large increases in breathing or heart rate like [carrying or lifting light loads or construction work] for at least 10 minutes continuously?		
Q.31	**If vigorous,** In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	1. < 7 days 2. ≥7 days	
Q.32	How much	1. < 30 minutes	

	time do you spend doing vigorous – intensity activities in a day?	2. ≥ 30 minutes	
Travel to and From Places			
Q.33	Do you walk or use a bicycle for at least 10 minutes to get to or from places?	1. Yes 2. No	
Q.34	In a typical week, how many days do you walk or cycle for at least 10 minutes continuously to get to or from places?	1. < 7 days 2. ≥ 7 days	
Q.35	In a day, how much time do you spend walking or cycling?	1. < 30 minutes 2. ≥ 30 minutes	
Q. 36 Recreational Activities			
Q.37	Do you do any	1. Yes	

	vigorous–intensity sports, fitness or recreational activities that cause large increases in breathing or heart rate [running or football] for at least 10 minutes continuously?	2. No	
Q.38	In a typical week, how many days do vigorous – intensity sports, fitness, or recreational activities?	1. < 7 days 2. ≥ 7 days	
Q.39	In a day, how much time do you spend doing moderate–intensity sports, fitness or recreational	1. < 30 minutes 2. ≥ 30 minutes	
History of Hypertension			

Q.40	Have you ever had your blood pressure measured by a doctor or other health worker?	1. Yes 2. No	
Q.41	What is the last time your blood pressure was taken?	1. Within past 12 months 2. 1-5 years ago 3. Not within the past 5 years	
Q.42	During the past 12 months have you been told by a doctor or a health worker that you have raised blood pressure?	1. Yes 2. No	
Q.43	Are you currently receiving any treatment/advice for high blood pressure prescribed by a doctor or other health worker?	1. Yes 2. No	
Individual History of Diabetes			
Q.44	Have you ever	1. Yes	

	had your blood sugar measured in the last 12 months?	2. No	
Q.45	During the past 12 months have you been told by a doctor or any other health worker that you have diabetes?	1. Yes 2. No	
Q. 46	Are you currently receiving any treatment for diabetes prescribed by a doctor or other health worker?	1. Yes 2. No	
Height and Weight Measurement			
Q.47	Record participant's height in centimeters	Cm:----------------------------------	
Q.48	Record participant's weight in kilograms	Kg:-------------------------------------	

Waist and Hip Measurement			
Q.49	Measure and record participant's waist circumference (cm)	Cm: ---	
Q. 50	Measure and record participant's hip circumference (cm)	Cm: ---------------------------------------	
Q.51	Calculate and record Waist: Hip Ratio (W/H)	W/H Ratio = -------------------	
Blood Pressure Measurement			
Q.52	Record cuff size used	1. Small 2. Medium 3. Large	
Q.53	Blood Pressure: Reading 1	Systolic (mmHg): Diastolic (mmHg):	
Q.54	Blood Pressure: Reading 2	Systolic (mmHg): Diastolic (mmHg):	
Q.55	Blood Pressure: Reading 3	Systolic (mmHg): Diastolic (mmHg):	
Q.56 Record Average Score for the		Systolic (mmHg):	

last 2 blood pressure measurements		Diastolic (mmHg):	
Q.57	During the past two weeks, have you been treated for raised blood pressure with drugs prescribed by a doctor or other health worker?	1. Yes 2. No	
Biomedical Measurements			
Family history of hypertension			
Q. 58	Has any of your close relatives (parents or siblings) suffered from hypertension?	1. Yes 2. No	
History of Known HIV			
Q.59	For how long have you known your HIV status?	1.< 5Years 2. ≥ 5Years	
HIV Treatment			
Q. 60	For how long have you been on treatment for HIV (antiretroviral	1. < 5 Years 2. ≥ 5 Years	

	therapy)?		
Q.61	What type of ARVs are you currently taking?	1. Highly active ARV (HAAARV) 2. Less Active ARV	
Q.62	**If ON HAARV drugs:** For how long have you been on HAARV drugs?	1. < 10 years 2. ≥ 10 years	
CD4 Count Measurement			
Q.63`	Observe and record CD4 Count results and date it was measured	CD4 Count: Date Measured: ------	
Diabetes Measurement			
Q.64	Test and record Random blood glucose results	1. < 11.0 mmol/l 2. ≥ 11.0 mmol/l	
Individual Experience of Gender-based Violence			
Q.65	In the past six months, have you experienced any emotional or physical violence	1. Yes 2. No	

	related to your HIV status?		
Social support network			
Q.66	Are you currently a member of any social support group?	1. Yes 2. No	

	Question	Response Category			
Depression Screening					
Q.67	Over the last two (2) weeks, how often have you been bothered by any of the following problems?	Not at all	Several days	More than half the days	Nearly every day
1.	Little interest or pleasure in doing things	0	1	2	3
2.	Feeling down, depressed, or hopeless	0	1	2	3
3.	Trouble falling or staying asleep or sleeping too much	0	1	2	3
4.	Feeling tired or having little energy	0	1	2	3
5.	Poor appetite or overeating	0	1	2	3
6.	Feeling bad about yourself, or that you are a failure	0	1	2	3

7.	Trouble concentrating on things (linked with persons usual activities, such as reading the newspaper or listening to a radio program)	0	1	2	3
8.	Moving or speaking so slowly that other people could have noticed. Or, the opposite, being so fidgety or restless that you have been moving around a lot more than usual.	0	1	2	3
9.	Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3
ADD ALL THE CIRCLED NUMBERS IN EACH COLUMN		**A=**	**B=**	**C=**	**D=**
CALCULATE SCORES: A+B+C+D		**Record total score:**			

Appendix 2: Informed Consent

Study Title: Prevalence of and Risk Factors for Hypertension among HIV-positive Women of Reproductive Age Receiving Antiretroviral Therapy in Meru County, Kenya

Principal Investigator

Mr. John Mwondo Anampiu

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University of Nairobi.

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Introduction

My name is John Anampiu, a student at the University of Nairobi undertaking a Master of Public Health (MPH) degree. As part of the course, I am carrying out a study on hypertension among HIV-infected women of reproductive age receiving antiretroviral therapy in Meru County. I, therefore, seek your permission to share with you more information about this study.

Purpose of the Study

The study seeks to estimate the level of hypertension and associated risk factors among HIV-infected women of reproductive age receiving antiretroviral therapy in Meru County. Findings of this study will contribute to the provision of optimal care for HIV-infected patients and HIV-infected women of reproductive age in particular.

Study Procedure

The study is being carried out among eligible and willing HIV-infected adult women aged between 18 and 49 years, already receiving antiretroviral therapy in selected comprehensive care centers in Meru County. You will be required to respond to some questions and your answers will be used to establish the frequency of hypertension and associated risk factors. You are, however, supposed to be interviewed only once in the entire study period. Data collection will also include taking some vital measurements on you. These vital measurements will include measuring your blood pressure, blood sugar, height, and weight. The processes of interviewing, physical measurements, and review of your health records will take about 30 minutes to complete.

Risks

To avoid risk of loss of your privacy, research assistants have been recruited from among the health workers providing ART at this facility.

Benefits

Your participation in this study does not attract any financial or material gain. However, some information resulting from the study would be of benefit to the you by encouraging to change your lifestyle for better health outcomes. Besides, the study findings would provide you with useful information for the management of hypertension and other related conditions. For instance, if you are found to hypertensive or diabetic, you will be referred to the appropriate clinic for further diagnosis and treatment.

Confidentiality

I will ensure that the information obtained from you is kept confidential and will only be used for the purposes of the study. Your name will not be recorded during the data analysis and reporting. However, your name and contact is important during data collection for purposes of follow up if found necessary to seek further clarification on some your information during successive stages of the research.

Compensation

Since you are not exposed to any risk in this study; you are not expected to be compensation for taking part in it.

Voluntary Participation

Your participation in this study is absolutely voluntary and you are free to withdraw from the study at any time, and that will not affect your access to hospital information and services in future.

Declaration

I declare that the information contained in the entire informed consent has been read out and explained to me and I now fully understand all the aspects of the study.

I, therefore, voluntarily agree to participate in the study.

Name of Participant: --

Signature/Thumb Print: --Date---------------------

Interviewer's Name: ---

Interviewer's Signature: ---------------------------------------Date----------------------------

Appendix 3: Budget and Budget Justification

Activity Description	No. of Items	Unit Cost (KES)	Frequency	Total Cost (KES)
Training allowance for 3 Research Assistants for 5 days	3	500	5	7,500
Training allowance for the principal investigator (PI) for 5 days	1	1,000	5	5,000
Daily Subsistence Allowance (DSA) for 3 Research Assistants @KES1000 for 15 Days during data collection	3	1,000	15	45,000
DSA for the Pl during supervision of field work (data collection)	1	3,000	20	60,000
DSA for 1 data entry clerk @KES 1,500 for 25 days	1	1, 500	25	37,500
DSA for PI during data analysis & report writing	1	2000	10	20,000
Printing and binding of reports	6	2,000	1	12,000
Research Authorization/ethics fees	1	19,000	1	19,000
Total				**206,000**

Appendix 4: Research Clearance from KNH-UON Ethic Research Committee and the Study Sites

UNIVERSITY OF NAIROBI
COLLEGE OF HEALTH SCIENCES
P O BOX 19676 Code 00202
Telegrams: varsity
Tel:(254-020)2726300 Ext 44355

KNH-UON ERC
Email: uonknh_erc@uonbi.ac.ke
Website: http:l/wmerc.uonbi.ac.ke Telegrams:
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
MEDSUP, Nairobi Facebook:
https://www.faceboolècom/uonknh.erc

KENYATTA NATIONAL HOSPITAL
APPROVED
10 MAY 2021
KNH/UoN-ERC
P.O. BOX 20723 - 00202 NAIROBI

Ref: KNH-ERC/A/165

10th May 2021

John Mwondo Anampiu
Reg. No.H57/69852/2013
School of Public Health
College of Health Sciences

<u>University of Nairobi</u>

Dear John,

ESEARCH PROPOSAL -PREVALENCE AND RISK FACTORS FOR HYPERTENSION AMONG HIV-POSITIVE WOMEN OF REPRODUCTIVE AGE RECEIVING ANTIRETROVIRAL THERAPY IN MERU COUNTY, KENYA (P6/0112021)

This is to inform you that the KNH- I-JON Ethics & Research Committee (KNH-UoN ERC) has reviewed and <u>approved</u> your above research proposal. The approval period is 10^{th} May 2021 -9^{th} May 2022.

This approval is subject to compliance with the following requirements:

a. Only approved documents (informed consents, study instruments, advertising materials etc.) will be used.

b. All changes (amendments, deviations, violations etc.) are submitted for review and approval by KNH-UoN ERC before implementation.

c. Death and life threatening problems and serious adverse events (SAEs) or unexpected adverse events whether related or unrelated to the study must be reported to the KNH-UoN ERC within 72 hours of notification,

d. Any changes, anticipated or otherwise

e. e that ^{m} ay increases the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- I-JON ERC within 72 hours.

f. Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.

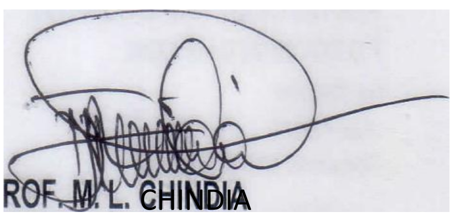
g. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (<u>Attach a comprehensive progress report to support the renewal</u>).

h. Submission of an executive summary report within 90 days upon completion of the study. . Protect to discover

This information will form part of the data base that will be consulted in future when processing related research studies so as to minimize chances of study duplication and/ or plagiarism,

For more details, consult the KNH- (JON ERC website http://www.erc.uonbi.ac.ke

Yours sincerely,



SECRETARY, KNH-U0N ERC

c.c. The Principal, College of Health Sciences, IJoN

The Senior Director, CS, KNH

The Chairperson, KNH- I-JON ERC

The Assistant Director, Health Information Dept, KNH

The Director, School of Public Health, IJoN

Supervisors: Dr. Peter Njoroge, School of Public Health, I-JON

Dr. Jacqueline Chesang, School of Public Health, UON

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COUNTY GOVERNMENT OF MERU

DEPARTMENT OF HEALTH

Telegrams: "MEDICAL" Meru

MERU TEACHING & REFERRAL HOSPITA

P. O. BOX 8- 60200, MERU

Telephone:Meru 064-32370/1

Fax: 31242

Email: hospitalmeru@gmail.com

Replying Address to:

Director

Ref: MRU/MED/GEN/R.14

DATE: 5th November,2021

John Mwondo Anampiu

Reg.No.H57/69852/2013

School of Public Health

College of Health Sciences University of Nairobi

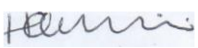
RE: RESEARCH AUTHORIZATION

Your request for permission to conduct a study within Meru Teaching & Referral Hospital on your topic "Prevalence and risk factors for hypertension among HIV-Positive women of reproductive age receiving antiretroviral therapy in Meru County, Kenya" is hereby granted.

Kindly ensure adherence to the ethical guidelines of your research and of the hospital.

You are required to share with my office the results of your research.

Also note that the hospital charges a research fee of Ksh.10,000/=which you are required to pay prior to commencing your study.



Hellen Ringera
For:Director
Meru Teaching &Referral Hospital

ospi

COUNTY GOVERNMENT OF MEREU

Telegrams: "HEALTH" Meru
Telephone: Meru
Fax: 31242
Email: hospitalmeru@gmail.com
When replying should be to:
County Director Medical Services

Ref: MRU/GEN/GEN/C.50

COUNTY DIRECTOR MEDICAL SERVICES
MERU COUNTY
P.O. BOX 8 – 60200
MERU

14th June, 2021

DEPARTMENT OF HEALTH

John Mwondo Anampiu

Reg. No.H57/69852/2013

School of Public Health

College of Health Sciences

University of Nairobi

RE: APPROVAL TO COLLECT

RESEARCH DATA Your request

on the above refers.

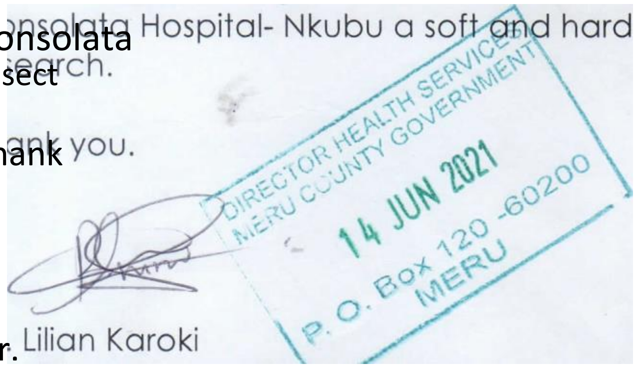
This office has no objection on your request and approval has been granted to collect data on your research on "Prevalence and risk factors for hypertension among HIV-Positive women of reproductive age receiving antiretroviral therapy in Meru County, Kenya" You are advised to give this office, Director-MeTRH, CEOs Maua

Methodist and hard copy after completion of your

Consolata

resect

Thank



nsolata Hospital- Nkubu a soft and hard
search.

ank you.

DIRECTOR HEALTH SERVICES
MERU COUNTY GOVERNMENT
14 JUN 2021
P. O. Box 120 -60200
MERU

Lilian Karoki

Dr.

For: Director of Medical- Services

<u>COUNTY GOVERNMENT OF</u>

<u>MERU</u>

c.c.

Director- MeTRH

CEO — Maua Methodist please assist the bearer of this letter.

CEO - Consolata Hosp. Nkubu

MAUA METHODIST HOSPITAL

P.O. Box 63-60600, Maua

Telephone: 064-21003 Mobile: 0724697053

Email: info.methodisthospitalmaua.or www.methodisthospitalmaua.

5th December 2021

Dear John Anampiu,

Greetings to you,

On behalf of the Maua Methodist Training, Research and Ethics committee, I am pleased to inform you that your request to conduct data collection , in our hospital, for your research study entitled :Prevalence and risk factors for hypertension among HIV-positive women of reproductive age receiving antiretroviral therapy in' Meru county, Kenya, has been approved.

This is to fulfil your study requirements to attain Masters in Public Health from the University of Nairobi, Kenya.

We hope that the results of your research will be shared with our clinical team to improve our quality of care in our Palliative department.

Yours sincerely,

Dr. Mark Karanja

<u>Medical Officer In Charge</u>

Maua Methodist Hospital

COUNTY GOVERNMENT OF MERU

DEPARTMENT OF HEALTH

Telegrams: "HEALTH" Meru
Telephone: Meru
Fax: 31242
Email: hospitalmeru@gmail.com
When replying should be to:
County Director Medical Services

Ref: MRU/GEN/GEN/C.50

COUNTY DIRECTOR MEDICAL SERVICES
MERU COUNTY
P.O. BOX 8 – 60200
MERU

14th June, 2021

John Mwondo Anampiu

Reg. No.H57/69852/2013

School of Public Health

College of Health Sciences

University of Nairobi

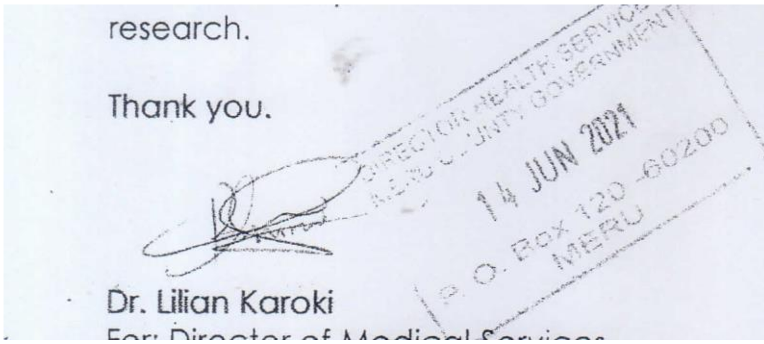
Tel: 0701858463

RE: APPROVAL TO COLLECT RESEARCH DATA

Your request on the above refers.

This office has no objection on your request and approval has been granted to collect data on your research on "Prevalence and risk factors for hypertension . among HIV-Positive women of reproductive age receiving antiretroviral therapy in Merv County, Kenya"

You are advised to give this office, Director-MeTRH, CEOs Maua Methodist and Consolata Hospital- NkUbU a softoñd hard copy after completion of your


research.

Thank you.

Dr. Lilian Karoki

For: Director of Medical' Services

<u>COUNTY GOVERNMENT OF MERU</u>

c.c. Director— MeTRH

CEO — Maua Methodist please assist the bearer of this letter.

CEO Consolata Hosp. Nkubu