# DETERMINANTS OF HYPERTENSION AMONG HIV POSITIVE PATIENTS AT MATHARE NORTH HEALTH CENTER, NAIROBI

**MASTER OF PUBLIC HEALTH**

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

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## DEDICATION

This dissertation is dedicated:

To the Almighty God, for strength and provision. It was only by Your grace.

To my family, for your constant encouragement and support

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## ABBREVIATION AND ACRONYMS

| | |
|---|---|
| **ART** | Antiretroviral Therapy |
| **AOR** | Adjusted Odds Ratio |
| **BMI** | Body Mass Index |
| **BP** | Blood Pressure |
| **CCC** | Comprehensive Care Clinic |
| **CVD** | Cardiovascular Disease |
| **ERC** | Ethics and Research Committee |
| **HAART** | Highly Active Anti-Retroviral Therapy |
| **HIV** | Human Immunodeficiency Virus |
| **KNH** | Kenyatta National Hospital |
| **LRT** | Likelihood Ration Test |
| **MOH** | Ministry of Health |
| **NASCOP** | National AIDS and STI Control Programme |
| **NCD** | Non- Communicable Disease |
| **NMS** | Nairobi Metropolitan Services |
| **OR** | Odds Ratio |
| **PLHIV** | People Living with HIV |
| **UoN** | University of Nairobi |
| **WHO** | World Health Organization |

## OPERATIONAL DEFINITION OF TERMS

**Determinants**: factors that affect the outcome/outcome variable

**Factors associated**: factors that may lead to an outcome of interest or linked to the outcome of interest through interaction with other factors

**Harmful use of alcohol**: drinking more than four standard alcoholic beverages in a single occasion in the last 30 days for females or five standard alcoholic beverages for males

**Hypertension case**: HIV positive participant on ART with systolic blood pressure greater than or equal to 140 mm Hg and /or diastolic blood pressure greater than or equal to 90 mm Hg on three different measurements or previously diagnosed with hypertension or on any blood pressure medication.

**One standard drink**: equivalent to consuming half standard bottle of regular beer (500ml), one single measure of spirits (30ml) or one medium size glass of wine (120ml)

**Physical inactivity**: adults with less than 150 minutes of vigorous or moderate-intensity physical activity throughout the week

**Moderate-intensity physical activity**: activities that cause small increases in breathing or heart rate, e.g. brisk walking or carrying light loads for at least 10 minutes continuously

**Vigorous-intensity physical activity**: activities that cause a significant increase in breathing or heart rate, e.g. carrying or lifting heavy loads, digging or construction work for at least 10 minutes continuously

**Psychological stress**: Self-reported feeling of strain or pressure

**Raised blood glucose**: fasting plasma glucose value≥ 7.0mmol/L or random plasma glucose value≥ 11.1mmol/L

**Tobacco use**: smoking one or more cigarettes/ tobacco products in the last 30 days

**Unhealthy diet**: less than five servings (400gms) of fruits or vegetables per day

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**ABSTRACT**

The double burden of both non-communicable and communicable conditions is becoming a reality in developing counties. Changes in lifestyle patterns and longer survival rates in HIV positive patients have led to an increased risk of developing non-communicable diseases like hypertension and other cardiovascular conditions. Hypertension contributes to a greater extend of the heart disease, which may be led to increased rate of sickness and death in HIV positive patients. High blood pressure in Kenya has been on the increase based on data from studies. Available data shows an increase in the prevalence of hypertension in people living with HIV in Kenya, but the research was done in tier three and four health facilities. It is not known if the prevalence and distribution of determinants is similar to that in the tier 2 facilities. Tier two health facilities like Mathare North health centre do not routinely screen HIV positive patients for hypertension. The objective of this study was to assess the prevalence and determinants of hypertension among HIV positive patients at Mathare North health centre, Nairobi.

A cross-sectional, mixed method study was conducted in Mathare North Health Centre located in Nairobi – Kenya, Ruaraka Sub County, Mathare North ward. A random sample of 148 participants was drawn from the study population. A questionnaire (modified from the WHO STEPs tool) was used to collect quantitative data from the participants and the registers available at the clinic while focus group discussions and key informant interviews were used for qualitative data. Data was collected on social, economic, demographic, behavioural, physiological and biomedical factors. Measurements of height, weight, blood pressure and blood glucose were taken for all respondents. Descriptive, univariable and multivariable analysis was done using Stata software, version 11 to show which determinants were statistically significant. The qualitative data from the focus group discussions and Key informant interviews was transcribed then analysed using NVivo, 2020. Ethical approval was sought from the KNH-UoN ERC and Nairobi Metropolitan Services (NMS) –Health department before proceeding with the research. Only the patients who gave written approval by signing the consent forms were included in the study.

Of the 148 participants included in the analysis, 17.5% were classified as hypertensive. Male respondents represented 51.4%. The participants' ages ranged between 25 and 73 years with a median age of 40 and an IQR of 15 years. In terms of physiological and behavioural factors,

4.7% and 1.3% of the participants reported current alcohol and harmful alcohol consumption respectively. Majority of the participants (57.4%) reported insufficient physical activity while all had insufficient daily intake of fruits and vegetables. From the multivariable analysis after controlling for other factors, current use of alcohol (aOR 6.78; 95% CI 1.13-40.50) and current regimen – EFV based (aOR 7.48; 95% CI 1.02-55.05) were associated with hypertension in HIV positive patients on ART. Stress and unhealthy diet were reported as the most significant factors associated with hypertension from the qualitative data collected through the focus group discussions and key informant interviews.

Therefore, Nairobi Metropolitan services health department, the facility health management team and the implementing partners needs to put in place proper structures for patient health education on predisposing factors (with a focus on modifiable risk factors), blood pressure screening for all patients, proper diagnostic systems and support groups for the hypertensive patients at the clinic to help mitigate stress.

# CHAPTER ONE: INTRODUCTION

## 1.0 Background

The “double burden of communicable and non-communicable diseases” is becoming a major challenge in both developed and developing countries (Boutayeb, 2010) due to globalization and urbanisation, which are associated with obesity, diabetes, and cardiovascular diseases (Kagaruki et al., 2018; Maher et al., 2010). Globally non-communicable diseases (NCDs) kill approximately 41 million people (71%) annually with cardiovascular conditions leading at 17.9 million (Maher et al., 2010; WHO, 2018). The complications of hypertension (the leading physiologic risk factor for cardiovascular disease) account for 9.4 million deaths annually (WHO, 2013). Longer survival due to the use of antiretroviral therapy has been associated with the increase in non-communicable diseases and hypertension in people living with HIV (Peck et al., 2014; Triant, 2014). HIV infection and the use of antiretroviral agents can result in impaired heart function due to inflammation, immunosuppression and effects like thickening of arterial walls and hyperlipidaemia therefore increasing morbidity and mortality (Dubé et al., 2008; Mse et al., 2017). In 2021, it was estimated that 38.4 million people were living with HIV globally and about 75% of them were on antiretroviral therapy (WHO, 2022) .The prevalence of hypertension in PLHIV was estimated at 24% (Bigna & Noubiap, 2021). According to the World Health Organization (WHO), "hypertension is a disorder in which the blood vessels have steadily increased pressure" with "systolic blood pressure equal to or greater than 140 mm Hg and/or diastolic blood pressure equal to or greater than 90 mm Hg" (WHO, 2013).

Hypertension is a public health concern that is associated with many disease outcomes and complications like heart attack, stroke, and kidney disease (Singh et al., 2017). Weak health systems in developing countries have resulted in a higher number of undiagnosed hypertensive people than in the developed countries (WHO, 2013). In Kenya, data showed that raised blood pressure awareness among hypertensives was only 15.6% (S. F. Mohamed et al., 2018). The estimated prevalence of hypertension in adults in Africa according to WHO is about 46% (Dzudie et al., 2017), while that in Kenya is about 23.8% (Ministry of Health Kenya, 2015). In low- and middle-income countries, the prevalence of hypertension among HIV positive people ranges from about 4.7 percent to 54.4 percent (Nguyen et al., 2015).

The pathophysiology of hypertension is multifactorial. The factors associated with hypertension include: socio-demographic, behavioural, physiological factors, and other predictors like other disease conditions and the use of medication. The socio-demographic and non-modifiable factors include sex, age, education level, religion, ethnic background, marital status, employment and income status (Ibekwe, 2015). A qualitative study carried out in Kenya showed that psychosocial stress had a possible association with hypertension, especially in PLHIV because of worrying about the HIV diagnosis (Temu et al., 2017) and the interaction with the behavioural risk factors for cardiac events like cigarette smoking (Bairey Merz et al., 2002). Age is also significantly associated with raised blood pressure (Rodríguez-Arbolí et al., 2017). A cross sectional study carried out in Malaysia showed an adjusted odds ratio of 1.069 ($p = 0.010$) meaning that patients who were more than 40 years old and living with HIV were approximately 1.07 times more likely to get hypertension than those below 40 years (Hejazi et al., 2014).

Behavioural risk factors such as harmful alcohol and tobacco use and physiological risk factors such as overweight (measured by body mass index – BMI), raised blood glucose and raised blood pressure are commonly associated with hypertension in studies carried out in Kenya and other countries among the general population and in PLHIV (Arruda Junior et al., 2010; Kagaruki et al., 2014; Olack et al., 2015). Excessive salt intake or high fat diets and inactivity or lack of exercise are also considered as significant behavioural risk factors (Ibekwe, 2015). Other predictors for hypertension include disease conditions like HIV which is associated with T-cells and Angiotensin II alterations and use of anti-retroviral agents like protease inhibitors which may cause thickening of arterial walls or hyperlipidaemia which may cause obesity also associated with hypertension (Hejazi et al., 2014; Maseko & Masuku, 2017). In Kenya, there is limited data on the prevalence of hypertension among people living with HIV. In a study carried out in Western Kenya in several Tier 3 and 2 health facilities supported by the AMPATH (Academic Model for the prevention and Treatment of HIV/AIDS) programme, the prevalence was 11.2% in men and 7.2% in women (Bloomfield et al., 2011). In an unpublished study carried out at Kenyatta National hospital – a Tier 4 health facility, the prevalence was 12.9% (Ngare, 2009). A more recent study in Nyanza Kenya carried out in a Sub – County hospital (Tier 3 health facility), 10.4% of the HIV positive participants had stage 1 hypertension. In this study, 1501 individuals were screened, and 1.9% were current smokers, 12.1% had BMI greater than $25kg/m^{2,}$ and 2.1% had raised blood glucose (Juma et al., 2019). This study will therefore investigate the

determinants of increased blood pressure(hypertension) among people living with HIV/AIDS and the magnitude of HIV positive patients on antiretroviral therapy who are hypertensive.

### 1.1 Problem statement

Hypertension among people living with HIV continues to be on the raise because of the longer survival associated with use of antiretroviral agents and decrease in opportunistic infections resulting in longer exposure to HIV and antiretrovirals with about 8.9 million affected globally (Bigna & Noubiap, 2021; Peck et al., 2014). High prevalence of hypertension has been reported among HIV positive patients ranging from 25.6% in Brazil, 45.6% in Malaysia, 27.9% in Uganda and Tanzania, 28.7%. (Arruda Junior et al., 2010; Hejazi et al., 2014; Mateen et al., 2013; Peck et al., 2014).- Data from a study carried out in Siaya, Kenya showed that 10.4% and 2.9% of the participants had stage 1 and stage 2 hypertension, respectively (Juma et al., 2019).

Hypertension in people living with HIV is associated with cardiovascular disease and contributes to the burden of kidney failure, premature mortality, and disability (Joshi et al., 2014; Maseko & Masuku, 2017). The major factors associated with hypertension in PLHIV highlighted in studies include excessive weight gain (higher body mass index), age (especially above 40 years), sex (mostly – male), use of antiretroviral agents especially protease inhibitors and HIV infection (Arruda Junior et al., 2010; Hejazi et al., 2014; Mateen et al., 2013; Peck et al., 2014). The magnitude and the distribution of the determinants for hypertension among the PLHIV at Mathare North health centre could be similar to the studies above. However, owing to the weak health systems (screening and diagnostic systems) at the tier two facility the burden of hypertension maybe higher but is unknown. One of the goals of the WHO 2030 action plan for NCD is to reduce the risk factors and therefore very important to identify the factors in order to have targeted interventions (WHO, 2021).

A review of available literature revealed that in Kenya, there is paucity of data on prevalence of hypertension among people living with HIV who seek care and treatment in tier 2 health facilities. The data available is based on studies carried out mostly in Western and Nyanza regions of Kenya within tier three and four facilities. Data from tier two facilities where a majority of HIV positive patients receive treatment is however not available. There is therefore need to understand the determinants of hypertension in this setting in order to design interventions specific to this population guided by the magnitude and distribution of

determinants of hypertension. consequently, the objective of this study was to assess the sociodemographic, behavioural, physiological and biomedical determinants of hypertension among people living with HIV attending the Mathare North health centre care clinic.

### 1.2 Justification of the study

In Kenya, there is a paucity of data on hypertension among PLHIV. The available data points to an increase in prevalence. Available evidence is however based on research carried out in tier three and four health facilities (Bloomfield et al., 2011; Juma et al., 2019; Ngare, 2009; Njeru, 2009) with no studies specifically carried out in tier two facilities where the majority of HIV positive patients receive care and treatment services. People living with HIV remain at an increased risk of hypertension due to longer survival rates attributed to use of antiretroviral therapy and the inter relationship of risk factors for non-communicable diseases and HIV. HIV infection and some anti-retroviral agents which are commonly used as both first line and second line agents like the protease inhibitors (Hejazi et al., 2014) and nucleoside reverse transcriptase inhibitors (Kagaruki et al., 2018) are considered potential drivers of hypertension. Despite most patients being on newer and safer molecules like Dolutegravir (Ministry of Health, 2018), antiretroviral agents still have an effect on the inflammatory process, systolic dysfunction and renin-Angiotensin-Aldosterone system (Chen et al., 2017; Fahme et al., 2018; Maseko & Masuku, 2017). Determining the prevalence of hypertension and associated risk factors among HIV positive patients on antiretroviral therapy will help to fill gaps in knowledge on the proportion of people living with HIV who are hypertensive and the distribution of the determinants in lower tier facilities in Kenya in order to design targeted interventions.

The study therefore aimed to assess the determinants of hypertension among people living with HIV to inform policy and design of strategies to prevent, screen and manage hypertension among HIV positive patients especially those who seek care and treatment in tier two public sector health facilities in Kenya.

### 1.3 Research questions

i. What proportion of HIV positive patients at Mathare North HC – Comprehensive care clinic are hypertensive?

ii. What are the social, economic and demographic factors associated with hypertension among HIV positive patients?

iii. What behavioural, physiological and biomedical factors are associated with hypertension among the HIV positive patients at the Mathare North HC comprehensive care clinic?

iv. What are the patients' and health care workers' perspectives on the factors associated with hypertension among people living with HIV/AIDS?

## 1.4 Objectives

### 1.4.1 Broad objective

To assess the determinants of hypertension among HIV positive patients at Mathare North Health centre.

### 1.4.2 Specific objectives

i. To determine the proportion of HIV positive patients who are hypertensive at the comprehensive care clinic

ii. To describe the social, economic and demographic factors associated with hypertension among HIV positive patients at the comprehensive care clinic – Mathare North health centre

iii. To determine the behavioural and physiological factors associated with hypertension among HIV positive patients

iv. To identify the biomedical factors associated with hypertension among HIV positive patients

v. To explore the perspective of the patients and the health care workers at the clinic on the determinants of hypertension among people living with HIV

## CHAPTER TWO: LITERATURE REVIEW

### 2.0 Introduction

The literature review focuses on studies carried out on the burden of hypertension among people living with HIV and the known determinants of hypertension namely: - social, economic and demographic factors, behavioural/ lifestyle factors and biomedical factors including infection with HIV and use of anti-retroviral agents.

### 2.1 Burden of hypertension

Hypertension, according to WHO "is a condition in which the blood vessels have persistently raised pressure'' (WHO, 2013). Hypertension is a major metabolic determinant of cardiovascular disease and contributes to the burden of kidney failure, premature mortality, and disability (Maseko & Masuku, 2017). The early stage of persistently raised blood pressure can be asymptomatic and go unnoticed (Souffront et al., 2016). The factors associated with hypertension are both non- modifiable like age, religion, marital status, sex, genetics and modifiable or lifestyle factors (Ibekwe, 2015).

The possible risk factors associated with hypertension in PLHIV are numerous and are inter-related. The use of medication such as antiretrovirals and the effect of urbanization and lifestyle changes on behavioural and non-modifiable risk factors has resulted in an increased risk of hypertension (Angkurawaranon et al., 2016).

According to a WHO report, the prevalence of hypertension in adults in Africa (46 percent) was higher than that in high-income countries by the year 2008. The global prevalence was estimated at (40 percent). Hypertension was also responsible for about 45% of deaths worldwide due to heart disease with Kenya having a cardiovascular disease death rate of more than 300 per 100,000 deaths (WHO, 2013). In Kenya, the prevalence of hypertension varies in rural and urban areas. A Ministry of Health report indicates prevalence of 21.4% in rural Kenya and 18% in Korogocho, a slum in Nairobi (Ministry of Health, 2015).

The burden of hypertension in PLHIV based on prevalence studies varies in developed and developing countries (Nguyen et al., 2015). A recent meta-analysis of studies conducted in different countries from America, Europe, Africa, and Asia showed an overall prevalence of 25.2

%, with 34.7% in ART experienced patients and 12.7% in ART-naïve participants (Mse et al., 2017). However, in a survey carried out in Barcelona, Spain the prevalence of hypertension was almost similar in the HIV infected participants (13.1%) and the control group (13.5%) (JERICO et al., 2005). The prevalence of hypertension among PLHIV in Kenya also varies based on data from some studies. In Western Kenya, an analysis of patient records showed that about 11.2 percent of the male HIV positive patients were hypertensive (Bloomfield et al., 2011). Unpublished studies carried out in Kenyatta National hospital and Thika District hospital the prevalence was 12.9% and 18% respectively (Ngare, 2009; Njeru, 2009). About 10.4% of the participants in a descriptive survey carried out in Siaya, Kenya had raised blood pressure (stage 1 hypertension) (Juma et al., 2019).

## 2.2 Determinants of hypertension

### 2.3.1 Social, Economic and Demographic factors

These factors increase the risk of hypertension by an adverse impact on behavioural factors. These include age, gender, marital status, religion, family history, level of education, and income/employment (Ibekwe, 2015; WHO, 2013).

Older age, level of education and marital status were associated with hypertension in a study carried out in Kibera- an informal settlement in Nairobi, Kenya (Olack et al., 2015). A survey carried out in several clinics in Tanzania showed a strong association between age above 40 years and hypertension in PLHIV with an adjusted odds ratio (OR) of 2.52 meaning the patients above 40 years had more than double the odds of hypertension than those below 40 years (Kagaruki et al., 2014).

Gender is a significant determinant of hypertension as shown in a Brazilian study. The association between being male and hypertension had an odds ratio of 1.85 meaning that HIV positive males had roughly twice the odds of hypertension than the female HIV positive patients (Arruda Junior et al., 2010). Men had a higher prevalence (11.2%) of hypertension than women (7.4%) in a study carried out in Western Kenya (Bloomfield et al., 2011). The prevalence of HIV in Kenya is however known to be higher in women (6.9%) than men (4.4%) (National AIDS and STI Control Programme (NASCOP), 2012).

Family history of cardiovascular disease has also been shown to be associated with hypertension in both HIV positive patients and the general population. In Italy, a cross sectional study showed that a HIV-positive patient with a family history of cardiovascular disease had about 1.58 times higher the odds of hypertension than a HIV-positive patient without the history of CV disease (AOR 1.58) (De Socio et al., 2014).

The level of education influences health-seeking behaviour and has an impact on employment status/income. Unemployment may influence blood pressure because of increased stress levels (WHO, 2013). The level of education in Kenya was shown to be related to HIV status in that people who had a higher level of education (secondary and above) had a higher prevalence of HIV than the lower levels at 7.4% and 4.4% in women and men respectively. According to the Kenya AIDS indicator survey, 2012, the prevalence of HIV was noted to be higher in the "currently employed (8.5% women; 4.7% men)" participants than in those "unemployed (5.9% women; 3.8% men)" (National AIDS and STI Control Programme (NASCOP), 2012). Those who had never been screen for raised blood pressure was highest amongst those with no formal schooling (68.9%) compared to 42.9% in those with secondary schooling and above. The proportion of those diagnosed with raised blood pressure recently (within the past 12 months) was highest in those with secondary and above schooling (Ministry of Health Kenya, 2015). Inadequate understanding of hypertension as shown in a qualitative study carried out in India contributes to low levels of perceived susceptibility and lack of seriousness in lifestyle adjustment as a preventive measure (Kusuma, 2009).

### 2.3.2 Behavioural Factors

Tobacco use, harmful alcohol use, physical inactivity and unhealthy diet are the most commonly known behavioural risk factors that are associated with hypertension (WHO, 2013). Harmful use of alcohol and substance abuse have been associated with increased risky behaviour like the use of injection drugs and multiple sexual partners which are factors for increased HIV infection risk. In Kenya, these factors are among the drivers of new HIV infections (National AIDS Control Council (NACC), 2014).

Tobacco use is a major factor associated with not only hypertension and cardiovascular disease but most NCDs. Globally, tobacco use is linked to over 7 million deaths (Ahluwalia et al., 2018).

According to the MOH- Kenya, about 1.7 million adults smoked tobacco (Ministry of Health, 2015). It alters the immune and virological response in PLHIV predisposing them to opportunistic infections (Bhatta et al., 2018). Smoking related illnesses like cardiovascular disease, malignancies, chronic obstructive pulmonary disease, the effect on the immune system and quality of life may contribute to morbidity and mortality among HIV positive individuals (Rahmanian et al., 2011). Meta-analysis of data from developing countries revealed that the prevalence of tobacco smoking among HIV-positive men was 24.4% with the crude prevalence in Kenya at 26.7% (Mdege et al., 2017). A cross sectional survey carried out in West Africa showed that the prevalence of smoking tobacco or cannabis was high in HIV positive patients. The prevalence was 29.7% in Mali, 14.2% in Cote d'Ivoire and 2.9% in Benin (Jaquet et al., 2009).

Harmful use of alcohol is associated with cardiovascular disease, diabetes, and hyperlipidaemia (Freiberg et al., 2010). Worldwide, it is estimated that 5.9% of all death can be attributed to the harmful use of alcohol (WHO, 2017a) while in Kenya it was estimated that 5.8% of adult males had some level of alcohol dependence (Ministry of Health, 2015). A study in Nepal showed the proportion of alcohol drinking HIV patients on antiretroviral therapy was 22.7% (Bhatta et al., 2018). Data from a survey in the United States of America among HIV infected veteran men showed that alcohol dependence was significantly associated with cardiovascular disease (Freiberg et al., 2010).

According to WHO, insufficient physical activity is associated with non-communicable conditions. There is a 20%-30% increased risk of death in people who are insufficiently active than in active people (WHO, 2017b). Physical activity has been associated with a reduction in systolic blood pressure due to the effect on peripheral resistance, changes in oxidative stress, insulin resistance, body mass and renin-angiotensin-aldosterone system (Hegde & Solomon, 2015). The weighted prevalence of insufficient physical activity in studies carried out in Bangladesh and Nairobi, Kenya among slum dwellers (informal urban settings) was 15.3% and 14.4% respectively, showing that insufficient physical activity is a problem even in low economic status population (Haregu et al., 2015; Rawal et al., 2017). However, another study carried out in Kenya in an informal setting, participants reported high (80%) levels of physical activity (Joshi et al., 2014).

Unhealthy diet is also a determinant for hypertension in Kenya due to urbanization and change in lifestyle, leading to a high consumption of food high in calories, fats, sugar and salt. There is an increased availability of fast food in Kenya, especially in urban areas. An unhealthy diet is closely related to obesity. The prevalence of obesity is on the increase with 25% of women aged 15-49 reported to be overweight and obese (Ministry of Health, 2015). In studies carried out in Bangladesh and Kenya in informal urban settings where an unhealthy diet was considered as insufficient fruits or vegetable intake, the weighted prevalence was 95.6% and 57.2% respectively, which was significantly high (Haregu et al., 2015; Rawal et al., 2017).

### 2.3.3 Physiological Factors

Stress is also considered a physiological factor associated with cardiovascular disease (Bairey Merz et al., 2002). Physiologic stress is a risk factor for cardiac events through the complex interaction of behavioural and other physiological factors like cigarette smoking, hypertension, diabetes mellitus and pathophysiological events like endothelial dysfunction, myocardial ischaemia, thrombosis and malignant arrhythmias (Bairey Merz et al., 2002). Chronic mental stress may indirectly lead to hypertension. It has been said to increase pulse rate, stimulate the renin-angiotensin-aldosterone system and also in turn impair lipid and glucose metabolism (Cheung & Li, 2012). A study carried out in Kenya showed that stress was perceived as a major cause of hypertension in HIV infected patients. Participants from the focus group discussion in the qualitative study stated that worrying about the HIV diagnosis was a likely cause of hypertension (Temu et al., 2017).

A body mass index greater than 25kg/$m^2$ is classified as overweight (S. F. Mohamed et al., 2018). Individuals with higher BMI have increased risk of hypertension due to its effect on cardiac output, vasodilation, and effect on the kidneys causing sodium retention (Re, 2009). According to the Kenya STEPwise survey, about 27% of Kenyans in the general public were reported to be obese or overweight with a majority living in urban areas (Ministry of Health Kenya, 2015). Studies among the HIV-positive population in several countries showed that obesity and overweight were significant predictors of hypertension. A case-control study carried out in Brazil showed that BMI >25 was independently associated with hypertension (OR=5.51; 95% CI, 3.36-9.17) (Arruda Junior et al., 2010) while another study in Malaysia, higher body mass index (OR 1.18; 95% CI, 1.106-2.71) (Hejazi et al., 2014). In Kenya, obesity was a

determinant for hypertension in HIV positive men and women with regression analysis data showing odds ratio (OR 2.41; 95% CI, 1.88 -3.09) and (OR 1.80; 95% CI, 1.50-2.16) respectively (Bloomfield et al., 2011).

Raised blood glucose as defined by the World Health Organisation is fasting plasma glucose above 7.0 mmol/L or random plasma glucose above 11.1 mmol/L (World Health Organization, 2006). Obesity and insulin resistance are linked with raised blood glucose which is then associated with hypertension (Cheung & Li, 2012). In a survey carried out in Kenya in the general population about 1.9% had raised blood glucose (Ministry of Health Kenya, 2015). Raised blood glucose was also shown to be significant in a Malaysian study where the odds of hypertension among HIV-positive patients with higher fasting blood glucose was about 1.332 times higher than the odds of hypertension in HIV positive patients with normal fasting blood glucose (Hejazi et al., 2014).

Persistently raised blood pressure which is the description of hypertension is a major risk factor for cardiovascular disease (WHO, 2013; Wu et al., 2015). The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC-7) states that the risk of cardiovascular disease begins at pressure of 115/75 mmHg and pre-hypertensive state is pressure of 120-139/80-89 mmHg (National Institutes of Health, 2003). A study carried out Spain that followed up patients for one year after initiation of Anti-retroviral agents showed a mean increase of systolic blood pressure of 7.9mmHg and diastolic blood pressure of 4.9mmHg at 48 weeks of treatment (Palacios et al., 2006). A similar study carried out in the University of Washington followed up patients after initiation of treatments also showed that the mean systolic blood pressure was significantly higher after initiation compared to before treatment (124.6 mmHg verse 121.6 mmHg; $p \leq 0.001$) (Crane et al., 2006).

### 2.3.4 Biomedical Factors

HIV infection is associated with hypertension because of the effect of infection on the immune response and the Renin-Angiotensin-Aldosterone systems (Fahme et al., 2018). HIV infection is known to cause endothelial dysfunction, lipid disorders (increased triglycerides and changes in fat metabolism and distribution), direct infection of endothelium by HIV, enhanced atheroma

formation and endothelial cell activation by viral protein (Dubé et al., 2008). It is also associated with the interaction of T lymphocytes and angiotensin II which is a mediator of hypertension (Maseko & Masuku, 2017).

The use of anti-retroviral agents has been indirectly linked with hypertension among HIV positive patients because of increased life expectancy. Age is associated with both hypertension and cardiovascular disease (Angkurawaranon et al., 2016). Use of Anti-retroviral agents has been associated with endothelial dysfunction (especially use of protease inhibitors and the thymidine analogue), increased oxidative stress, insulin resistance, accelerated lipid accumulation in vessel wall, ART associated lipodystrophy leading to metabolic disorders (Dubé et al., 2008; Mse et al., 2017). They also predispose the patient to higher body mass index which are associated with cardiovascular disease (Bloomfield et al., 2011; Hejazi et al., 2014; Kagaruki et al., 2014). Use of reverse transcriptase inhibitors has been associated with lipodystrophy and insulin resistance but not to a great extent like with the protease inhibitors (Osegbe et al., 2016). In a similar study, the odds of elevated blood pressure were significantly lower in patients on Atazanavir (OR, 0.2; 95% CI, 0.03 – 0.9; p=0.03) and Efavirenz (OR, 0.4; 95% CI, 0.2 -0.9; p=0.02) than patients on a Lopinavir/Ritonavir based regimen (Crane et al., 2006).

A meta-analysis carried showed that blood pressure levels were higher in ART exposed participants than the ART naïve participants (Masenga et al., 2019). A study carried out in Cameroon showed that the odds of hypertension among patients on ART was higher than that in HIV positive patients not on HAART with an association even after adjusting for other variables in the study like age, gender, smoking and family history (Dimala et al., 2016). Similarly, a Ugandan study, 27.9% of the patients who were followed up for a year after initiation of anti-retroviral treatment were hypertensive (Mateen et al., 2013). Another study in Tanzania showed almost similar results with the prevalence higher in HIV positive patients on ART compared to ART naïve patients at 28.7% and 5.3% respectively (Peck et al., 2014). However, a study in Kenya had different results with the prevalence in the patients on HAART at 12.9% and 14.3% in the HAART naïve patients (Ngare, 2009).

According to the current Kenya National HIV treatment guidelines, the recommended first line regimen for adolescents and adults is a combination of Tenofovir, Lamivudine and Efavirenz (TDF/3TC/EFV) or Tenofovir, Lamivudine and Dolutegravir (TDF/3TC/DTG) while the

recommended second line regimen is Zidovudine, Lamivudine and Atazanavir/Ritonavir (AZT/3TC/ATV/r) or Tenofovir, Lamivudine and Atazanavir/Ritonavir (TDF/3TC/ATV/r) (Ministry of Health, 2018). However, over the years the patients may have been exposed to many agents because of failure on a particular regimen or the several changes to treatment guidelines in Kenya in the past years. Patients were initially on combinations with stavudine (D4T), Zidovudine (AZT), Abacavir (ABC), Didanosine (DDI) and Nevirapine (NVP) before the introduction of the safer molecules in use now (Ndakala et al., 2017).

In Kenya, there is a paucity of data on hypertension among PLHIV. The available data points to an increase in prevalence. Available evidence is however based on research carried out in tier three and four health facilities (Bloomfield et al., 2011; Juma et al., 2019; Ngare, 2009; Njeru, 2009) with no studies specifically carried out in tier two facilities where the majority of HIV positive patients receive care and treatment services. It is not known whether the prevalence and distribution of the determinants of hypertension in HIV positive patients in tier two facilities is similar to that in tier three and four facilities. This study therefore assessed the prevalence and determinants of hypertension among HIV positive patients at Mathare North health centre.

## 2.3 CONCEPTUAL FRAMEWORK

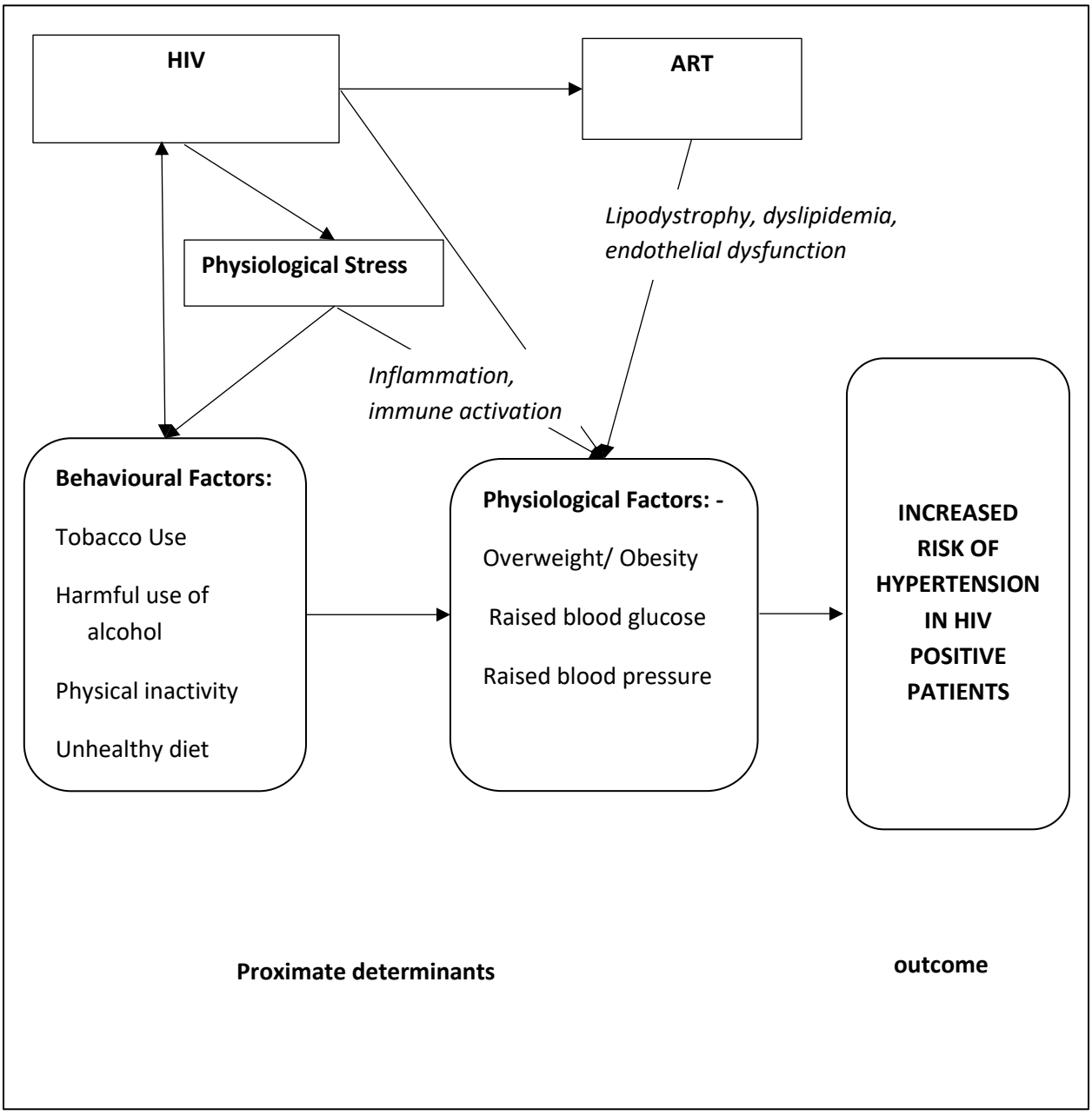


*Figure 1: The conceptual framework for the predictor and outcome variables*

Modified from source: "The Prevalence and sociodemographic Determinants of Diabetes and Hypertension among HIV Infected and Healthy Population in Namibia," by (A. Mohamed, 2015)

## CHAPTER THREE: METHODOLOGY

### 3.0 Introduction

This chapter focuses on study methods and provides information on study design, study area, population, sampling, variables, data collection, analysis and management techniques, ethical considerations and study limitations.

### 3.1 Study design

A facility based cross sectional design using both quantitative and qualitative techniques was used to evaluate the determinants of hypertension among the HIV positive patients on anti-retroviral agents at the HIV care clinic (Comprehensive Care Clinic – CCC) at Mathare North Health Centre, Nairobi County. A facility-based survey was selected because of the ease of recruiting HIV positive participants.

### 3.2 Study area

The study area was Mathare North Health centre in Nairobi, Kenya. The facility is located in Ruaraka constituency which neighbours Starehe, Kasarani and Roysambu. Based on the 2009 Kenyan population and housing census, the Mathare North ward had a population of 55,158 people with approximately 18,450 households. The area for the ward is 0.5 $km^2$ with a density of 119,055 people per km squared (UN HABITAT, 2010). This population serves as the catchment population for the facility. Mathare North Ward neighbours Mathare 4A area that is mostly an informal settlement.

Mathare North and Mathare area 4A is predominantly inhabited by a mixture of lower -middle and low-income households. Housing varies from high rise story buildings to iron sheet structures (ACF International Network, 2009). The area is characterized by overcrowding, poor sanitation and increased exposure to environmental hazards that predispose the population to both communicable and non-communicable diseases. Unemployment is high and correlated with poverty. About 56% of the population has casual jobs or small scale businesses with an average monthly income of less than 8,500 Kenyan shillings which is reflective of a predominantly low income populace (Muungano Support Trust, 2012). High levels of unemployment/ poverty are associated with increased blood pressure due to increased levels of stress, harmful alcohol consumption and tobacco use. An unhealthy diet is also a major issue in Mathare. A survey

carried out by Action Against Hunger in 2009 reported that the households that consumed fruits were as low as 22% (ACF International Network, 2009). Education levels are also very low in Mathare North ward with about 40% not having any formal schooling which may contribute to unemployment and poverty (Kenya National Bureau of Statistics & Society for International Developement, 2013).

Mathare North Health Centre is a government owned level 3 (tier 2) facility offering the following services: curative and preventive services, laboratory services, immunization, family planning, ante-natal care, nutrition services, TB screening and treatment, maternity care and HIV testing, care and treatment services. Based on the Kenya Health Information System –DHIS2, the general monthly workload for curative services was 1600 patients and 1920 HIV positive patients registered at the comprehensive care centre at the hospital as of December 2018. The clinic had 1809 patients above the age of 20 years (1271 females and 538 males). Very few patients were screened for hypertension or other NCDs. Only about 41 patients were managed for hypertension at the facility the same month (Ministry of Health-Kenya, 2017).

### 3.3 Study population

#### 3.3.1 Target Population

The sampling frame comprised of all HIV positive patients at the Mathare North health centre clinic. The results of the study can be considered generalizable to this population since the study sample was derived from it.

#### 3.3.2 Study population

The study population was all HIV positive patients registered at Mathare North heath centre comprehensive care clinic for care and treatment eligible to participate in the study. This included patients above 18 years of age registered at the time of the survey based on the health records- patient files and registers (pre-ART and ART registers).

Inclusion criteria

- Patients who are HIV Positive and above 18 years of age
- Patients on Anti-Retroviral Therapy

- Patients at the clinic who gave informed consent

Exclusion Criteria

- Patients who declined to participate
- Children and patients below 18 years
- Pregnant women
- Patients co-infected with tuberculosis to reduce bias because of the possible association between anti-tuberculosis medication and hyperglycaemia
- Patients who were diagnosed as hypertensive before HIV infection

## 3.4 Sampling

### 3.4.1 Sampling Procedure

#### 3.4.1.1 Sampling procedure for quantitative research

Simple random sampling was used to identify participants for the quantitative aspects of the study. A list of all HIV positive patients registered at the clinic drawn from the patient register or the electronic records constituted the sampling frame. Sampling was based on a list of patients scheduled to attend the clinic on particular days when data collection was carried out. These patients were assigned numbers sequentially, based on how they appeared in the appointment diary. This was used as the sampling frame. MS Excel 2013 was then be used to generate random numbers. The patients selected using the random numbers and who consented to participate were then be screened and interviewed for the study, those who did not consent to take part in the study were removed from the list and random numbers generated again. Selection and recruitment of participants was done as shown in the flow chart -figure 2.

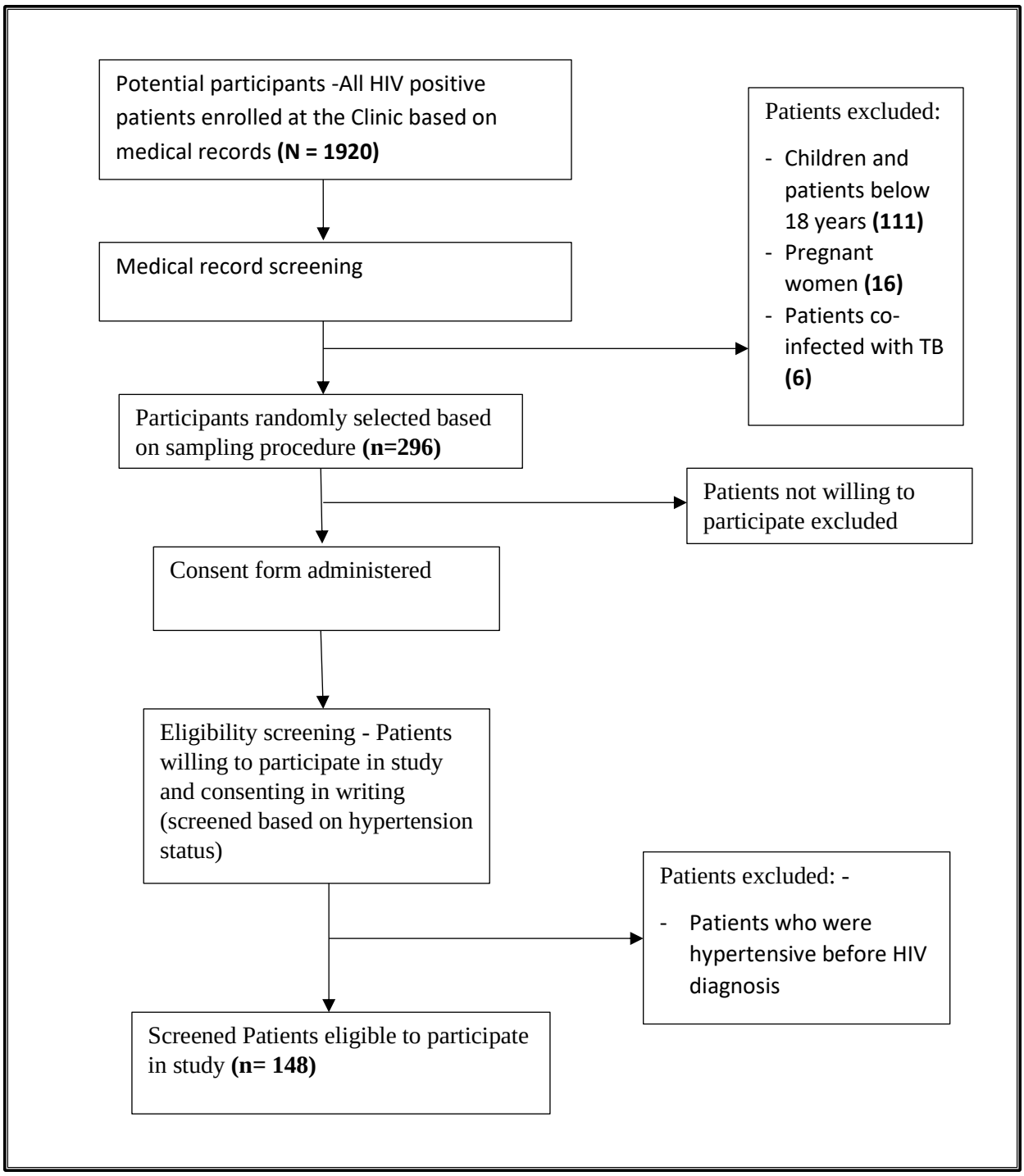


*Figure 2: Selection and recruitment flowchart*

### 3.4.1.2 Sampling Procedure for qualitative research

Purposive sampling was used for the qualitative research because it entailed deliberate selection of participants from the staff at the clinic and patients from the active support groups. The

participants for the focus group discussions were drawn from active support groups of PLWHIV attached at the clinic. This included both men and women. Health workers based at the clinic were respondents for the key informant interview.

Two focus groups – FGDs (one for males and the other females) with 11 participants each drawn from the same support group were formed for collecting qualitative data.

A key informant guide was used to interview the five healthcare workers at the clinic who consented to participate in the study. Only four healthcare workers were available for the interviews, two clinicians -registered clinical officers, one nurse and one nutritionist.

### 3.4.2 Sample Size Determination

The sample size used in this study was calculated using Epi Info$^{TM}$ software, version 7.2.2.6 using the following formula:

$n= [DEFF*N\ p(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1) +p*(1-p)]$

where: -

$Z\alpha$ – The value of $Z\alpha$ required for confidence= $1 - \alpha$: $Z\alpha$ 2 = 1.96 for a 2-tailed test or 2-sided confidence interval (95%)

N- Population size = 1809 (Ministry of Health-Kenya, 2017)
DEFF – design effect =1
d – Margin of error 5%
p – Hypothesized frequency in the population -10.4% (Juma et al., 2019)

n= 133

After adjusting for a 10% non-response rate the sample size to be used was 148 participants

## 3.5 Variables

### 3.5.1 Outcome Variable

**Hypertension case** - HIV positive participant on ART with systolic blood pressure greater than or equal to 140 mm Hg and /or diastolic blood pressure greater than or equal to 90 mm Hg on

three different measurements, previously diagnosed with hypertension but after HIV diagnosis or on any blood pressure medication.

**Non-case** – HIV positive participant on ART with systolic blood pressure below 140mm Hg and /or Diastolic blood pressure below 90 mmHg on three different measurements / not previously diagnosed with hypertension or not on any blood pressure medication.

### 3.5.2 Predictor Variables

Information was collected from the participants using the questionnaires and patient records on the following predictor variables: social, economic, demographic factors, behavioural, physiological and biomedical factors.

***Table I: Description of study predictor variables***

| **Variable** | **Description** |
|---|---|
| **Social, Economic and Demographic Information** | |
| Sex (categorical) | Female or Male |
| Age (continuous) | age in years – a continuous variable determined by date of birth |
| Marital Status (categorical) | Assessed as single, married or other |
| Religion (categorical) | Assessed in four categories: - Christian, Muslim, Hindu and other |
| Education Level (categorical) | Assessed on four levels that include higher education, no formal schooling, secondary or primary. |
| Employment Status (categorical) | occupation/ work status – employed, self-employed, unemployed or other |
| Income (continuous) | average earnings for participant from work/ occupation |
| Family history of CVD (categorical) | History of hypertension or other cardiovascular condition in the participant's family- YES/NO |

**Behavioural Factors**

| | |
|---|---|
| Tobacco Use (categorical) | proportion of participants smoking cigarettes or have ever smoked (daily smoker, non-smoker or ex-smoker) |
| Harmful Alcohol use (categorical) | Proportion of participants drinking more than four standard alcoholic beverages in a single occasion in the last 30 days for females or five standard alcoholic beverages for males (Yes/ No) |
| Physical activity (categorical) | Assessed as either sufficient (at least 30 minutes a day for five days a week of physical activity of vigorous or moderate intensity) or insufficient (less than 30 minutes a day or less than five days a week of physical activity of vigorous or moderate intensity) |
| Healthy diet (categorical) | Assessed as either Insufficient (unhealthy diet which is less than five servings (400gms) of fruits or vegetables per day) or sufficient (healthy diet which is more than five servings of either fruits or vegetables) |

**Physiological Factors**

| | |
|---|---|
| Psychological stress (qualitative variable) | Self-reported by participants in the focus group discussions as feeling strain or pressure |
| Overweight (categorical) | Classified as overweight (BMI greater than 25 $kg/m^2$) or normal (BMI less than 25 $kg/m^2$ )<br><br>Body Mass Index (BMI) will be calculated based on participant's height in Centimetres (cm) and weight in Kilograms (kg) |
| Raised Blood glucose (categorical) | Categorised as either Raised blood glucose (fasting plasma glucose value≥ 7.0mmol/L or random plasma glucose value≥ 11.1mmol/L) or Normal blood glucose) |

| | |
|---|---|
| Raised blood pressure (categorical) | Categorised as either raised blood pressure (systolic blood pressure >=140 mm Hg and /or diastolic blood pressure => 90 mm Hg) or normal blood pressure |
| **Biomedical Factors** | |
| Duration since HIV diagnosis (continuous) | number of years/month since the participant was first diagnosed as HIV Positive |
| ART Status (categorical) | On Anti-Retroviral therapy – Yes/ No |
| Duration on ART (continuous) | Number of years/ Months on Anti-Retroviral therapy |
| ART regimen (categorical) | Combination of anti-retroviral agents the participant is using currently and past regimens |

## 3.6 Data collection

### 3.6.1 Data collection procedure for quantitative research

Two trained research assistants (nurse interns) collected data using a modified World Health Organization stepwise surveillance questionnaire (Appendix I). The questionnaire was interviewer-administered and was translated to Kiswahili for the participants who did not understand English. Blood pressure, blood glucose and anthropometric measurements were also taken. Similar blood pressure machines, glucometers, weighing scales and height boards were used on all participants as a quality control measure.

Blood pressure measurement was done using an automated digital machine (Omron -M2 Basic - HEM-7120-E) with an appropriate size cuff. The measurements were taken after the participant had been seated for at least 15 minutes with the patient's elbow rested on the table. Three blood pressure measurements were taken at an interval of three minutes between each reading (WHO, 2012).

A BMI scale that can measure both height and weight was used. The participant was asked to remove their shoes, headgear and any extra outer clothing like jackets and stand straight on the

scale facing the research assistant. The height was then recorded in centimetres and weight in kilograms. The participant's BMI will then be calculated based on these measurements (WHO, 2012).

A glucometer (On Call Plus) was used to measure either random or fasting blood glucose reading from the participant. After the participant was in a sitting position, the research assistant put on gloves, switched the meter on and inserted the test strip. The assistant then swabbed the finger of the participant using the provided alcohol swabs then lanced the fingertip using lancets. The blood drop produced was then be put on the test strip and the reading displayed on the meter after approximately 15 seconds recorded (WHO, 2012).

### 3.6.2 Data collection procedure for qualitative research

Two focus group discussions with 11 participants each were conducted. The discussion was designed to generate information from the patients' perspective on the perceived causes and complications of hypertension among people living with HIV. It brought out issues such as beliefs linked to causes of hypertension that would not be adequately brought out using the questionnaires because the participants were from different social and cultural backgrounds. The FGDs examined the meaning that the patients gave to their situation (Liamputtong, 2009). The target participants for the discussion were HIV positive patients above 18 years of age (male and female) who were currently on anti-retroviral agents. The principal investigator facilitated the discussions assisted by the research assistants and a peer educator. The discussions were based on the themes in the focus group discussion guide (Appendix III). The discussion was audio-recorded, and notes taken by the research assistant for reference.

Key informant interviews focused on the in-depth understanding of the aspects of HIV Positive hypertensive patients at comprehensive care clinic from the service providers 'perspective. The clinical team (nurses, clinicians and nutritionists) offered critical in-depth information/ specialized information which could not be obtained from the patients or through other channels. The interviews captured in the respondents' own words, their thoughts, feelings, and experiences on what factors were likely to be associated with hypertension, who was more at risk and what interventions could be put in place to prevention hypertension. It brought out perceptions or attitudes that would influence the management of the patients at the clinic (Liamputtong, 2009).

A key informant guide was used to interview all the healthcare workers at the clinic (who consented to participate) based on the themes/ questions in the guide (Appendix IV). Four healthcare workers (two clinicians – registered clinical officers, one nurse and one nutritionist) were available and consented to the interviews.

### 3.7 Data analysis and management

The questionnaires were checked for completeness daily. The data was then entered into MS Excel 2013 and exported to Stata, version 11 (Stata Corporation, College Station, Texas, USA) and checked for missing values or duplication. The out-of-range values were checked for by running distribution frequencies. Cross tabulation was also carried out to check for data inconsistencies. Data coding (transformation) was then done before the data was analysed.

Analysis was carried out using Stata, version 11(Stata Corporation, College Station, Texas, USA). Descriptive statistics- median, inter-quartile range and frequencies were carried out on variables like age, income, years since HIV diagnosis and duration on ART. The continuous data like age, income, number of years on treatment were then categorised. The categorical data like sex, level of education, employment status was presented in table form to show distribution. Univariable analysis of all the variables was carried out and presented in a table format to show frequency (in percentages), Odds ratios and p-values. The significance of the variables at univariable analysis stage was evaluated using a likelihood ratio test (LRT) at $p<0.20$ – a liberal p-value (Dohoo et al., 2012) .A logistic regression model was then used to evaluate the effect of each significant predictor on hypertension in HIV positive patients. Logistic regression was used because the outcome variable hypertension in HIV positive patients was dichotomous. A likelihood ratio test (LRT) was used to determine the overall significance of the logistic model. The LRT compared the likelihood of the full model (with all the variables) with the likelihood of the null model. This then determined whether the predictors contributed significantly to the prediction of the outcome- hypertension in HIV positive patients. Variables that were found to be significant were included in the logistic regression model in by eliminating variables at $p>0.05$ (Dohoo et al., 2012). The significant variables were presented in a table format.

Qualitative data collected from the focus group discussions and key informant interviews was recorded (audio recording) during the sessions. A research assistant took notes during the

discussion to complement the audio recordings. The recordings were transcribed verbatim then accuracy confirmed by reading through the notes again with the recording. The written material was imported into NVivo 2020 (QSR International). The results were then grouped into predetermined themes based on the focus group and key informant guides and any new or emerging ideas not in the guides incorporated.

### 3.8 Minimization of errors and biases

Bias was minimized by training of the research assistants on the study methods and tools. They were trained on how to take blood sugar, blood pressure and anthropometric measurements. Similar blood pressure machines and glucometers were used for all patients to avoid any variations introduced by the machines.

The principal investigator trained the research assistants on data collection tools and methods. The tool was pre-tested before the commencement of the study. The process of pre-testing the tool and training of the research assistances took two days at Mathare North health centre because access to other facilities was limited due to COVID-19 protocols. Day one focused on pre-testing the tool then the second day involved collection of feedback on the tool and making any necessary changes.

Logistic regression was used to minimize any confounding at analysis stage. This was done by comparing the log odds ratio of the crude model and the adjusted model (minus the possible confounders). Because the change in model did not result in more than 30% change, then the confounding was not significant (Dohoo et al., 2012).
The focus group discussions and the key informant interviews were audio recorded to ensure all the discussions were available for future reference during analysis.

### 3.9 Ethical considerations

Ethical clearance was sought and obtained from the Kenyatta National Hospital/University of Nairobi Ethics and Research Committee under the reference number **Ref: KNH-ERC/A/152**. Before any data was collected, written permission was sought and obtained from the Nairobi Metropolitan services (NMS)- Health Department, Ruaraka Sub County Health Management Team (SCHMT) and Mathare North health centre facility in-charge under the reference number **REF: EOP/NMS/HS/7/VOL.1/RS/011**. All study participants were informed of the study

objective, benefits, and risks and those willing to participate signed a written informed consent. Consent was administered before screening of the participants for eligibility to ensure willingness to participate. No identifying information was used in the questionnaires. Codes were used on the questionnaires to protect the identity of the participants. There was no direct benefits or remuneration for the willing participants. All collected information was kept confidential and only between the research team.

### 3.10 Limitations and Mitigation strategies

- Self-reporting of behavioural factors like the use of alcohol and tobacco did not yield very accurate data. This may have led to under-estimation of any relationship between the outcome and predictor variables

- Because the study design was cross sectional, it did not give definitive conclusions or allow for the determination of causality but that was data collected can be used to build on future research.

# CHAPTER FOUR: STUDY RESULTS

## 4.0 Introduction

This chapter provides the study findings from both the qualitative and quantitative data. Frequency tables are used to describe the background information of all participants. Descriptive statistics are also used to summarize data for the continuous variables. Univariable and multivariable data analysis results are also presented. The qualitative data is presented based on both deductive and inductive themes.

## 4.1 Quantitative data results

### 4.1.1 Descriptive statistics

A total of one hundred and forty-eight (148) participants from the comprehensive care clinic, Mathare North Health centre participated in the study giving a response rate of 100%. The participants were all registered for care and treatment at the clinic and were on anti-retroviral therapy. The complete data from the one hundred and forty-eight (148) questionnaires was considered for analysis.

The estimated portion of participants who were hypertensive based on blood pressure measurements done on the day of the interview or previous history of using blood pressure medication was 17.6%.

Table II shows the social, demographic and economic characteristics of the study participants. The median age of the respondents was forty years with an interquartile range (IQR) of 15 years (33 - 48). The male participants were 51.4% (n= 76) while females were 48.6% (n=72). Most of the respondents were married at 64.9% (n=96) while all the respondents in the study were Christians. A significant number of participants had secondary school level of education at 48.7% (72) while 38.51%(n=57) had primary school level and 4.1%(n=6) with no formal schooling. In terms of employment, a significant proportion were currently or in the last 12 months either employed (31.8%, n=47) or self-employed (27.0%, n=40) (41.2%, n=61). The median income per month for the respondents was ten thousand (10,000) Kenyan shillings with an interquartile range (IQR) of 10,000(0 - 18,000). Approximately Fifteen percent (n= 23) of the respondents reported a history of hypertension or a cardiovascular disease in their family.

***Table II: Descriptive statistics for the Social, Economic and Demographic data of the respondents (n=148)***

| VARIABLE | Values | Median | Inter-quartile range (IQR) | Frequency n (%) |
|---|---|---|---|---|
| Age (years) | (25-73) | 40 | 15 | |
| | 25-34 | | | 40(27.0%) |
| | 35-44 | | | 58(39.2%) |
| | 45-54 | | | 33(22.3%) |
| | 55+ | | | 17(11.5%) |
| Sex | Female | - | - | 72(48.7%) |
| | Male | - | - | 76(51.3%) |
| Marital Status | Married | | | 96(64.9%) |
| | Single | | | 20(13.5%) |
| | Other | | | 32(21.6%) |
| Religion | Christian | - | - | 148(100%) |
| Highest Level of Education | No formal schooling | - | - | 6(4.0%) |
| | Primary School | - | - | 57(38.5%) |
| | Secondary School | - | - | 72(48.7%) |
| | Higher education | - | - | 13(8.8%) |
| Employment status | Employed | - | - | 47(31.8%) |
| | Self-employed | | | 40(27.0%) |
| | Unemployed | | | 55(37.2%) |
| | Other | - | - | 6(4.1%) |
| Income per month (Kenya shilling) | (0-70,000) | 10,000 | 10,000 | |
| | Less than 15,000 | - | - | 51(48.1%) |
| | 15,000-25,000 | | - | 40(37.7%) |

| | | | | |
|---|---|---|---|---|
| | More than 25,000 | - | - | 15(14.2%) |
| Family history of hypertension | No | - | | 125(84.5%) |
| | Yes | | | 23(15.5%) |

The descriptive data for the behavioural, physiological and biomedical factors is presented in Table III. Approximately two percent (n=3) of the respondents reported ever using tobacco and none of them reported current use. Current alcohol use was reported in only 4.7%(n=7) of the participants, while harmful alcohol use (use of more than 5 standard drinks) was reported in two of the seven participants who were consuming alcohol. Insufficient physical activity (based on exercise days) was reported in 57.4% (n=57) of the participants. Unhealthy diet which was a measure of daily intake of fruits and vegetables was reported in all the participants. The median daily vegetable and fruits intake was two servings against a recommendation of five servings.

***Table III: Descriptive statistics for the Behavioural, Physiological and Biomedical data of the respondents (n=148)***

| **VARIABLE** | **Values** | **Median** | **Inter-quartile range (IQR)** | **Frequency n (%)** |
|---|---|---|---|---|
| History of tobacco use | No | | | 145(97.97%) |
| | Yes | | | 3(2.03%) |
| Current tobacco use | No | | | 148(100%) |
| | Yes | | | 0(0%) |
| Current alcohol use | No | | | 141(95.3%) |
| | Yes | | | 7(4.7%) |
| Harmful Alcohol consumption | No | | | 146(98.7%) |
| | Yes | | | 2(1.3%) |
| Physical activity | Insufficient | | | 85(57.4%) |
| | Sufficient | | | 63(42.6%) |
| Healthy diet (No. of Fruit/ Vegetables servings per day) | Insufficient | - | - | 148(100%) |

| | | | | |
|---|---|---|---|---|
| Body Mass Index (categories) | Normal | | | 82(55.4%) |
| | Overweight | | | 66(44.6%) |
| Raised blood sugar | No | | | 146(98.7%) |
| | Yes | | | 2(1.3%) |
| Years since HIV diagnosis | | 6 | 5.5 | |
| | Less than 5 years | - | - | 42(28.4%) |
| | 5+ years | - | - | 106(71.6%) |
| Duration on ART | | 5 | 4 | |
| | Less than 5 years | - | - | 53(35.8%) |
| | 5+ years | - | - | 95(64.2%) |
| Current ART regimen | ATV/R based | - | - | 12(8.1%) |
| | DTG based | - | - | 90(60.8%) |
| | EFV based | - | - | 46(31.1%) |
| Previous ART regimen | DTG based | - | - | 4(2.7%) |
| | EFV based | - | - | 114(77.0%) |
| | NVP based | - | - | 30(20.3%) |

Normal Body mass index (below 25kg/m2) was reported in 55.4%(n=82) of the participants while 44.6%(n=66) were classified as overweight. The proportion of participants with Raised Blood glucose levels based on a random blood glucose measurement done on the day of the interview was 1.3%(n=2). Approximately seventeen percent (n=26) of the participants were classified as hypertensive based on a mean blood pressure measurement (systolic blood pressure >=140 mm Hg and /or diastolic blood pressure => 90 mm Hg) or those that reported to be currently on blood pressure medication.

All participants in the study were living with HIV and the median number of years since HIV diagnosis was six years with an inter quartile range of 5.5 years (4- 9.5) while the median duration on antiretroviral therapy was five years with an inter quartile range of 4 years (4- 8). Based on current antiretroviral regimen, majority of the participants (60.8%, n=90) were on a

DTG based regimen which is in line with the recommendation by the Ministry of Health, Kenya for all adults. All the participants had previous exposure to another regimen with 77.0%(n=114) reporting they had used a EFV based regimen which was previously the recommended first line regimen for all adults.

### 4.1.2 Univariable and Multivariable analysis

Univariable analysis was used to determine the independent association of the behavioural, physiological and biomedical factors with the outcome hypertension. The odds ratio (OR), the corresponding 95% confidence intervals and p-values were reported. Pearson's Chi-squared test and Fisher's exact test were used for statistical comparison because all the data was categorised. Where the expected cell values were below 5, Fisher's exact test was used. The measures of association for the behavioural and physiological factors were as presented in Table IV.

***Table IV: Univariable analysis of the behavioural and physiological factors associated with hypertension in HIV positive patients on Antiretroviral therapy at Mathare North Health centre (n-148)***

| Variable | Category | Hypertensive case | | Odds Ratio | 95% CI | $Chi^2$ p-value |
|---|---|---|---|---|---|---|
| | | No N=122 | Yes N=26 | | | |
| History of smoking | No | 120 (82.8%) | 25 (17.2%) | 1.00 | Reference | 0.470 |
| | Yes | 2 (66.7%) | 1 (33.3%) | 2.40 | [0.21,27.50] | |
| Currently smoking | Ex-smoker | 2 (66.7%) | 1 (33.3%) | 1.00 | Reference | 0.470 |
| | N/a | 120 (82.8%) | 25 (17.2%) | 0.42 | [0.04,4.77] | |
| Currently using alcohol | No | 118 (83.7%) | 23 (16.3%) | 1.00 | Reference | 0.072* |
| | Yes | 4 (57.1%) | 3 (42.9%) | 3.85 | [0.81,18.35] | |
| Physical activity | Insufficient | 68 (80%) | 17 (20%) | 1.00 | Reference | 0.370 |
| | Sufficient | 54 (86%) | 9 (14%) | 0.67 | [0.28,1.61] | |

| | | | | | | |
|---|---|---|---|---|---|---|
| Diet (Number of servings) | Insufficient | 122 (82.4%) | 26 (17.6%) | NA | NA | NA |
| BMI | Normal | 68 (83%) | 14 (17%) | 1.00 | Reference | 0.860 |
| | Overweight | 54 (82%) | 12 (18%) | 1.08 | [0.46,2.52] | |
| Blood glucose | Normal | 120 (82.2%) | 26 (17.8%) | 1.00 | Reference | 0.510 |
| | Raised | 2 (100.0%) | 0 (0.0%) | 1.00 | [1.00,1.00] | |

**Variable independently associated with hypertension at 20% level of significance*

***Blood glucose - None of those with raised glucose had hypertension*

Currently using alcohol was independently associated with hypertension in PLHIV on antiretroviral therapy at the Mathare North health centre clinic where those currently using alcohol had 3.85 times the odds of hypertension compared to those not currently using alcohol. The other behavioural and physiological factors were not independently associated with hypertension in PLHIV in this study.

***Table V: Univariable analysis of the biomedical factors associated with hypertension in HIV positive patients on Antiretroviral therapy at Mathare North Health centre (n=148)***

| **Variable** | **Category** | **Hypertensive case** | | **Odds Ratio** | **95% CI** | **Chi$^2$** **p-value** |
|---|---|---|---|---|---|---|
| | | **No** **N=122** | **Yes** **N=26** | | | |
| Duration since HIV diagnosis | <5years | 36 (85.7%) | 6 (14.3%) | 1.00 | Reference | 0.510 |
| | 5+ years | 86 (81.1%) | 20 (18.9%) | 1.40 | [0.52,3.76] | |
| Duration since ART initiation | <5years | 45 (85%) | 8 (15%) | 1.00 | Reference | 0.550 |
| | 5+years | 77 (81%) | 18 (19%) | 1.31 | [0.53,3.27] | |
| Current ART regimen | ATV/R based | 11 (92%) | 1 (8%) | 1.00 | Reference | 0.660 |
| | DTG based | 73 (81%) | 17 (19%) | 2.56 | [0.31,21.22] | |

| | | | | | | |
|---|---|---|---|---|---|---|
| | EFV based | 38 (83%) | 8 (17%) | 2.32 | [0.26,20.58] | |
| Previous ART regimen | DTG based | 3 (75.0%) | 1 (25.0%) | 1.00 | Reference | |
| | EFV based | 96 (84.2%) | 18 (15.8%) | 0.56 | [0.06,5.72] | 0.580 |
| | NVP based | 23 (76.7%) | 7 (23.3%) | 0.91 | [0.08,10.23] | |

Table V presented the measures of association for the biomedical factors. Based on the p-values at 20% significance level, the factors examined were not independently associated with the outcome variable in this study.

Potential predictors with p-value < 0.2 in the crude association analysis were included in the adjusted analysis. Key physiological and biomedical variables shown to be significant in other similar studies were included in the model despite not meeting the p < 0.2 cut-off as shown in Table VI. Multivariable analysis was done using the multiple logistic regression model. The adjusted odds ratio (AOR), the corresponding 95% confidence interval and p-value were reported.

***Table VI: Multivariable analysis of factors associated with hypertension in HIV positive patients on ART at Mathare North Health Centre, Nairobi, n=148***

| **Variable** | **Category** | **Crude analysis** | | **Adjusted analysis** | | |
|---|---|---|---|---|---|---|
| | | **Crude Odds Ratio** | **95% CI** | **Adjusted Odds ratio** | **95% CI** | **P-value** |
| Currently using alcohol | No | 1.00 | Reference | 1.00 | Reference | |
| | Yes | 3.85 | [0.81, 18.35] | **6.78*** | **[1.13,40.50]** | **0.036** |
| BMI | Normal | 1.00 | Reference | 1.00 | Reference | |
| | Overweight | 1.08 | [0.46, 2.52] | 0.89 | [0.27,2.97] | 0.849 |
| Duration since HIV diagnosis | <5years | 1.00 | Reference | 1.00 | Reference | |
| | 5+ years | 1.40 | [0.52, 3.76] | 4.01 | [0.43,37.75] | 0.225 |

| | | | | | | |
|---|---|---|---|---|---|---|
| Duration since ART initiation | <5years | 1.00 | Reference | 1.00 | Reference | |
| | 5+years | 1.31 | [0.53, 3.27] | 0.40 | [0.07,2.17] | 0.289 |
| Current ART regimen | ATV/R based | 1.00 | Reference | 1.00 | Reference | |
| | DTG based | 2.56 | [0.31, 21.22] | 3.55 | [0.55,22.77] | 0.182 |
| | EFV based | 2.32 | [0.26, 20.58] | **7.48*** | **[1.02,55.05]** | **0.048** |
| Previous ART regimen | DTG based | 1.00 | Reference | 1.00 | Reference | |
| | EFV based | 0.56 | [0.06, 5.72] | 0.39 | [0.02,9.01] | 0.556 |
| | NVP based | 0.91 | [0.08, 10.23] | 0.43 | [0.02,12.07] | 0.619 |

After adjusting for other predictors in the model, current alcohol users had 6.78 times higher odds of having hypertension compared to non-users (aOR=6.78, 95% CI: [1.13, 40.50]).
Also, HIV positive patients who were on an EFV based ART regimen had 7.48 higher odds of having hypertension compared to those on ATV/R based regimen (aOR=7.48, 95% CI: [1.02, 55.05]).

### 4.2 Qualitative data results

#### 4.2.1 Profile of Respondents

A total of 22 respondents (11 male and 11 female) participated in the two focus group discussions while four key informants from the Mathare North health centre comprehensive care clinic were interviewed. All the respondents in the focus group discussion were patients registered for HIV care and treatment at the facility and on antiretroviral therapy.

The key informants comprised of clinical officers, nutritionist and nurse who had on average two to four years of experience working at the comprehensive care clinic.

#### 4.2.2 General knowledge on hypertension

General knowledge on hypertension was based on an understanding of raised blood pressure or hypertension, signs and symptoms, blood pressure measurements and the normal blood pressure values. The respondents had some knowledge of what hypertension or high blood pressure was.

Most referred to it as ‘pressure’ but were not very clear on the exact definition. They however had some way of describing it that had to do with blood flow and heartbeat. One of the male respondents said,

> *“My understanding when someone says pressure, the measurement according to what is normal for a human being, how they should breathe or heartbeat from the heart is a higher measurement than should be” (MALE, FGD # 4)*

While another responded,

> *“Issues of pressure determine movement of blood, oxygen in the body so if the pressure is raising, flow of blood within your system is not going well …..” (MALE, FGD # 8)*

The respondents were however not sure what the normal values or readings of blood pressure were. One of the respondents reported,

> *“Knowing that your pressure is not normal is complicated……” (MALE, FGD # 8)*

The participants were also asked about their experience getting blood pressure measured and if they had ever done it. The participants in the women’s group all reported to have had a blood pressure measurement done at one point or another however very few men had ever had the measurement done. One of the male respondents reported that he has never had a reason to get his blood pressure measured.

> *“I have never had a problem to cause me to get my pressure taken” (MALE, FGD # 3)*

From the women’s groups they reported that because of family planning or antenatal clinic visits they had had their blood pressure measurement done.

> *“Maybe you have gone for a family planning appointment, you must be measured your blood pressure first” (FEMALE, FGD #11)*

Participants of the focus group discussion were asked about any signs and symptoms of hypertension and most seemed to think that headache, dizziness and swelling of hands, body and feet were the most common. One participant reported:

*"... you can have changes in the body like sweating, swelling your legs so these are the normal ones" (MALE, FGD # 8)*

While another reported:

*"You may have a headache or feel dizzy many times" (FEMALE, FGD #7)*

One of the female participants however reported that high blood pressure was in some cases asymptomatic:

*"For me when I got (raised blood pressure), I did not have any of the signs mentioned but I collapsed then I was measured (blood pressure) and told it was high" (FEMALE, FGD #1)*

### 4.2.3 Perceptions on Predisposing factors

The key informants reported that most patients attending the Mathare North health centre clinic were not aware of the factors that might predispose them to hypertension.

*"Most patients are not aware of the factors; they may be hypertensive but do not know what the possible causes are" (KII-4)*

However, the respondents in the focus group discussions seemed to have an idea of some predisposing factors based on people they knew who had hypertension or from health talks at the facility.

#### 4.2.3.1 Social, economic and demographic factors

Family history of hypertension or cardiovascular disease, sex and economic status were reported as the likely factors associated with hypertension.

*"Maybe we say a parent had it(hypertension), you find that maybe one of their children will be diagnosed with it so we can say they inherited it from their parent" (FEMALE, FGD # 4)*

Economic status was also considered a factor by the participants though most of them linked it with stress which they considered to be the most common predisposing factor.

*"due to financial constraints, you find that the children need to go to school and you don't have the money, sometimes maybe you are not married, you are a single mother there is that pressure, the children need this, you don't have the money so in the process you find you think over board so that pressure comes….."(FEMALE, FGD # 5)*

In terms of gender, the female participants thought that women were more predisposed to hypertension than men because of the use of contraceptives and also linked it to handling of family issues that cause stress.

*"I think women we get more high blood pressure; I don't know if it's because we are concerned with family issues, so you find we are stressed up by children, so you find your pressure sometimes raises" (FEMALE, FGD # 4)*

*"it's us women who get it more because we are the ones who use family planning, we are the ones who get pregnant, it's us whose lives change all the time so it's easy to get" (FEMALE, FGD # 3)*

The male participants thought that both genders were equally predisposed to hypertension.

*"it's the same for both so just depends on how you manage causes of pressure" (MALE, FGD # 8)*

#### 4.2.3.2 Behavioural and physiological factors

Being overweight was identified as a factor predisposing to hypertension and linked with high blood glucose. The participants reported:

*"Mostly people who are overweight- unhealthy weight……." (MALE, FGD # 4)*

*"… because pressure is related to overweight and also those who are measured blood glucose and it's found to be high also are overweight so we can say it's one of the symptoms" (MALE, FGD # 8)*

The male participants however thought that use of alcohol was a protective factor not predisposing. One male participant reported:

*"No, because when you have pressure, you are not normal so when you pass by the bar and drink two to three beers, you relax and forget those things causing pressure to raise" (MALE, FGD # 6)*

Other factors identified by the participants were stress and unhealthy diet (processed food) which they reported as the most common factors associated with hypertension.

*"It is a lifestyle disease that comes because of a lifestyle or stress. (FEMALE, FGD #5)*

*"…lifestyle because most people want to do things differently like processed food especially if you live in town (urban city) ……its (processed food) quick and easy to find" (MALE, FGD # 8)*

#### 4.2.3.3 Biomedical factors

The key informants thought that raised blood pressure in people living with HIV was a concern but most of the patients attending the clinic at Mathare North health centre were not aware of the risk. The informants reported:

*"...and it's a concern because most of them start HIV when they have normal BP then later on, they become hypertensive, so it really needs intervention on what is causing them to be hypertensive" (KII-1)*

*"Most of the HIV positive patients their major concern is to get the ARVs not any other service. The other services are like a waste of time like being counselled for hypertension is not such a concern to them" (KII-1)*

The participants in the focus group discussions were however aware that raised blood pressure in people living with HIV was a concern through they were not very clear on how HIV or use of anti-retroviral agents was linked to the raised blood pressure. One of the female respondents reported:

*…. another thing, you know when you have HIV sometimes it lowers our immunity, so you find if your immunity is down your chance of getting that hypertension is high" (FEMALE, FGD # 9)*

On use of antiretroviral agents, one of the key informants thought that one of the newer agents, Dolutegravir was likely to be linked to raised high blood pressure:

> *"Maybe with the current ARVs I have seen some patients on DTG with elevated blood pressure but no sure if its related" (KII-4)*

while the focus group discussion participants thought that use of antiretrovirals combined with the other predisposing factors was likely to be related to hypertension.

> *"Yes, the medication we use are strong and its more than one so maybe many plus lifestyle, maybe the food that we eat that we eat, when they combine, the system can get over worked" (MALE, FGD # 8)*

#### 4.2.3.4 Preventive measures

In terms of prevention of hypertension, the key informants thought that screening and creation of awareness were key strategies for the people living with HIV:

> *"Every patient should have blood pressure measured and all the nutrition measures then once they are sent to the nutrition room, they can be repeated ……" (KII-1)*

> *"We can do more health talks for all clients so that we create awareness and for those who have it, we can create awareness on how to live a healthy lifestyle and also advise to keep check they blood pressure regularly" KII-2)*

The focus group discussion participants thought that focusing on lifestyle; healthy diet, physical activity and stress management were key strategies in prevention and management of hypertension in patients living with HIV:

> *"I think I should be eating a lot of greens(vegetables) and drinking a lot of water also avoid using a vehicle since I leave in the neighbourhood, I should just walk" (FEMALE, FGD # 3)*

> *"You find that the stress is brought about by finances so if you can find something to keep you busy, you look for some little money, it reduces stress" (MALE, FGD # 8)*

# CHAPTER FIVE: DISCUSSION

## 5.0 Introduction

This chapter provides interpretation of the study findings in relation to the study objectives. The broad objective of this study was to assess the determinants of hypertension among HIV positive patients at Mathare North Health centre.

## 5.1 Prevalence of hypertension among HIV positive patients

The proportion of hypertensives among the HIV positive patients on Antiretroviral therapy at Mathare North HC was found to be 17.6%. This was higher than in the studies carried out in tier 3 and 4 facilities among PLHIV in Kenya but lower than studies carried out outside Kenya. In a study carried in Nyanza Kenya, the prevalence of stage 1 hypertension among the participants was 10.4%(Juma et al., 2019) while in another study carried out in western Kenya the prevalence was 11.2% and 7.4% among HIV positive men and women respectively (Bloomfield et al., 2011). A meta-analysis of studies conducted in different countries from America, Europe, Asia and Africa reported a prevalence of 34.7% in ART experienced patients (Mse et al., 2017). The prevalence reported in East African countries was 28.7% (Tanzania) (Peck et al., 2014) and 20.9% (Uganda) (Kalyesubula et al., 2016). The differences in prevalence rate in Kenya could be due to the weak screening systems in the Tier 2 facilities associated with higher levels of undiagnosed hypertension.

## 5.2 Predisposing factors

### 5.2.1 Social, economic and demographic factors

Sex, age, marital status, religion, education level, employment status, income and family history of cardiovascular disease were the factors considered in this study. The distribution of the factors was described in Table II. Association with the outcome variable – hypertension was not determined.

### 5.2.2 Behavioural and physiological factors

The behavioural and physiological factors assessed in this study were tobacco use, harmful alcohol use, physical inactivity, unhealthy diet and stress. Current use of alcohol was shown to be associated with hypertension in HIV positive patients after univariable analysis in our study.

The respondents who reported currently using alcohol were 6.7 times (aOR =6.78; 95% CI: -1.13, 40.50) more likely to develop hypertension compared to those not using alcohol. This finding is corroborated by another study where harmful use of alcohol was associated with cardiovascular disease, diabetes, and hyperlipidaemia (Freiberg et al., 2010).

Tobacco use, physical inactivity and unhealthy diet were not significantly associated with hypertension in our study. A Meta-analysis of data from developing countries revealed that the prevalence of tobacco smoking among HIV-positive men was 24.4% with the crude prevalence in Kenya at 26.7% (Mdege et al., 2017). A cross sectional survey carried out in West Africa showed that the prevalence of smoking tobacco or cannabis was high in HIV positive patients. The prevalence was 29.7% in Mali, 14.2% in Cote d'Ivoire and 2.9% in Benin (Jaquet et al., 2009). The difference in results could be because these indicators were self-reported and not based on any data available in the respondents' medical records.

Body Mass index was not significantly associated with hypertension in our findings. Univariable analysis showed that a higher percentage of the respondents (17% and 83%) in the hypertensive and non-hypertensive groups respectively had normal BMI levels. Multivariable analysis in our study showed that higher BMI was not significantly associated with hypertension in HIV positive patients on HAART but a similar study carried in western Kenya showed that overweight or obesity was strongly associated with hypertension in both HIV positive men and women (Men: OR 2.41,95% CI 1.88-3.09, Women: OR 1.80, 95% CI 1.50-2.16) (Bloomfield et al., 2011) while another study carried out in Tanzania, overweight or obesity was a predictor of hypertension in HIV positive patients on ART(Kagaruki et al., 2014). BMI was also significantly associated with hypertension in a study carried out in Barcelona (Body mass index (OR: 1.18; 95% CI: 1.10–1.27)) (JERICO et al., 2005). The difference in results could be due to the difference in population and adherence to nutrition advice that is provided at the clinic to people living with HIV.

Raised blood glucose was not independently associated with hypertension in our study (none of the patients with raised blood glucose had hypertension) but in a study carried out in Ethiopia, raised blood glucose or diabetes mellitus was independently associated with increased risk of hypertension (Fiseha et al., 2019). Similarly in a Malaysian study, the odds of hypertension among HIV-positive patients with higher fasting blood glucose was about 1.332 times higher

than the odds of hypertension in HIV positive patients with normal fasting blood glucose (Hejazi et al., 2014). The difference in results in our study could be linked to the findings on body mass index which was also not significantly associated with hypertension.

### 5.2.3 Biomedical factors

The biomedical factors assessed in the study included: HIV infection and use of highly active antiretroviral agents. In our study, use of an Efavirenz based ART regimen was associated with hypertension after controlling for other predicators. The odds of hypertension among HIV positive patients on an EFV based regimen was about 7.8 (AOR 7.48; 95% CI: -1.02, 55.05) times higher than the odds of hypertension in HIV positive patients on the ATV/R based and DTG based regimens. In a study carried out in Cameroon, following multivariate analysis with logistic regression, use of HAART was found to be significantly associated with hypertension after controlling for other factors like age, gender, family history of hypertension, smoking and BMI (Dimala et al., 2016).In a study carried out in Ethiopia, they found that patients who were on a Zidovudine based regimen were at a higher risk of developing hypertension (Mulugeta et al., 2021). This was similar to a study carried out in south Africa (Brennan et al., 2018). The difference in findings could be due to changes in the Kenya national treatment guidelines where most of the participants were on safer antiretroviral agents like Tenofovir and Dolutegravir (Ministry of Health, 2018). Antiretroviral agents like Dolutegravir (integrase strand transfer inhibitor) have however been associated with weight gain and lipodystrophy which can be associated with increased blood glucose and blood pressure(Musekwa et al., 2021) .Duration on ART was also not significantly associated with hypertension in our study which differed from results from a study carried out in Ethiopia where longer duration on ART was independently associated with hypertension (Fiseha et al., 2019).

## 5.3 Perspective of the patients and the health care workers on the determinants of hypertension among people living with HIV

In the group discussions the HIV positive patients on antiretroviral therapy and healthcare workers expressed the importance of knowledge on hypertension, predisposing factors and prevention strategies. The discussion was important because it highlighted the perceptive of the patients on hypertension and its management in HIV positive patients which is helpful to healthcare workers in the overall management of the patients. There were however varying

levels of information on hypertension among the patients which was similar to a study carried out in Tanzania (Kagaruki et al., 2018). The key informants interviewed stated that health education of all HIV positive patients was an important aspect in addressing the varying levels of hypertension prevention and management knowledge among the patients.

Stress was highlighted by the female participants in the focus group discussions as the most common predisposing factor for hypertension. They stated that stress was due to the diagnosis with HIV, fear of the unknown in terms of treatment outcome but was also linked to other factors like financial status, employment status and stigma. This corroborated a study carried out in Kenya where the participants reported stress related to worrying about HIV diagnosis as a major determinant (Temu et al., 2017). The male participants however thought that unhealthy diet was the most common predisposing factor. They explained that processed food was cheaper and easily accessible to most people in the urban informal settlement than healthy options. These findings were similar to those from a study in India were the participants stated that diet rich in fats and salt was linked to hypertension (Kusuma, 2009). The female participants also expressed that because of other compounding factors like use of contraceptives, they thought they were at a higher risk of hypertension than the men, but this differed from results from quantitative studies that showed men had a higher prevalence of hypertension(Juma et al., 2019).

From our study findings, the key informants noted that hypertension is a major concern in patients living with HIV. They however stated that because of the limited knowledge among the patients, few were aware of the associated risk and proper preventive and management strategies. The participants in the focus group discussion were aware that having HIV and using anti-retroviral agents maybe predispose them to hypertension but were not clear to what extent and exactly how that happened.

In terms of preventive measures, the key informants and participants in the focus groups agreed that regular screening and lifestyle changes (healthy diet and physical activity) were key. These findings corroborated those from other studies in India and Kenya (Kusuma, 2009; Temu et al., 2017; Vedanthan et al., 2016). The key informants emphasized that health education on hypertension and its determinators was an important preventive strategy because most patients according to them were not aware of the risk and the proper preventive measures. They also

reported that it was important for Tier 2 facilities like Mathare North health centre to invest in blood pressure screening of all patients because this was not a routine practice.

# CHAPTER SIX: CONCLUSION AND RECOMMENDATIONS

## 6.0 Introduction

This chapter outlines the conclusion and recommendations. The conclusion has major findings from the study in relation to the specific objectives. The final section explores recommendations related to screening, prevention, and control of hypertension in HIV positive patients.

## 6.1 Conclusion

The findings of this study showed that 17.6% of the HIV positive participants on anti-retroviral therapy were hypertensive during the period of August – December 2020 based on blood pressure readings or previous diagnosis. This is higher than the prevalence reported from studies carried out in tier three and four facilities.

Socio-economic factors in this study were only described and association not determined because they were considered distal determinants. Among the behavioural factors, current use of alcohol was found to be univariably associated with hypertension. The final model included current use of alcohol, physiological and biomedical factors based on knowledge from previous studies. Use of an Efavirenz based regimen was found to be significant after adjusting for possible confounders in the model.

The qualitative aspect of the study on the perception of patients and healthcare workers on hypertension and associated factors revealed that most participants thought that stress and unhealthy diet were the most common factors associated with hypertension in patients living with HIV on anti-retroviral therapy at the Mathare North health centre Clinic.

The findings of this study can only be used to generate hypothesis and other study designs like cohort studies can be used to validate results.

## 6.2 Recommendations

Based on the findings of this study, some key recommendations that can be made to help reduce the burden of hypertension among HIV people living with HIV at the Mathare North health centre clinic include:

1. The proportion of hypertensive patients in our study was higher than that reported in tier three and four facilities therefore there is need for the county government to invest resources to strengthen the health structures in lower tier facilities to ensure proper screening for hypertension and associated determinants among of all people living with HIV attending care and treatment clinics.

2. Current use of alcohol was found to be a significant factor in this study. The facility management and the implementing partners need to establish systems for psychosocial support for patients using alcohol because this is a behavioural factor.

3. Use of anti-retroviral therapy and specifically use of an Efavirenz based regimens was found to be significantly associated with hypertension. Current changes in the national treatment guidelines have partially addressed this because use of Efavirenz is not the recommended first line option however because use of Dolutegravir (the first line option) is associated with dyslipidemia and therefore increased blood glucose and blood pressure, then systems still need to be put in place to routinely screen all patients on ART for hypertension.

4. Stress was also noted to be significantly associated with hypertension therefore the facility clinical team needs to routinely carry out mental assessment of all the patients and ensure all are attached to a psychosocial group.

5. Because of the limited knowledge of hypertension and its predisposing factors among PLWHIV attending the clinic, a well-structured patient health education system needs to be put in place. This can be a multi-disciplinary approach headed by the clinician or nurse at the comprehensive care clinic. This can be done daily before the clinic starts or through the support groups.

6. The health centre management in collaboration with the Nairobi Metropolitan services health department need to invest in the screening and testing infrastructure needed to support the patients i.e., blood pressure machines, glucometers and other lab testing equipment and reagents.

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**APPENDIX I: INTERVIEWER ADMINISTERED QUESTIONNAIRE**

**DETERMINANTS OF HYPERTENSION AMONG HIV POSITIVE PATIENTS AT MATHARE NORTH HEALTH CENTER, NAIROBI**

Date of interview ……..

Interview ID ……..

Instructions: - complete all sections of the questionnaire by indicating **X** in the appropriate checkbox or writing in the space provided.

**A. Demographic, Social and Economic Factors**

1. Sex: Male ☐ Female ☐

2. Date of Birth ……/…….. (Month/Year) (Age …….)

3. Marital Status

☐ Single ☐ Other

☐ Married

4. Religious affiliation

☐ Christian ☐ Islam

☐ Hindu ☐ Other

5. What is your highest level of education?

☐ No formal schooling
☐ Primary school
☐ Secondary school
☐ Higher education

6. Employment: What is your employment situation currently or in the past 12 months?

   ☐ Employed
   ☐ Self-Employed
   ☐ Unemployed
   ☐ Other

7. Income: how much do you earn on average per day/week/ month?

   Per day …….. (Kshs.)

   Per Week …….. (Kshs.)

   Per Month …….. (Kshs.)

**History of raised blood pressure**

8. Has anyone in your family ever been diagnosed with or treated for raised blood pressure or a heart condition?

   ☐ Yes ☐ No

**B. Behavioural Factors**

**<u>Tobacco use</u>**

9. Have you ever smoked or used any tobacco products (e.g., cigarettes, hand-rolled, cigars, pipes, shisha)?

   ☐ Yes ☐ No

   If yes, describe your current situation: -

   ☐ Currently using (in the last 30 days) – daily/current smoker

   ☐ Stopped using/ not used in the last 30 days –ex-smoker

**<u>Alcohol consumption</u>**

(Alcoholic drinks include beer, wine, spirits, fermented cider, changaa, busaa or any other local brew)

10. Do you currently (in the last 30 days) consume any alcoholic drinks?

    ☐ Yes ☐ No

11. If Yes to the question above, how many standard drinks do you take on one occasion or one day?

No. of standard drinks …….

(1 standard drink = equivalent to consuming half standard bottle of regular beer (500ml), one single measure of spirits (30ml) or one medium size glass of wine (120ml))

**Physical activity**

12. How many days a week are you involved in at least 30 minutes of vigorous/moderate-intensity sports, fitness or recreational (leisure) like cycling, swimming, volleyball or involved in vigorous/moderate-intensity activity that causes small to large increases in breathing or heart rate like brisk walking or carrying heavy to light loads?

…….. Days per week

**Healthy diet**

(Based on the consumption of fruits or vegetables daily)

13. Based on your assessment, how many servings of fruits and vegetables do you consume daily? …….. Servings

( 1 serving = 400gms or 1 cup of vegetables or one medium-sized fruit like apple or banana, one large orange or small wedge of watermelon)

**C. Physiological Factors**

**14. Blood Pressure**

| | | |
|---|---|---|
| Reading 1 | systolic (mmHg) | ……. |
| | Diastolic (mmHg) | ……. |
| Heart Rate Reading 1 | Beats per minute | ……. |

| | | |
|---|---|---|
| Reading 2 | systolic (mmHg) | ……. |
| | Diastolic (mmHg) | ……. |
| Heart Rate Reading 2 | Beats per minute | ……. |
| Reading 3 | systolic (mmHg) | ……. |
| | Diastolic (mmHg) | ……. |
| Heart Rate Reading 3 | Beats per minute | ……. |

15. In the past 30 days, have you been treated for raised blood pressure with drugs (medication) prescribed by a doctor or other health worker?

☐ Yes ☐ No

16. Based on the blood pressure measurements above or the history is the participant a hypertensive case?

☐ Yes ☐ No

**17. Height and Weight**

Height in centimetres (cm) ……..

Convert to metres (m) ……..

Weight in Kilograms (Kg) …….

Body Mass Index (BMI) ……kg/m2

(BMI = (weight in Kgs/ height in metres squared)

**18. Blood Glucose**

Fasting blood glucose level ……. Mmol/L

Or

Random (2 h) blood glucose level …….mmol/L

**D. Biomedical Factors**

19. How many years has it been since you were diagnosed HIV positive?
    Years/months ……. (Check patient file to confirm)
20. On ART? Yes ☐ No ☐

21. If yes, for how many years/ months ……..

22. If on ART, which is the current regimen …… (check patient file to confirm)

23. If on ART and has used other regimens, indicate all other regimens the patient has used ……. (Check patient file for details)

**APPENDIX II: KISWAHILI VERSION OF INTERVIEWER ADMINISTERED QUESTIONNAIRE**

**SABABU ZA HATARI YA SHINIKIZO LA DAMU KWA WAGONJWA WA UKIMWI KWA KITUO CHA AFYA MATHARE NORTH, NAIROBI**

Tarehe ya mahojiano ..... ..

Nambari ya Mahojiano ..... ..

Maagizo: - kamiliza sehemu zote za swala kwa kuonyesha **X** katika sanduku la hundi sahihi au uandishi katika nafasi iliyotolewa.

**A. Idadi ya Watu, Kijamii na Kiuchumi**

1. Jinsia: Kike ☐ Kiume ☐

2. Tarehe ya kuzaliwa ..... / ..... .. (Mwezi / Mwaka) (Umri .....)

3. Hali ya ndoa

☐ Hajaolewa ☐ Yengine

☐ Alioa

4. Uhusiano wa kidini

☐ wa Kikristo ☐ Uislam

☐ Hindu ☐ Nyingine

5. Ni kiwango gani cha juu cha elimu?

☐ Hakuna elimu rasmi

☐ Shule ya msingi

☐ Shule ya Sekondari

☐ Elimu ya Juu

6. Ajira: ni nini hali yako ya ajira kwa sasa au katika miezi 12 iliyopita?

☐ Alioajiriwa

☐ Kazi binafsi

☐ Haifanyi kazi

☐ Nyingine

7. Mapato: ni kiasi gani unapolipwa kwa wastani kwa siku / wiki / mwezi?

Kwa siku ..... .. (Kshs.)

Kila wiki ..... .. (Kshs.)

Kwa Mwezi ..... .. (Kshs.)

**Historia ya shinikizo la damu iliyoinua**

8. Je, mtu yeyote katika familia yako amewahi kukutwa au kutibiwa kwa shinikizo la damu lililoinua au hali ya moyo?

☐ Ndio ☐ la

**B. Sababu za tabia**

**Matumizi ya tumbaku**

9. Je! Umewahi kuvuta au kutumia bidhaa za tumbaku (k.m. sigara, mkono uliovingirishwa, sigara, mabomba, shisha)?

☐ Ndio ☐ la

Ikiwa ndiyo, taja hali yako ya sasa: -

☐ Hivi sasa unatumia (katika siku 30 zilizopita) - siku ya kila siku / sigara

☐ Imesimama kutumia / haijatumiwa siku 30 za mwisho -o-sigara

**Matumizi ya pombe**

(Vinywaji vya pombe ni pamoja na bia, divai, roho, cider, kuchochea, busaa au pombe yoyote ya ndani)

10. Je! Sasa (katika siku 30 zilizopita) hutumia vinywaji vingine vya pombe?

☐ Ndio ☐ la

11. Ikiwa Ndio kwa swali hapo juu, unachukua vinywaji ngapi wakati mmoja au siku moja?

Hapana ya vinywaji vya kawaida .....

(1 kiwango cha kawaida cha kunywa = sawa na kunywa chupa ya nusu ya kawaida ya bia (500ml), moja ya kipimo cha roho (30ml) au kioo cha kawaida cha divai (120ml))

**<u>Shughuli ya kimwili</u>**

12. Ni siku ngapi kwa wiki unashiriki katika angalau dakika 30 za michezo ya nguvu / ya kiwango kikubwa, fitness au burudani (burudani) kama baiskeli, kuogelea, volleyball au kushiriki katika shughuli nzito / kiwango cha wastani ambacho husababisha ongezeko kubwa ndogo kwa kiwango cha kupumua au moyo kama kutembea kwa haraka au kubeba mizigo nzito?

..... .. Siku kwa wiki

**<u>Chakula cha afya</u>**

(Kulingana na matumizi ya matunda au mboga kila siku)

13. Kulingana na tathmini yako mwenyewe, ni sehemu ngapi za matunda na mboga unazotumia kila siku? ..... .. Utumishi

(1 huduma = = 400gms au 1 kikombe cha mboga mboga au matunda 1 ya ukubwa wa kati kama apple au ndizi, 1 machungwa kubwa au kabari ndogo ya maji ya mvua)

**C. Mambo ya Biolojia**

14. Shinikizo la damu

Kusoma 1 systolic (mmHg) .....

Diastolic (mmHg) .....

Kiwango cha Moyo Kusoma 1 Inapiga kwa dakika .....

Kusoma 2 systolic (mmHg) .....

Diastoli (mmHg) .....

Kiwango cha Mapigo ya Moyo 2 Inapiga kwa dakika .....

Kusoma 3 systolic (mmHg) .....

Diastoli (mmHg) .....

Kiwango cha Moyo Kusoma 3 Inapiga kwa dakika .....

15. Katika siku 30 zilizopita, umepata kutibiwa kwa shinikizo la damu lililoinua na madawa ya kulevya (dawa) zilizoagizwa na daktari au mfanyakazi mwingine wa afya?

☐ Ndio ☐ la

16. Kulingana na vipimo vya shinikizo la damu hapo juu au historia ni mshiriki wa kesi ya shinikizo la damu?

☐ Ndio ☐ la

17. Urefu na Uzito

Urefu kwa sentimita (cm) ..... ..

Badilisha kwa mita (m) ..... ..

Uzito wa Kilo (Kg) .....

Mwili wa Misa Index (BMI) ..... kg / m2

18. Glucose ya Damu

Kufunga kiwango cha damu ya glucose ..... Mmol / L

Au

Random (2 h) ngazi ya damu ya glucose .....mmmm / L

**D. Mambo ya Biomedical**

19. Imekuwa miaka mingapi tangu umeambukizwa kuwa na VVU?

Miaka / miezi ..... (Angalia faili ya mgonjwa kuthibitisha)

20. Juu ya ART? ☐ Ndio ☐ la

21. Kama ndiyo ndiyo, kwa miaka ngapi / miezi ..... ..

22. Ikiwa juu ya ART, ambayo regimen ..... (angalia faili ya mgonjwa kuthibitisha)

23. Ikiwa kwenye ART na imetumia regimens zingine, onyesha regimens zote zingine ambazo mgonjwa ametumia ……. (Angalia faili ya mgonjwa kwa maelezo)

## APPENDIX III: FOCUS GROUP DISCUSSION GUIDE

### Introduction

Welcome and thank you for volunteering to take part in this discussion. Your opinion is very important. The discussion will assess your feelings and thoughts on hypertension in people living with HIV and factors that may be associated with it. The focus group discussion will not take more than two hours. The discussion will be audio recorded. Anonymity will be maintained to ensure the participants of the discussion cannot be identified. The audio recordings and discussion notes will be kept safe and only accessible to the research team.

Only one person can speak at a time but not in any particular order. There are no wrong answers in the discussion. You are free to ask any questions at this point before we begin the discussion.

### Questions

Understanding of hypertension

1. What does hypertension or raised blood pressure mean to you?
2. How would you know if your blood pressure is normal or raised? (Probe on measurement of blood pressure, normal pressure values)
3. Have any of you ever measured your blood pressure? If No, why not? (Probe on any fears about measurement of blood pressure)
4. Have any of you experienced or had raised blood pressure or know someone who has hypertension? How would you know if you have raised blood pressure? (Probe for symptoms of hypertension like headache, sweating, restlessness)
5. What happens when someone has raised blood pressure? How serious is hypertension? (Probe on problems that may be caused by raised blood pressure)

Causes of hypertension

6. What do you think causes raised blood pressure? (Probe on age, sex, religion, marital status, employment, education)
7. Which of the factors discussed above is most common according to you? Why?
8. According to you, who is more likely to get hypertension? (Probe on differences in sex, age, religion, marital status or education levels)
9. Do you think having a family member with raised blood pressure means you are likely to get hypertension? (Probe on family history link)

10. According to you, do you think how you live your life can lead to raised pressure? If yes, why? (Probe on factors like stress, alcohol use, tobacco use, unhealthy diet and physical activity)

11. What other factors that have not been discussed yet may be related to hypertension? (Probe on other disease conditions like raised blood glucose)

Hypertension in people living with HIV

12. According to you, is raised blood pressure a concern in people living with HIV? If yes, why?

13. How do you think hypertension and HIV are related?

14. Do you think HIV medication – anti-retroviral agents can cause raised blood pressure? If yes, how?

Prevention

15. How do you think you can prevent hypertension? (Probe on issues related to lifestyle changes and screening)

16. What do you think can be done at the Mathare North Health centre clinic to improve the prevention and management of hypertension?

17. Let us summarise the key points discussed today. Have we left anything out?

18. Do you have any questions?

Thank you for your time and contribution to the discussion.

## APPENDIX IV: KEY INFORMANT INTERVIEW GUIDE

Interview Date ……

Interview No: - ……

### Introduction

Welcome and thank you for volunteering to take part in this interview. Your opinion as a health care provider is very important. The interview will assess your thoughts on hypertension in people living with HIV and factors that may be associated with it. The interview will not take more than 30 minutes. The discussion will be audio recorded. Anonymity will be maintained. The audio recordings and discussion notes will be kept safe and only accessible to the research team.

There are no wrong answers in the discussion. You are free to ask any questions at this point before we begin the discussion.

1. What is your designation? (Clinician, nurse, nutritionist)
2. How many years have you worked at the comprehensive care clinic? (In years/months)
3. What is hypertension? Is it a concern among the PLHIV attending the clinic?
4. In your opinion, what are some of the factors contributing to or predisposing PLHIV to hypertension?
5. Who do you think is affected more, men or women? Why?
6. Do you think there is a difference in the prevalence of hypertension in people living with HIV and HIV negative patients? Why?
7. Do you think patients attending the clinic are aware of the predisposing factors to hypertension? Which factors do they are aware of and why?
8. Does the clinic have a way of sensitizing patients on the predisposing factors for hypertension? How is it done and how often?
9. What can be done to prevent hypertension among PLWHIV? What can be done at individual, community, facility and Ministry of health level?
10. According to you, what can be done to strengthen the screening and management of hypertension in people living with HIV?

## APPENDIX V: INFORMED CONSENT FORM

**Title of the study:** Determinants of hypertension among HIV-positive patients at Mathare North Health Centre, Nairobi

**Investigator:** Faith Mbithe Ndeto, University of Nairobi, Department of Public and Global Health

### Introduction

I would like to tell you about a study being conducted by the above listed researcher. The purpose of this consent form is to give you the information you will need to help you decide whether or not to be a participant in the study. Feel free to ask any questions about the purpose of the research, what happens if you participate in the study, the possible risks and benefits, your rights as a volunteer, and anything else about the research or this form that is not clear. When we have answered all your questions to your satisfaction, you may decide to be in the study or not. This process is called 'informed consent'. Once you understand and agree to be in the study, I will request you to sign your name on this form. You should understand the general principles which apply to all participants in medical research: i) Your decision to participate is entirely voluntary ii) You may withdraw from the study at any time without necessarily giving a reason for your withdrawal iii) Refusal to participate in the research will not affect the services you are entitled to in this health facility or other facilities. We will give you a copy of this form for your records.

May I continue? **YES / NO**

This study has approval by The Kenyatta National Hospital-University of Nairobi Ethics and Research Committee protocol No: _____

### WHAT IS THIS STUDY ABOUT?

The researchers listed above are interviewing individuals who have been selected randomly from the comprehensive care clinic, Mathare North Health Centre. The purpose of the interview is to find out the social, economic, demographic, behavioural, physiological and biomedical factors that are associated with hypertension. Participants in this research study will be asked questions about the factors mentioned above that are known to be associated with hypertension. Participants will also have the choice to undergo tests such as blood pressure and blood glucose

levels and measurements for height and weight. There will be approximately 427 participants in this study randomly chosen. We are asking for your consent to consider participating in this study.

**WHAT WILL HAPPEN IF YOU DECIDE TO BE IN THIS RESEARCH STUDY?**

If you agree to participate in this study, the following things will happen: You will be interviewed by a trained interviewer in a private area where you feel comfortable answering questions. The interview will last approximately thirty (30) minutes. The interview will cover topics such as family history of cardiovascular disease, use of tobacco and alcohol, diet, physical activity, HIV status and use of anti-retroviral agents. After the interview has finished, your height, weight, blood pressure and blood glucose levels will be measured. The blood glucose measurement will require a prick of the finger to draw a blood sample. We will ask for a telephone number where we can contact you if necessary. If you agree to provide your contact information, it will be used only by people working for this study and will never be shared with others. The reason why we may need to contact you is to make a follow up on any of the questions asked in the interview.

**ARE THERE ANY RISKS, HARMS DISCOMFORTS ASSOCIATED WITH THIS STUDY?**

Medical research has the potential to introduce psychological, social, emotional and physical risks but efforts have been put in place to minimize the risks. One potential risk of being in the study is loss of privacy. We will keep everything you tell us as confidential as possible. We will use a code number to identify you in a password-protected computer database and will keep all of our paper records in a locked file cabinet. However, no system of protecting your confidentiality can be absolutely secure, so it is still possible that someone could find out you were in this study and could find out information about you. Also, answering questions in the interview may be uncomfortable for you. If there are any questions you do not want to answer, you can skip them. You have the right to refuse the interview or any questions asked during the interview. We will do everything we can to ensure that this is done in private. Furthermore, all study staff and interviewers are professionals with special training in these examinations/interviews. You may feel some discomfort when your finger is pricked for the

blood glucose sample. In case of an injury, illness or complications related to this study, contact the study staff right away at the number provided at the end of this document. The study staff will treat you for minor conditions or refer you when necessary.

**ARE THERE ANY BENEFITS BEING IN THIS STUDY?**

You may benefit by receiving free blood pressure and blood glucose testing, free counselling on prevention and management of hypertension. We will refer you to a hospital for care and support where necessary. Also, the information you provide will help us better understand the factors that are associated with hypertension. This information is a contribution to science and help in policy making.

**WILL BEING IN THIS STUDY COST YOU ANYTHING?**

Participation in this research will not have any financial cost to you.

**WHAT IF YOU HAVE QUESTIONS IN FUTURE?**

If you have further questions or concerns about participating in this study, please call or send a text message to the study staff at the number provided at the bottom of this page. For more information about your rights as a research participant, you may contact the Secretary/Chairperson, **Kenyatta National Hospital-University of Nairobi Ethics and Research Committee** Telephone No. **2726300** Ext. 44102 email uonknh_erc@uonbi.ac.ke.

The study staff will pay you back for your charges to these numbers if the call is for study-related communication.

**WHAT ARE YOUR OTHER CHOICES?**

Your decision to participate in research is voluntary. You are free to decline participation in the study and you can withdraw from the study at any time without injustice or loss of any benefits.

**CONSENT FORM (STATEMENT OF CONSENT)**

**Participant's statement**

I have read this consent form or had the information read to me. I have had the chance to discuss this research study with a study counsellor. I have had my questions answered in a language that I understand. The risks and benefits have been explained to me. I understand that my participation in this study is voluntary and that I may choose to withdraw at any time. I freely agree to participate in this research study. I understand that all efforts will be made to keep information regarding my personal identity confidential.

By signing this consent form, I have not given up any of the legal rights that I have as a participant in a research study.

I agree to participate in this research study: **Yes** **No**

I agree to provide contact information for follow-up: **Yes** **No**

**Participant printed name**: _____

**Participant signature / Thumb stamp** _____ **Date** _____

**Researcher's statement**

I, the undersigned, have fully explained the relevant details of this research study to the participant named above and believe that the participant has understood and has willingly and freely given his/her consent.

**Researcher 's Name**: _____ **Date**: _____ **Signature:** _____

**Role in the study**: _____

For more information contact _____ at _____ from _____ to_____

Witness Printed Name (If witness is necessary, A witness is a person mutually acceptable to both the researcher and participant)

Name _____ Contact information _____

Signature /Thumb stamp: _____ Date; _____

**APPENDIX VI: KISWAHILI VERSION OF INFORMED CONSENT FORM**

**Kichwa cha utafiti**: Sababu Za Hatari Ya Shinikizo La Damu Kwa Wagonjwa Wa Ukimwi Kwa Kituo Cha Afya Mathare North, Nairobi

**Mtafiti**: Faith Mbithe Ndeto, Chuo Kikuu cha Nairobi, Shule ya Afya ya Umma

**Utangulizi**

Ningependa kukuambia kuhusu utafiti unaofanywa na mtafiti aliyeorodheshwa hapo juu. Madhumuni ya fomu hii ya idhini ni kukupa taarifa unayohitaji ili kukusaidia uamuzi au ikiwa ni mshiriki katika utafiti. Jisikie huru kuuliza maswali yoyote kuhusu madhumuni ya utafiti, kinachotokea ikiwa unashiriki katika utafiti, hatari na faida iwezekanavyo, haki zako kama kujitolea, na kitu kingine chochote kuhusu utafiti au fomu hii ambayo haijulikani. Tunapojibu maswali yako yote kwa kuridhika kwako, unaweza kuamua kuwa katika utafiti au la. Utaratibu huu unaitwa 'kibali cha habari'. Mara unapoelewa na kukubali kuwa katika utafiti, nitawaombea kusaini jina lako kwenye fomu hii. Unapaswa kuelewa kanuni za jumla ambazo zinatumika kwa washiriki wote katika utafiti wa matibabu: i) Uamuzi wako wa kushiriki ni kikamilifu kwa hiari ii) Unaweza kujiondoa kwenye utafiti wakati wowote bila ya kutoa sababu ya uondoaji wako iii) Kukataa kushiriki katika utafiti hauathiri huduma unazostahili kwenye kituo hiki cha afya au vifaa vingine. Tutakupa nakala ya fomu hii kwa rekodi zako.

Naweza kuendelea? **NDIO/ LA**

Utafiti huu una kibali na Kliniki ya Taifa ya Kenyatta-Chuo Kikuu cha Nairobi Kitivo cha Maadili na Utafiti wa Kamati Hapana: _____

**NI NINI KUFUNA KUFANYA?**

Watafiti waliotajwa hapo juu ni kuhoji watu ambao wamechaguliwa kwa nasibu kutoka kliniki ya huduma ya kina, Kituo cha Afya cha Mathare Kaskazini. Madhumuni ya mahojiano ni kujua kijamii, kiuchumi, idadi ya watu, tabia, biolojia na biomedical sababu zinazohusiana na shinikizo la damu. Washiriki katika utafiti huu wa utafiti wataulizwa maswali kuhusu mambo yaliyotajwa hapo juu ambayo yanajulikana kuwa yanahusishwa na shinikizo la damu. Washiriki pia

watakuwa na uchaguzi wa kupima mtihani kama vile shinikizo la damu na viwango vya damu ya glucose na vipimo kwa urefu na uzito. Kutakuwa na washiriki wapatao 427 katika utafiti huu kwa nasibu waliochaguliwa. Tunaomba ridhaa yako kufikiria kushiriki katika utafiti huu.

**NINI KATIKA KUFANYA KATIKA UNAJIFUNA KUTIKA MAFUNZO YA KUTOA?**

Ikiwa unakubali kushiriki katika somo hili, mambo yafuatayo yatatokea: Utaulizwa na mhojiwaji mwenye ujuzi katika eneo la kibinafsi ambako unasikia kujibu maswali. Mahojiano itaendelea dakika thelathini (30). Mahojiano yatashughulikia mada kama historia ya familia ya ugonjwa wa moyo, utumiaji wa tumbaku na pombe, chakula, shughuli za kimwili, hali ya VVU na matumizi ya mawakala wa kupambana na virusi vya ukimwi. Baada ya mahojiano kumaliza, urefu wako, uzito, shinikizo la damu na kiwango cha damu ya glucose utahesabiwa. Upimaji wa damu ya glucose itahitaji pigo la kidole kuteka sampuli ya damu. Tutaomba namba ya simu ambapo tunaweza kuwasiliana na wewe ikiwa ni lazima. Ikiwa unakubaliana kutoa maelezo yako ya mawasiliano, itatumiwa tu na watu wanaofanya kazi kwa ajili ya utafiti huu na kamwe hawatashirikiwa na wengine. Sababu ambayo tunaweza kuwasiliana nanyi ni kufuatilia swali lolote lililouliwa katika mahojiano.

Je, kuna baadhi ya maadili, magonjwa yanayotokana na mafunzo haya?

Utafiti wa matibabu una uwezo wa kuanzisha hatari za kisaikolojia, kijamii, kihisia na kimwili lakini juhudi zimewekwa ili kupunguza hatari. Hatari moja ya kuwa katika utafiti ni kupoteza faragha. Tutaweka kila kitu unachotuambia kama siri iwezekanavyo. Tutatumia namba ya nambari ili kukutambua kwenye darasani ya kompyuta iliyohifadhiwa na nenosiri na tutahifadhi rekodi zote za karatasi kwenye baraza la mawaziri lililofungwa. Hata hivyo, hakuna mfumo wa kulinda siri yako inaweza kuwa salama kabisa, kwa hiyo bado inawezekana kwamba mtu anaweza kujua wewe ulikuwa katika utafiti huu na anaweza kupata habari kuhusu wewe. Pia, kujibu maswali katika mahojiano inaweza kuwa na wasiwasi kwako. Ikiwa kuna maswali yoyote unayotaka kujibu, unaweza kuruka. Una haki ya kukataa mahojiano au maswali yoyote yaliyoulizwa wakati wa mahojiano. Tutafanya kila kitu tunaweza kuhakikisha kuwa hii imefanywa kwa faragha. Zaidi ya hayo, wafanyakazi wote wa utafiti na wahojiwa ni wataalamu wenye mafunzo maalum katika mitihani / mahojiano haya. Unaweza kujisikia wasiwasi wakati kidole chako kinapopigwa kwa sampuli ya damu ya glucose. Ikiwa kuna jeraha, magonjwa au

matatizo yanayohusiana na utafiti huu, wasiliana na wafanyakazi wa kujifunza mara moja kwa idadi iliyotolewa mwishoni mwa hati hii. Wafanyakazi wa kujifunza watawapata kwa hali ndogo au kukutaja wakati unahitajika.

Je, kuna faida yoyote kuwa katika mafunzo haya?

Unaweza kufaidika kwa kupata shinikizo la damu huru na kupimwa kwa damu ya glucose, ushauri wa bure juu ya kuzuia na usimamizi wa shinikizo la damu. atakupeleka kwenye hospitali kwa ajili ya huduma na msaada ikiwa inahitajika. Pia, taarifa unayoyatoa itatusaidia kuelewa vizuri mambo ambayo yanahusiana na shinikizo la damu. Taarifa hii ni mchango kwa sayansi na msaada katika kufanya sera.

**KUPATA KUJUA KWENYE KUPATA NINI?**

Kushiriki katika utafiti huu hakutakuwa na gharama yoyote ya kifedha kwako.

**NINI UNA MAFUNZO KATIKA KATIKA?**

Ikiwa una maswali zaidi au wasiwasi juu ya kushiriki katika utafiti huu, tafadhali piga simu au tuma ujumbe wa maandishi kwa wafanyakazi wa kujifunza kwa namba iliyotolewa chini ya ukurasa huu. Kwa habari zaidi kuhusu haki zako kama mshiriki wa utafiti unaweza kuwasiliana na Katibu / Mwenyekiti, Kenyatta National Hospital-Chuo Kikuu cha Nairobi Maadili na Utafiti Kamati Namba Namba 2726300 Ext. 44102 barua pepe uonknh_erc@uonbi.ac.ke.

Wafanyakazi wa kujifunza watawalipa malipo yako kwa idadi hizi ikiwa wito ni kwa ajili ya mawasiliano inayohusiana na utafiti.

**NINI CHANGO CHINI CHINI?**

Uamuzi wako wa kushiriki katika utafiti ni wa hiari. Wewe ni huru kupungua kushiriki katika utafiti huo na unaweza kujiondoa kwenye utafiti wakati wowote bila udhalimu au kupoteza faida yoyote.

**FORM YA SHAHILI (MAELEZO YA KUTIKA)**

**Taarifa ya Mshiriki**

Nimeisoma fomu hii ya idhini au nilisoma habari. Nimekuwa na fursa ya kujadili utafiti huu wa utafiti na mshauri wa utafiti. Nimekuwa na maswali yangu akajibu kwa lugha ambayo ninayoelewa. Hatari na faida zimeelezwa kwangu. Ninaelewa kuwa ushiriki wangu katika utafiti huu ni hiari na kwamba nipate kuchagua kuchagua wakati wowote. Ninakubali kwa hiari kushiriki katika utafiti huu wa utafiti. Ninaelewa kwamba jitihada zote zitafanywa kuweka taarifa kuhusu utambulisho wangu binafsi.

Kwa kusaini fomu hii ya kibali, sijaacha haki yoyote ya kisheria niliyoshiriki katika utafiti wa utafiti.

Nakubali kushiriki katika utafiti huu wa utafiti: Ndiyo Hapana

Nakubali kutoa taarifa ya mawasiliano kwa kufuatilia: Ndio Hapana

Jina la kuchapishwa la mshiriki: _____
Sahihi mshiriki / Sura ya thumb _____ Tarehe _____

Taarifa ya Mtafiti

Mimi, aliyechaguliwa, ameelezea kikamilifu maelezo muhimu ya utafiti huu wa utafiti kwa mshiriki aliyechaguliwa hapo juu na kuamini kwamba mshiriki ameelewa na ametoa idhini yake kwa hiari na kwa hiari.

Jina la Mtafiti: _____ Tarehe: _____ Saini: _____

Jukumu katika utafiti: _____

Kwa habari zaidi wasiliana _____ kwa _____ kutoka _____ hadi _____

Jina la Kuchapishwa kwa Shahidi (Ikiwa shahidi ni muhimu, shahidi ni mtu anayekubaliana na mtafiti na mshiriki)

Jina _____ Maelezo ya mawasiliano _____

Sahihi / kitambulisho: _____ Tarehe; _____

## APPENDIX VII: KNH/UoN – ERC APPROVAL LETTER

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://www.erc.uonbi.ac.ke
Facebook: https://www.facebook.com/uonknh.erc
Twitter: @UONKNH_ERC https://twitter.com/UONKNH_ERC

KENYATTA NATIONAL HOSPITAL
P O BOX 20723 Code 00202
Tel: 726300-9
Fax: 725272
Telegrams: MEDSUP, Nairobi

Ref: KNH-ERC/A/152

15th May 2020

KENYATTA NATIONAL HOSPITAL
APPROVED
15 MAY 2020
KNH/UoN-ERC
P. O. BOX 20723 - 00202 NAIROBI

Dr. Faith Mbithe Ndeto
Reg. No.H57/87885/2016
School of Public Health
College of Health Sciences
University of Nairobi

Dear Dr. Ndeto

**RESEARCH PROPOSAL – DETERMINANTS OF HYPERTENSION AMONG HIV POSITIVE PATIENTS AT MATHARE NORTH HEALTH CENTER, NAIROBI (P842/10/2019)**

This is to inform you that the KNH- UoN Ethics & Research Committee (KNH- UoN ERC) has reviewed and **approved** your above research proposal. The approval period is 15th May 2020 – 14th May 2021.

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 that may increase the risks or affect safety or welfare of study participants and others or affect the integrity of the research must be reported to KNH- UoN ERC within 72 hours.
e. Clearance for export of biological specimens must be obtained from KNH- UoN ERC for each batch of shipment.
f. Submission of a request for renewal of approval at least 60 days prior to expiry of the approval period. (*Attach a comprehensive progress report to support the renewal*).
g. Submission of an *executive summary* report within 90 days upon completion of the study. 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- UoN ERC website**http://www.erc.uonbi.ac.ke**

Protect to discover

Yours sincerely,

**PROF. M. L. CHINDIA**
**SECRETARY, KNH-UoN ERC**

c.c. The Principal, College of Health Sciences, UoN
The Director, CS, KNH
The Chairperson, KNH- UoN ERC
The Assistant Director, Health Information, KNH
The Director, School of Public Health, UoN
Supervisors: Dr. Tom Olewe,School of Public Health, UoN
Dr. Faith Thuita, School of Public Health, UoN

## APPENDIX VIII: NAIROBI METROPOLITAN SERVICES APPROVAL LETTER

REPUBLIC OF KENYA

**NAIROBI METROPOLITAN SERVICES**

*Directorate of Health Services*

**REF: EOP/NMS/HS/7/VOL.1/RS/011** **DATE:11th August, 2020**

Dr. Faith Ndeto
Sub County Pharmacist
Nairobi

Dear Madam,

**RE: RESEARCH AUTHORIZATION**

This is to inform you that the Nairobi Metropolitan Services - Health Directorate Research working group reviewed the documents on the study titled **"Determinants of Hypertension among HIV positive patients at Mathare North Health Centre, Nairobi".**

I am pleased to inform you that you have been authorized to undertake the study at Mathare North Health Centre – Ruaraka Sub County, Nairobi Metropolitan Services.

You will be required to adhere to the ethical code of conduct for health research in accordance to the Science Technology and Innovation Act, 2013 and the approval procedure and protocol for research for Nairobi County.

On completion of the study, you will submit one hard copy and one copy in PDF of the research findings to the Research Technical Working Group.
By copy of this letter, the Sub County Medical Officer of Health, Ruaraka will to accord you the necessary assistance to carry out this research study.

Yours sincerely,

DR. OUMA OLUGA
FOR: DIRECTOR HEALTH SERVICES

CC:
Sub County Medical Officer of Health
Ruaraka

Kenyatta International Convention Centre P.O. Box 49130-00100, GPO, Nairobi, Kenya
Tel: +254 (0) 20 2217774/3
Email: transport@nms.go.ke | Web: www.nms.go.ke

## APPENDIX IX: UNIVERSITY OF NAIROBI DIGITAL REPOSITORY DEPOSIT AGREEMENT

### UNIVERSITY OF NAIROBI DIGITAL REPOSITORY

### DEPOSIT AGREEMENT

To efficiently administer the University of Nairobi Digital Repository and preserve its contents for long-term use, the University requires certain permissions and warrants from a depositor or copyright owner. By accepting this agreement, a copyright owner still retains copyright to their work and does not give up the right to submit the work to publishers or other repositories. If one is not a copyright owner, they represent that the copyright owner has given them permission to deposit the work.

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Title: DETERMINANTS OF HYPERTENSION AMONG HIV POSITIVE PATIENTS AT MATHARE NORTH HEALTH CENTER, NAIROBI

Author: DR. FAITH MBITHE NDETO

**Depositor's Declaration**

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Name: DR. FAITH MBITHE NDETO

College: HEALTH SCIENCES

Sign:

Date: 26/10/2022

## APPENDIX X: ORGINALITY – TURNITIN REPORT

DETERMINANTS OF HYPERTENSION AMONG HIV POSITIVE PATIENTS AT MATHARE NORTH HEALTH CENTER, NAIROBI

ORIGINALITY REPORT

| 13% | 11% | 9% | 3% |
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