PREVALENCE AND FACTORS ASSOCIATED WITH HYPERTENSION AMONG ADULT OUTPATIENTS AT MPEKETONI SUB-COUNTY HOSPITAL, LAMU, KENYA

BY

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A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PUBLIC HEALTH, COLLEGE OF HEALTH SCIENCES, MOI UNIVERSITY

2023

DECLARATION

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To my beloved parents and my sister for their wise counsel and support.

ABSTRACT

Background: Hypertension is a leading cause of cardiovascular diseases and a growing public health problem globally. The STEPS (Stepwise Approach to Non-Communicable Disease Risk Factor Surveillance), report (2015) indicated that the prevalence of hypertension in Kenya was approximately 23.8% and that 56% of Kenyans had never been screened for raised blood pressure. Population-based data to inform policy development are scarce in Kenya. According to the Lamu County Integrated Development plan (2018-2022), hypertension is ranked as the fifth cause of outpatient morbidity with a prevalence of 3.5% and a mortality rate of 7.3%. The number of outpatient cases at Mpeketoni sub-County Hospital with hypertension almost doubled from 356 patients in 2014, to 607 in 2017.

Objectives: To determine the prevalence and behavioral, social, and metabolic factors associated with hypertension among adults attending Mpeketoni sub-County Hospital.

Methods: Hospital-based cross-sectional study design was used. Two hundred and fifty-five participants were recruited using systematic sampling. A trained research assistant assessed the participants and administered the study questionnaire. Variables collected included, body weight, height, waist circumference, blood pressure. Mean, standard deviation and frequencies were used to describe the participant characteristics. Chi square and Logistic regression were used to test associations; variables that were significant at $p \leq 0.05$ were entered into Multiple Logistic Regression. Odds ratio was used to determine the level of association between the independent and dependent variables.

Results: Two hundred and fifty-five participants aged 19 to 74 years with mean age of 38 ± 12.5 years were enrolled. They comprised of 48.6% males with majority aged between 25-34 years old. The overall prevalence of hypertension was 34.1%. The prevalence of hypertension was higher in females (41.2%) than males (26.6%) (p=0.014), among married than unmarried participants (40.9% vs 19%) (p=0.001). Those who were obese (47.5%), farmers (62%) and were not participating in vigorous intense activities (35.9%) had a higher prevalence of hypertension. Age was an independent predictor of hypertension; (aOR=15.1; 95 % CI=5.6-40.5). Individuals with an elevated waist circumference were more likely to have hypertension than those with normal waist circumference (aOR=3.3; 95% CI=1.6-6.8). Participants with a family history of high blood pressure were more likely to develop hypertension compared to those without a family history of raised BP (aOR=2.7; 95% CI=1.2-6.2).

Conclusion: Hypertension affects at least one in three adults attending outpatient department. Age of 45 years and above, being female, a farmer and being obese have higher risk of developing hypertension. Participation in less vigorous activities and having a family history were also more likely to develop hypertension.

Conclusion: The Public Health Department of Lamu County needs to put in strategies to ensure residents engage in physical exercise and maintain healthy weight targeting those older than 45 years. By sensitizing the residents on the importance of physical exercise and having accessible facilities where exercise can be done for example sports grounds and fitness centers.

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ACKNOWLEDGMENTS

I thank the Almighty God for providing a sure way throughout the study. I thank my supervisors Dr. Samson Ndege and Prof. Paul Ayuo for their tireless guidance and advice during fieldwork and the write up of this thesis.

I thank Moi University and the School of Public Health for facilitating me in this study by ensuring that I am well equipped with the knowledge necessary to do the study.

I am also grateful to management of Mpeketoni sub-County Hospital for granting me permission to carry out this research at their health facility.

I am grateful to all the participants who agreed to participate in the study. I am also grateful to my parents and sister for their moral and financial support towards this study.

I would also like to express my sincere thanks to Mr. Mukonza, Mr. Jillo, Mr. Chikanda, Mr. Mohammed Moroa and the Clinical Officers at the outpatient clinic for their cooperation throughout the study period.

I am truly grateful to my friends, Rachel Ambasa, Jeina Kakui, Isaac Bolo, Miriam Maina, Mercy Kaponda, Pastor Ian Okwado, Flora Okwado, Pastor Zedekiah, Mrs. Rhodah Omondi, Pastor Magak, Petwa Malaba, Irene Gaturu and Brian Ombaka for their prayers and moral support.

Lastly, thanks to all my colleagues and my classmates for the assistance offered during the entire period of study.

ABBREVIATIONS

aOR	Adjusted Odds Ratio
BP	Blood Pressure
BMI	Body mass index
CDC	Center for Disease Control and Prevention
CVDs	Cardiovascular Diseases
DBP	Diastolic Blood Pressure
DHS	Demographic Health Survey
DHIS2	District Health Information System 2
HDL	High Density Lipids
HBP	High Blood Pressure
HPT	Hypertension
IREC	Institutional Research and Ethics Committee
LCHSI	Lamu County Health Strategic & Investment Plan
LMICs	Low and Middle-Income Countries.
NCD	Non-Communicable Diseases
NGO	Non-governmental organization
SBP	Systolic Blood Pressure
STEPs	STEPwise Survey to NCD Risk Factor Surveillance
SPSS	Social Package for Statistical Sciences
SSA	Sub Saharan Africa.
US	United States
WHO	World Health Organization

OPERATIONAL DEFINITIONS

Alcohol use: Defined as the act of ingesting a beverage containing ethanol (Encyclopedia of Behavioral Medicine, 2013 Edition) Editors: Marc D. Gellman, J. Rick Turner.)

Body Mass Index (BMI): Calculated as weight in kilograms divided by height in meters squared (weight (kg)/height (m^2). The BMI was categorized as per the World Health Organization guidelines underweight (BMI <18.5), normal (BMI ≥18.5 to ≤ 24.9), overweight (BMI ≥ 25.0 to ≤ 29.9) or obese (BMI ≥30.0). (WHO, 2020)

Hypertension: Defined as persistently elevated systolic and/or diastolic blood pressure of 140/90mmHg or more in subjects aged 18 years and above. (Kenya National Guidelines for Cardiovascular Diseases Management).

Overweight: Body mass index (BMI) ≥ 25 but less than 30 kg/m^2 (WHO, 2020).

Obesity: Defined as abnormal or excessive fat accumulation where body mass index (BMI) is above 30 kg/m^2 (WHO, 2020).

Physical activity: Bodily movement produced by skeletal muscles that requires energy expenditure. It refers to all movement including leisure time, for transport to get to and from places, or as part of a person's work. Both moderate and vigorous –intensity physical activity improves health. (WHO, 2020).

Smoking status: A recorded variable based on several questions about cigarette smoking. It includes the categories of current smoker, former smoker, never smoked, and smoking status unknown. (CDC, 2017).

Waist circumference: Used as a measure of abdominal obesity: Defined as waist-to-hip ratio (WHR) greater than 88 centimeters in women and greater than 102 centimeters in men. Comprehensive Clinical Nephrology (Fourth Edition, 2010).

Family History of Hypertension: Means having someone in the family (a blood relative such as a mother, father, sister, or brother) who has had high blood pressure before the age of 60 (CDC, 2015).

CHAPTER 1

INTRODUCTION

1.1 Background

Blood pressure is measured in millimeters of mercury (mmHg). Hypertension is defined as a systolic pressure of higher than or equal to 140 mmHg and a diastolic pressure of higher than or equal to 90 mmHg. (CDC, 2015)

Hypertension if not controlled may cause conditions such as heart attack, aneurysm, heart failure, kidney failure, visual impairment, metabolic syndrome, and dementia (WHO, 2021).

High blood pressure is a significant contributor to non-communicable disease (NCD) burden in both first and third world countries. It is a primary cause of hemorrhagic and athero-thrombotic stroke, hypertensive heart disease, hypertensive kidney failure and coronary artery disease (Joshi et.al. 2014).

Four major risk factors for high blood pressure are unhealthy diets, tobacco use, the harmful use of alcohol and physical inactivity (Olack et al, 2015). Risk factors of hypertension globally are obesity possibly due to more readily available westernized diet, increase in sedentary lifestyle and advancement in age (Bromfield and Mutner, 2013).

Globally, cardiovascular diseases accounts for close to 17.9 million deaths annually; 9.4 million of these deaths are caused by complications of hypertension (WHO, 2017). Hypertension, unprotected sex and being underweight are among the major factors that contribute to disease burden globally (Ondimu et.al, 2018).

Globally, premature deaths are majorly caused by high blood pressure. It affects more than thirty percent of the adult population (WHO, 2020). In 2019, more than half of the female population, and almost half of males were previously diagnosed with high blood pressure globally, (NCD Risk Factor Collaboration- (NCD-RisC), (2021). According to Mill et.al, 2020, the prevalence of hypertension has increased in LMICs due to low levels of awareness and inadequate treatment.

It is predicted that in 2025, the percentage hypertensive adults will rise to 60% to a total of 1.56 billion (Kearney, 2005). High blood pressure prevalence might rise to 44% (95% CI, 43–45%) in 2030, globally (WHO, 2017). This is an indication that, high blood pressure is amongst the major contributors to challenges in public health globally. Therefore, prevention, early detection, treatment, and control of this condition need to be prioritized.

Among the WHO regions, Africa was ranked as having the highest prevalence of hypertension; whereby, a third of the population are affected however, the American region had the lowest prevalence (WHO 2014). The ageing population in Africa, which is projected to increase from 5.2% in 2000 to 8.9% in 2050, excess body weight, being a current smoker and drinker are factors associated with hypertension (Sarki et.al, 2015).

A recent systematic analysis reported that sub-Saharan Africa's combined prevalence of high blood pressure in adults whose age was sixty-five years and above was sixty-one percent (Zhou et al, 2017). Several studies have indicated an increase in the

prevalence of hypertension in Africa, Nigeria with the highest population is a major contributor to this increase. (Adeke et.al, 2022).

In a study done in four countries in sub-Saharan Africa (Tanzania, South Africa, Nigeria, and Uganda), only half of hypertensive participants knew that their hypertension is raised. The prevalence of pre-hypertension was 21.0 %. Advanced age, elevated body mass index, lower level of education, and tobacco use were associated with high blood pressure. There is therefore a need to prioritize the prevention strategies for higher age groups and to increase detection rates of cases of raised blood pressure and provide enough resources for treatment (Guwatudde et.al, 2015). Other factors causing the rise in the burden of hypertension were untreated cases, undiagnosed or inadequately treated cases. (Ataklte, et.al, 2015). Lack of awareness and lack of effective treatment especially in the age group of 40-60 has also contributed to a high prevalence of high blood pressure in sub-Saharan Africa. (Gómez-Olivé, et.al, 2017).

A recent analysis of African studies showed rates of 27 percent, 18 percent, and 7 percent respectively in awareness, care, and prevention of high blood pressure (Chow et, al. 2013). An epidemiological pattern has shown that the combined occurrence of hypertension among the elderly in Africa is higher than in the age group of forty or younger (Mohammed, et al, 2018).

Different countries show varied prevalence rates in adult population aged 15 and above. For instance, Ethiopia reported 16.9% (Bonsa et al. 2014) while Ghana reported a prevalence of 13.7% (Sanuade et al. 2018). The urban areas in Benin the

prevalence was 23% (Soubeiga et al. 2017) and 54.6% in Ghana (Sanuade et al. 2018). In rural Uganda, the prevalence was 14.6% (Kotwani et al. 2013) and 28.9% in Nigeria (Adeloye et al. 2015). In a study done in Northern Africa (Cameroon), among adults in Ombe (a community in the rural area in Cameroon), the prevalence among adults was 19.8%. Harmful alcohol consumption, advanced age and physical inactivity were significant risk factors for high blood pressure. The participants showed that they had knowledge about hypertension however, not more than half had ever gone for blood pressure checks. Prevention measures such as improving physical activity, reduction of alcohol consumption and regular screening will be helpful in reduction of cases of hypertension. (Princewel et.al, 2019).

Findings from a study conducted in Uganda on people who were above 18 years old revealed a prevalence of 31.5% and a pre-hypertension prevalence of 38.8%. In Uganda the hypertension status raises concern due to the high population who are at risk including the young people. (Lunyera et.al. 2018).

An important element of primary cardiovascular disease prevention is screening for hypertension and antihypertensive drug treatment (Awino et al, 2016). World-wide cardiovascular diseases resulting from atherosclerosis account for 20% of all deaths. As developing countries go through epidemiological transition, they are threatened with both non-communicable and communicable diseases hence further weakening their economies (Lackland, et. al, 2015).

The mortality rate due to hypertension in Kenya was 0.60% of total deaths according to the WHO data published in May 2014. This ranks Kenya position one hundred and

twenty in the world. A greater number of black individuals are hypertensive than the white persons in the United Kingdom and United States could be due to lower awareness among black people than in white people (Mugambi, 2016).

Kenya among other LMICs has a high prevalence of non-communicable diseases. The high increase in hypertension and associated cardiovascular disease in SSA are caused by same risk factors identified in first world countries; increased sodium intake, elevated body mass index, and physical inactivity. The social determinants of health causing the rising incidence of high blood pressure and CVD in SSA, include poverty hence limiting accessibility to health care, with many patients earning less the one US dollar per day (Keith C. Ferdinand, 2020).

In many developing countries including Kenya, hypertension is becoming a public health challenge. This may be attributed to the lack of access to services required to screen for the disease or even education on the prevention of the disease. Considering the advanced complications associated with high blood pressure, early screening and prevention are paramount in reducing its burden (Awino et al, 2016).

A quarter of the population aged 18-69 years in Kenya, is estimated to be hypertensive and a half pre-hypertensive. Hypertension is associated with a high cost of health care to patients and family, contributing to over 50% of the cost of health care (Gatimu and John, 2020).

In Kenya, studies on hypertension, have reported prevalence ranging from 18.4 to 32.6% in different settings and populations (Mohammed, 2018). A recent study in

Kenya on hypertension showed an awareness rate of 15.5 percent, of which 26.9 percent were on therapy and only 51.7 percent were monitored (Mohamed et al, 2018).

The STEPwise survey report on Non-Communicable Disease, showed that the prevalence of high blood pressure in Kenya is approximately 23.8% and 56% of Kenyans have never been checked for raised blood pressure (STEPWise Report, 2015). This may be attributed to the lack of access to services required to screen for the disease or even education on the prevention of the disease (Awino et al, 2016). Control rates remain poor, mainly due to lack of awareness, despite the availability of antihypertensive therapy (Mills et al 2016).

In a population-based study to assess the difference of prevalence between the urban and rural areas varies risk factors associated with high blood pressure among Kenyan women, the town areas had a higher prevalence (11.61%), compared to the rural areas (7.86%). Obesity, aging and being diabetic were associated with hypertension in both rural and urban areas. Among the urban, women with a high wealth status were more likely to be hypertensive whereby, women from rich and richest wealth groups were 2 to 2.3 more likely to be hypertensive than poor and poorest wealth groups (Muhammad et.al, 2017). In another study among urban males in Mombasa in 2010, the prevalence was 6.7%. Hypertension was associated with aging and smoking (Salehmohamed Juma Suheil, 2010).

Hypertension among other NCDs, diabetes, cancers, and mental health conditions are on the increase in Lamu where Mpeketoni is located. Nevertheless, the response to

this epidemiological transition is still weak both in terms of preventive measures and treatment of those diagnosed (LCHSI, 2018).

Studies on hypertension have been done in Nairobi and Western regions of Kenya. In the Coastal region a study has been done in Mombasa therefore, hence there is scanty evidence from Lamu County. The main objective of this study is to determine the risk factors associated with hypertension among adults in Mpeketoni sub-County.

1.2 Problem Statement

The Lamu County Health Strategic and Investment Plan, 2013/14 to 2017/18 indicates that hypertension is ranked third among the causes of mortality in the non-communicable diseases. The number of outpatient cases at Mpeketoni sub-County Hospital with hypertension has almost doubled from 356 patients in 2014 to 607 in 2017 (DHIS 2). This steady rise in the number of hypertensive cases may result in high morbidity and mortality hence the need to identify the factors associated with hypertension in this county.

1.3 Justification

Hypertension is associated with high level of complications such as heart failure, rupture of aneurysm and kidney failure, therefore early screening and mitigation are of great importance in reducing its burden (Awino et al, 2016). In Kenya, hypertension and its risk factors has been studied particularly in major towns including Nairobi and those in Western and Rift Valley regions (Hendricks, 2012). However, there is lack of data from smaller towns like Mpeketoni. Therefore, data generated from this study will serve as a baseline for monitoring the changing pattern

of hypertension and its risk factors, and inform development of appropriate policies, strategies, planning and targeting of preventive public health interventions.

1.4 Research Questions

i. What was the prevalence of hypertension among adult outpatients attending Mpeketoni Sub-County Hospital?

ii. What were the risk factors associated with hypertension among adult outpatients attending Mpeketoni Sub-County Hospital?

1.5 Broad Objective

To determine the prevalence and factors associated with hypertension among adult outpatients attending Mpeketoni sub-County Hospital.

1.6 Specific Objectives

1) To determine the prevalence of hypertension among adult outpatients attending Mpeketoni sub-County Hospital.
2) To describe the socio-economic factors associated with hypertension among adult outpatients attending Mpeketoni sub-County Hospital.
3) To identify the behavioral factors associated with hypertension among adult outpatients attending Mpeketoni sub-County Hospital.
4) To determine the metabolic factors associated with hypertension among adult outpatients attending Mpeketoni sub-County Hospital.

CHAPTER 2

LITERATURE REVIEW

2.1. Introduction

Blood pressure is measured using two numbers. The first number, the systolic blood pressure, represents the pressure in your blood vessels when the heart beats. The second number is the diastolic blood pressure which represents the pressure in the blood vessels when the heart rests between beats.

Blood pressure for adults aged 18 years and above can be classified as follows; normal: systolic lower than 120 mmHg, diastolic lower than 80mmHg, pre-hypertension: systolic 120-139mmHg, diastolic 80-89 mm Hg, stage 1: systolic 140-159mmHg, diastolic 90-99mmHg, stage 2: systolic 160mmHg or greater, diastolic 100 mmHg or greater (Alexander M, 2017).

There are two types of hypertension namely; primary (essential) or secondary. Over 90% of all cases of hypertension are primary hypertension, with no obvious identifiable cause, although there are recognizable risk factors. Highest percentage of the cases (90%) are cases of primary hypertension, the exact cause is not easily identifiable however, the risk factors can be identified. Secondary hypertension contributes to the remaining 10% of the cases mainly caused by other diseases such as kidney disease (Owolabi et, al 2017).

The exact cause of primary hypertension remains unknown, however there are factors that are associated with this condition. The major behavioral factors for NCDs, hypertension being one of them include; physical inactivity, high salt and sodium intake, tobacco use, harmful alcohol consumption. (Riley, et.al, 2016).

These risk factors are also associated with other non-communicable diseases (NCDs) such as diabetes mellitus, cancers, cardiovascular diseases (CVD), chronic respiratory disease, asthma, and musculo-skeletal disorders. These factors can be classified into modifiable and non-modifiable risk factors. The non-modifiable risk factors are attributes in the individual that cannot be altered, therefore, nothing much can be done to control them. Examples of these factors include age, gender, race, family history, genetic composition (Minda et al 2018). Modifiable risk factors of hypertension are characteristics, exposures, or lifestyle patterns that can be altered to mitigate the advancement of the disease. These modifiable risk factors include obesity, excessive salt intake, inactivity or lack of exercise, high fat diet, tobacco use and harmful alcohol consumption (Gebremichael et al 2019).

Low- and Middle-Income Countries (LMICs) have the highest prevalence of high blood pressure globally, where it affects approximately a fifth of their adult population. This is attributed to changes in lifestyle, for instance, excessive tobacco use, harmful alcohol consumption, reduced physical activity and consumption of high sodium and fat diets. (Fottrell et al, 2018). Raised blood pressure is rising in LMICs, however, it is still prevalent in prevalent issue in central and eastern Europe due to favorable trends in both regions. (NCD Risk Factor Collaboration (NCD-RisC) (2017)

Despite the fact that current disease estimates are based on sparse data in sub-Saharan Africa (SSA), the projections show an escalation of NCDs due to demographic and epidemiologic transitions. Hypertension control has not been prioritized and there has been a challenge in implementing sustainable programs due to limited experience (Dalal et.al, 2011). Sub-Saharan Africa (SSA) compared to North Africa, has low awareness level, and the management of high blood pressure is poor. This is more pronounced in rural areas due poor health systems and compliance to treatment (Okello et.al, 2020).

A non-standardized hypertension prevalence of 6.4% was reported in a survey done in Kenya at a regional center in 1986 among residents in Kenya, (Mathenge, 2010). In 2008, a regional cross-sectional study was done (Bob et al, 2016). The participants in this study were adults who were 50 years and above among both rural and urban population. The findings showed a prevalence of 50.1%. The prevalence of obesity, hypertension and diabetes was higher among urban participants than in their rural counterparts and this may be due to the inactive lifestyle in the urban areas.

In another study done by Joshi et.al in a town slum in Nairobi in 2014, the prevalence of hypertension was 22.8% and only 20% of the respondents knew their hypertensive status. High blood pressure was associated with excess weight and excessive alcohol consumption. Hypertension was also associated with hypertension in a study done in India among truck drivers by Lakshman in 2014. Alcohol consumption and smoking were also associated with high blood pressure in a study done by Mundan et.al in 2013 at Armed Forces Memorial Hospital on factors associated with hypertension

among the Kenya defense forces personnel. This is an indication that there is need for more awareness and running of programs that will enable prevention of hypertension.

A hospital-based survey carried out in Yala sub-County Hospital reported a prevalence of 36.9% (Awino, et.al 2016). Ogola et.al done, reported a prevalence of 24.6%, in Kenya in 2017. A STEPwise survey carried out in 2015 in Kenya, showed that, 23.8% of the respondents were found to have high blood pressure. The disease and other NCDs cause 27% of the total deaths in the country and over 50% of the total admissions in Kenya (STEPwise Report, 2015). Though the study did not point out the risk factors for high blood pressure, the following were picked out as major risk factors for NCD; high salt intake, inadequate physical activity, tobacco smoking, high alcohol intake (consuming alcohol on a daily basis).

In the coastal region, few studies on hypertension have been done. In 2010, Mohamed et al did a study in Mombasa to find out the risk factors associated with high blood pressure among males in Mombasa Old Town area and the results showed that hypertension was mainly associated with aging and smoking. Therefore, it is important to ensure there in increased awareness and implementation of prevention programs in the coastal region too. This research seeks to determine prevalence of high blood pressure and to identify the risk factors associated with high blood pressure in Mpeketoni and hence help in policy making and coming up with strategies on awareness and primary prevention.

According to a study on the prevalence and factors likely to cause heart disease in a town slum (Kibera) age-standardized prevalence of high blood pressure was 22.8%. (Joshi et.al, 2014). The data on associated risk factors such as obesity, inadequate

physical activity, smoking, alcohol drinking and diabetes was also collected. The findings showed that fifty-two percent were excessive alcohol drinkers, a tenth were currently smoking, and five percent were diabetic. Majority of the men had a normal waist circumference and BMI, while thirty percent of females had an elevated BMI. These findings of high prevalence of high blood pressure, associated with obesity, show the necessity for more sensitization and actively applying prevention programs.

Mundan et.al in 2013, the findings revealed that high waist circumference, cigarette smoking and certain dietary habits are associated with hypertension among the armed forces. As per the fitness index results the level of physical fitness was 95% among this population. According to these findings there is therefore need to encourage healthy lifestyles which is a preventive measure and find out other risk factors that are likely to be associated with hypertension and occurrence of cardiovascular diseases (CVDs) among this population.

Increased rate of urbanization which causes changes in lifestyle is one of the major causes of increase in hypertension especially in urban areas. Kenya has an urban population of 22.3%, this population is growing at a rate of 4.2%, which is approximately twice the national population growth rate which is 2.4% (Joshi et.al, 2014). The age-adjusted prevalence of high blood pressure was 32.6% (± 2.2) for adults above 18 years (Jenson et.al, 2011).

Mwangi et.al, conducted a study in 2017 among employees working at a call centre, findings revealed age, BMI, family history of high blood pressure, inadequate physical activity and unhealthy diet were associated with hypertension. A high BMI

was also associated with high blood pressure in a study done by Kanegae et.al, in 2017.

A study on prevalence, awareness, and management of high blood pressure in Nairobi showed that females who had advanced age, obese, and diabetic were more likely to develop hypertension. Males who had advanced age, currently drinking alcohol on a daily basis and had an elevated abdominal waist were associated with high blood pressure. The age-standardized prevalence was 18.4% (23.8% women and 17.2% men) (Van et.al, 2013).

2.2 Demographic factors

Hypertension is a silent disease, and its risk factors are both non-modifiable and modifiable. The associated risk factors for hypertension are:

2.2.1 Age

Aging increases the risk for high blood pressure and heart disease. Aging causes the blood vessels to become flaccid this causes an increase pressure throughout the system (CDC, 2015).

Hypertension development due to biological aging could be due to inflammation, oxidative stress, and endothelial dysfunction. Life expectancy continues to increase globally especially in the first world countries leading to an increase in the population of the aged adults (over 65 years of age). The prevalence of hypertension is high among the elderly, they therefore contribute largely to hypertension-related morbidity and mortality (Buford, 2016). According to Mohammed, et.al in a study done in

Ethiopia in 2018, the prevalence of hypertension was high among older adults. Adults aged above 70 years were twice more likely to have hypertension in comparison to those who were 50-59 years old.

In Low-income countries, the burden of high blood pressure is mainly because it is often not adequately diagnosed and treated among older persons. The prevalence of high blood pressure was high among the participants whose age is forty-five years and above, the prevalence was higher among the older as than the middle-aged respondents in study done in Malawi in 2022 (Kohler et.al, 2022).

According to a study done by Mogaka et.al in 2022 in Western Kenya, individuals with hypertension were more likely to be 40 years and above. In addition, advanced age was a significant risk factor for high blood pressure; respondents aged 40-49 years were ten times more likely to have hypertension than those who were below 30 years (Awino et.al, 2016). The elderly are more likely to be exposed to lifestyle risk factors for high blood pressure associated with lifestyle, consequently the observed increase in hypertension risk with increase in age.

According to Olack et.al, 2015, age is an important risk factor for high blood pressure. Men had a higher prevalence of high blood pressure than women and it increased with increase in age. For every additional age group, the prevalence increased by almost 20%. Preventive measures need to be taken to prevent the likelihood of the aged hypertensive respondents progressing to full hypertension (Bob et al, 2016).

2.2.2 Gender

A higher percentage of men than women have high blood pressure (HBP) until 45 years of age. From ages 45 to 54 and 55 to 64, the percentages of men and women with HBP are similar. After that, a much higher percentage of women have HBP than men (CDC, 2015). Swedish men had a higher prevalence than Chinese men, while the contrary was true for the respective women according to a study done in China and Sweden. These observed gender variances in prevalence could be attributed to different lifestyles men and women have. The onset of hypertension is related to biological mechanisms and physiological factors, as well as differences in health literacy levels. (Santosa et.al, 2020).

In a study done by Nshirimana in 2019 at Karen Hospital, males were two times more likely to have hypertension in comparison to the females. This could be attributed to the fact that males are more involved in lifestyle behaviours than females and they are also rarely screened if they are not sick. On the other hand, females are more likely to be screened during special clinics like antenatal clinics and raise in hypertension can be captured early enough. However, according to Olack et.al, 2015, the prevalence of high blood pressure was high among females compared to males among those aged 44 years and above. These studies show that we cannot conclude that gender is an associated risk factor for hypertension.

2.2.3 Marital status

According to a study done in Iran, the association between marital status and hypertension has not been clearly understood. However previous studies have suggested some explanations for the effects of marital status including

psychopathological factors, neuroendocrine pathways, health behaviours (physical activity, diet, and adherence) and biological mediators. It has been suggested that married men have better sleep, less stress, better moods and have a healthier diet compared with never married. (Montazer, et.al, 2016). Married men had a lower risk of being hypertensive compared to their unmarried, divorced, and widowed counterparts (Ramezankhani et.al, 2019).

A study done in Ghana, showed that marital status was a more significant risk factor of hypertension in comparison to men. This finding was mainly among the married, cohabiting and previously married women after controlling for lifestyle and socio-demographic factors (Tuoyire and Ayetey, 2018).

According to study done by Mwagi et.al, in Nairobi, Kenya, the separated, divorced and widowed had a higher prevalence than the married, however the singles had a higher prevalence than the two categories. A national survey done in Kenya in 2018, showed that the married participants had a higher prevalence that those who were not married (Mohammed, et al, 2018)

The prevalence of high blood pressure was highest among the widowed recorded the highest prevalence of high blood pressure (60.4%) and least was among the unmarried respondents. This could be due to the psychological stress faced by the widowed. (Awino et.al, 2016).

2.2.4 Socio-economic status

A study done in 76 in LMICs to determine the hypertension prevalence between socioeconomic groups showed that the differences were minimal; those who had the lowest level of education and those who ranked the least in the wealth index had a high prevalence of high blood pressure (Kirschbaum, et.al, 2022).

Socio-economic factors such as occupation, education, and wealth contribute to about 20% of the noticeable contrast in hypertension. The findings in this study revealed that participants in formal paid employment had a high prevalence compared participants who were either self-employed or unemployed individuals (Gatimu and John, 2020).

In Kenya, studies have shown that those who formally employed and those in white collar jobs have a higher likelihood of developing hypertension compared to the casual laborers, this is because the casual workers are generally physically active. These studies also showed that low education level (incomplete or complete primary educations) and poverty was associated with hypertension. Low education level was attributed to low level of knowledge of hypertension and its mitigation measures (Olack, et.al, 2015).

According to Mwagi et.al 2017 among workers at a call center in Nairobi Kenya, there was a rising rate of pre-hypertension among the working population. This study therefore showed that the high prevalence of high blood pressure was related to high socio-economic status.

Pengpid and Carl in a 2020 study done in Kenya, reported that higher education and greater wealth increased the risk of hypertension. However, in a study done in 2018 at Bomet County by Ondimu et.al, participants with a low income was associated with a high prevalence of hypertension.

A study done by Chowdhury et.al in 2021, which showed that 1 out of 10 women in Kenya are hypertensive women who lived in the urban areas had a higher prevalence of compared to those who lived in rural areas.

2.3 Behavioural factors

2.3.1 Physical activity

Physical activity is recommended for the heart and circulatory system. Lack of enough physical exercise increases the likelihood of hypertension, cardiovascular disease, and stroke. Physical inactivity also increases the chances of one being overweight or obese (CDC, 2015).

According to The Lancet inadequate physical activity is the fourth major cause of deaths globally. Due to inadequate physical activity, 1.4 billion people are at a risk of developing chronic illness (Guthold R, et.al, 2018).

The WHO guidelines for physical activity and sedentary lifestyle show notable advances in scientific knowledge relating to physical activity and health (WHO, 2020). Males and population with higher socio-economic groups have higher physical activity levels. Other factors that contribute to physical activity behavior across the

lifespan include race, genetics, interpersonal and environmental factors (Bauman AE, et.al, 2012).

Findings from studies have shown that physical inactivity is associated with high blood pressure. In a study done in Sri-Lanka, inadequate physical activity was reported among the individuals who had high blood pressure compared to those whose blood pressure was normal (A.U. Gamage & R. de A. Seneviratne, 2021).

Findings from a study done in Nigeria and Ghana showed that inadequate physical activity was the major risk factor for high blood pressure among older adults. This concurs with previous reports and reviews, where regular physical activity was reported to greatly lower the risk of hypertension and CVD (Akpa, et.al, 2021)

According to Mundan et.al in 2013 in the Armed Forces Memorial Hospital in Kenya, there was an association between physical activity and hypertension, normotensives had a higher level of physical activity as compared to the hypertensives.

According to the study done by Mohamed in 2010 on risk factors of hypertension among males in Mombasa, there was an association between high blood pressure and inadequate physical activity.

2.3.2 Diet

The amount of salt intake is a key factor of blood pressure levels. For prevention of cardiovascular diseases which is the leading cause of death globally, WHO

recommends salt intake of less than 5 grams (approximately 2g sodium) per person per day.

Several studies show a relationship between high sodium intake and increased prevalence of hypertension. (Grillo, et.al, 2019) However, in majority of the first world countries, processed foods contribute to approximately 75% of salt in the diet, while in LMICs, most sodium consumption is from the salt added while cooking in households (WHO, 2022).

According to a study done in Korea, high salt consumption is a public health concern. However, the mechanism through which the sodium contributes to the advancement of hypertension is complicated, but epidemiological research has revealed that blood pressure can be minimized by reducing sodium intake. In this study, the findings showed that high consumption of salted seafood increased the likelihood of getting high blood pressure by 28% (Lee & Park, et.al 2018). Lockland et.al and Yoon et al in 2015 found that there was an association between high salt intake and hypertension.

The prevalence of hypertension in the sub-Saharan African region is 46% among adults aged above 25 years. High salt intake being one of the risk factors associated with this high prevalence there is need to sensitize the population to reduce salt intake. Global salt intakes are estimated at around 10 g/day, well above the World Health Organization recommended level of <5 g/day (Sookram, et.al, 2015).

2.3.3 Body Mass Index

A high body mass index which is due to being overweight, was demonstrated to be an independent risk factor for hypertension (Feng et.al, 2012). According to a study Zhang, et.al. in 2021, obesity was the most important risk factor for hypertension in all age groups. However, the specific mechanism explaining the relation of visceral fat and hypertension remains unknown. Mechanisms involved in the pathogenesis of hypertension show an association with inflammatory processes.

In a study done at Siaya County by Awino, et.al in 2016, increasing BMI (Body mass index) was associated with high blood pressure. Obese participants were four times more likely to develop high blood pressure as compared to the participants who had normal weight. Obesity or being overweight raised the likelihood of being hypertensive by 1.7 compared to having a normal BMI. In agreement to other studies, it was concluded that rich females (according to the wealth index) had a higher probability of being overweight than poorer females as shown by both body mass index and waist circumference.

A high BMI was a predictor of high blood pressure in a study done by Hasan et.al in Nepal in 2016. This may be due to the fact that the overweight females could have adopted inactive lifestyles and unhealthy diets that predispose them to a high risk of being hypertensive (Olack et.al, 2015).

According to the study done by Landi in 2018 in Italy, participants with a normal BMI, had a lower prevalence of high blood pressure of 45% compared to 67% among the participants with a high body mass index.

2.3.4 Alcohol consumption

Harmful use of alcohol can increase blood pressure. It can also cause heart failure, stroke, and produce irregular heartbeats (CDC, 2015).

Epidemiological and clinical studies have shown that high alcohol consumption is associated with high blood pressure. However, the mechanism through which alcohol raises blood pressure has not been established. Proposed mechanisms include an imbalance of the central nervous system, impairment of the baroreceptors, enhanced sympathetic activity, stimulation of the rennin-angiotensin-aldosterone system, increased cortisol levels, stimulation of the endothelium leading to inhibition of endothelium-dependent nitric oxide production. Major contributors of the alcohol-induced hypertension are loss of relaxation due to inflammation and oxidative injury of the endothelium by angiotensin II leading to inhibition of endothelium-dependent nitric oxide (Husain, et.al, 2014).

A study done in China by Ji et.al, in 2018, alcohol dependence was associated with increased odds of having high blood pressure. Additionally, the association between alcohol dependence and high blood pressure increased with higher level of alcohol dependence.

According to a study done by Mohamed, et al on the risk factors for hypertension among males in Mombasa, 13% of those who reported to have been taking alcohol were hypertensive. The odds of developing high blood pressure the among alcohol consumers was 2.3 (Mohamed, et al. 2018). According to Awino et.al, current drinkers had the highest prevalence (39%).

According to a study done by Ibebuike et.al, in Nigeria in 2021, there was an association between hypertension and alcohol consumption. The participants who had the consumed the highest amount of alcohol (more than 30g drinkers/week) were twice more likely be hypertensive than moderate and non-drinkers.

According to a study done in Kailuan in China, after adjusting for age, exercise, smoking status, occupation and salt intake, body mass index, family history of cholesterol and being diabetic, the participants who were never exposed to alcohol had lowest risk of developing hypertension and there was an association between alcohol consumption and the risk of high blood pressure. Therefore, according to this study, long-term alcohol intake is a significant risk factor of high blood pressure and light to moderate alcohol consumption raises the risk of high blood pressure. (Peng, 2013).

2.3.5 Smoking

Cigarette smoking acutely exerts a hypertensive effect, mainly through the stimulation of the sympathetic nervous system. However, the impact of chronic smoking on blood pressure, available data does not clearly show a direct causal relationship between smoking and hypertension. Smoking, affecting arterial stiffness and wave reflection might have greater negative effect on central blood pressure, which is more closely related to target organ damage than branchial blood pressure. Hypertensive smokers are more likely to develop severe forms of hypertension, including malignant and renovascular hypertension, an effect likely caused by an accelerated atherosclerosis (Virdis et.al, 2010).

Smoking increases blood pressure temporarily and attributes to the risk of damaged arteries. Consumption of tobacco can be harmful to one's health more so if one is already at risk for hypertension. Secondhand smoke exposure to other people's smoke increases the risk of heart disease for nonsmokers. According to a study done by Joshi et.al, a comparison between the normotensive and the hypertensive showed that participants who were current smokers and had started smoking at an older age and had a longer duration of smoking were more likely to be hypertensive (Joshi et.al, 2014).

According to Awino et.al, current smokers were approximately three times more likely to be hypertensive than non-smokers. This finding is similar to a finding in a study done by Dalal et.al, 2011 whereby smokers were 1.13 more likely to be hypertensive. Cigarette smoking makes blood cells sticky hence allowing cholesterol and low-density lipoproteins to build up inside them causing a condition known as atherosclerosis. This in turn can lead to raised blood pressure by increasing sympathetic drive to the heart than peripheral blood vessels.

A STEPwise survey done in Kenya in 2015, showed that smoking was one of the risk factors of hypertension (Bloomfield, et.al, 2013). Finding in a study done in Mombasa also showed a relationship between smoking and hypertension. Among those who were hypertensive, 12.9% smoked and only 2.7% of those who did not smoke were diagnosed with high blood pressure. The relative risk was 4.713. This showed that hypertension was associated with smoking and hypertension (Mohamed et al, 2018).

2.4 Metabolic risk factors

2.4.1. Diabetes

Hypertension can cause and worsen the complications of diabetes, including diabetic eye disease and kidney disease. The diabetic have a higher likelihood to develop hypertension in their lifetime. Diabetes damages arteries, causing atherosclerosis increasing the probability of developing hypertension and other cardiovascular conditions. Atherosclerosis can lead to kidney failure, stroke, heart failure or blood vessel damage (Yoon et al, 2015).

Hypertension and diabetes are common comorbidities; the diabetic are twice likely to be hypertensive than those who are not. Diabetes is associated with a likelihood of developing heart conditions including hypertension. Underlying molecular mechanisms, including oxidative stress, inflammation and fibrosis causing microvascular and macrovascular complications of diabetes, also cause vascular remodeling and dysfunction in hypertension (Petrie et.al, 2018).

According to a study done by Abdelbagi et.al, in Southern Sudan in 2021, there was a high prevalence of high blood pressure among patients with diabetes mellitus. (45.6%), this study concurs with findings of a study done in Ethiopia in 2020 by Akalu & Belsti, which revealed that the diabetic had a high prevalence of hypertension (59.5%).

2.4.2 Genetics (Family history)

There is a high likelihood of one or members of his/her family to develop hypertension if their parents or close blood relatives have had hypertension. It is therefore paramount for both children and adults to have regular blood pressure

checks. Heredity factors cannot be controlled however, one can take measures by living a healthy lifestyle hence reducing the risk **(**CDC, 2015).

There are different mechanisms proposed to explain the association between high blood pressure and positive family history which include increased renal proximal sodium re-absorption and genetic traits associated to hypertension such as high sodium-lithium counter transport (Ranasinghe, et.al, 2015).

A study done in China showed that family history was an independent risk factor for hypertension. In a population of the elderly living in Beijing, there was a higher likelihood for developing hypertension if they had a first degree relative who was hypertensive. It also revealed that family history is highly related with the likelihood of developing high blood pressure in women than in men (Liu et.al, 2015). Positive family history of hypertension was also related with significantly hypertension in Croatia (Krtalic et.al, 2019). Female participants with parental raised blood pressure had higher systolic, mean arterial pressure and pulse pressure.

Some studies have however, showed that there is no difference between those with a positive family history and those without a positive family history. For example, according to Awino et.al, in 2016, the prevalence of hypertension was almost the same among those with positive family history and those without a positive family history.

2.5 Conceptual Framework

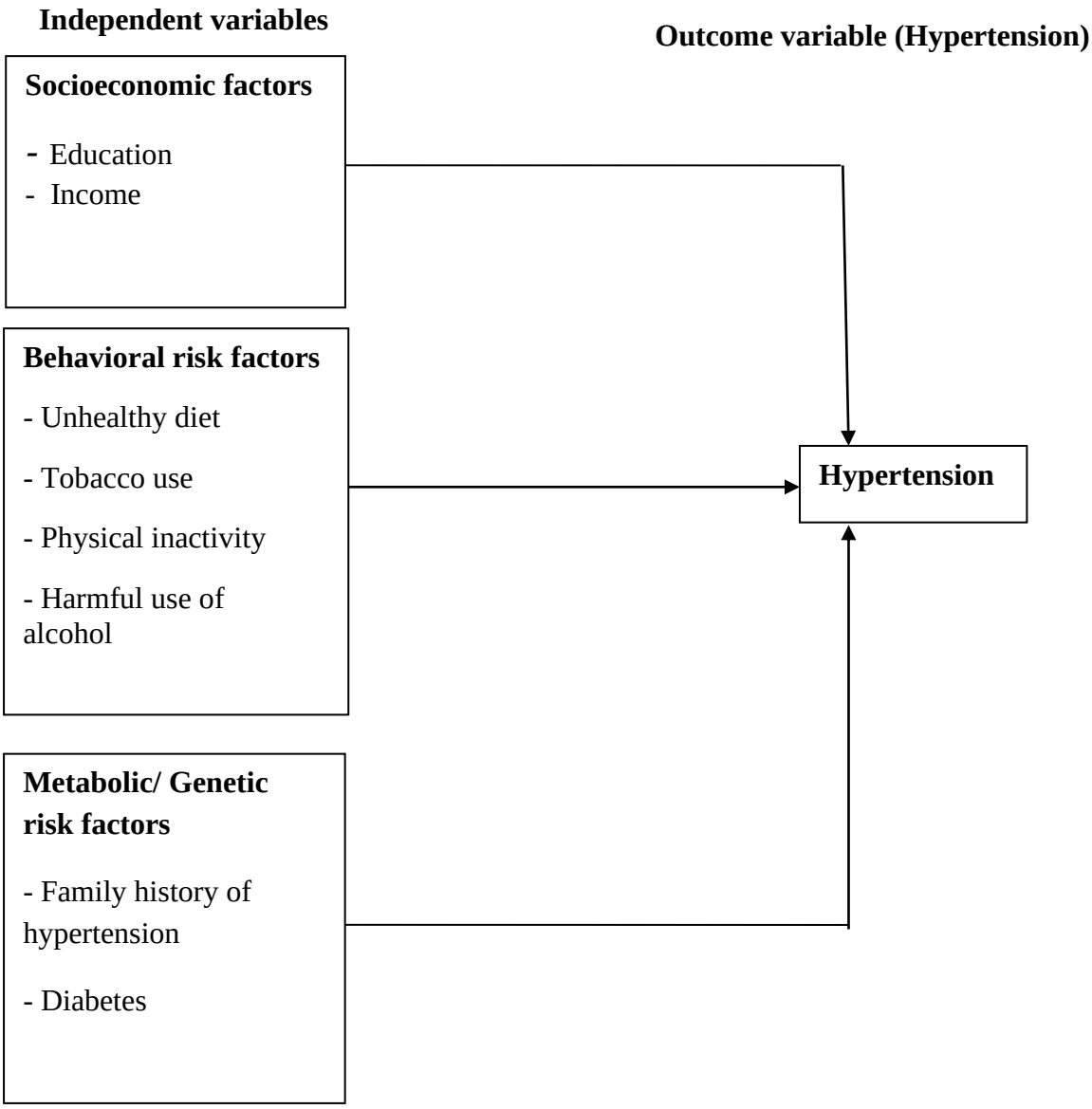

Figure 1: Conceptual Framework (Mbuno, GM, 2022)

CHAPTER 3

METHODOLOGY

3.1 Study Setting

The study was carried out at Mpeketoni sub-County Hospital which is located in Lamu County at the coastal region of Kenya. This hospital serves the residents of Mpeketoni sub-County and its environs. It has an Outpatient Department, a Maternity Ward, and a Radiology Department. The outpatient services offered include Tuberculosis, Diabetes and Hypertension clinics. The sub-county hospital serves approximately 23,000 people (LCHSI, 2018). Agriculture and related activities contribute 90 percent of the rural household income. The farming activities have resulted to an increase in economic activities and hence good income (Lamu CIDP, 2018).

3.2 Study Population

This was made up of males and females aged 18 years and above attending Mpeketoni sub-County Hospital for outpatient services.

3.3 Study design

Cross sectional study design was adopted, because it is suitable for accessing the prevalence of a disease in a population at a given point in time and for comparison of many different variables at the same time.

3.4 Sample size determination

The formula for a known population was used to determine the required sample size. (Israel, G 2009 & Yamane T. 1967), confidence level (CL) = 95%, 5% degree of precision, and add non-response rate of 10% to the final sample size.

$$n = \frac{N}{1 + N(e)^2}$$

N = the population size - (Hospital Records, total number of hypertension patients at Mpeketoni sub-County Hospital December 2019)

e = level of precision=0.05

n = the desired sample size

n = (1124)/ 1 + 1124 (0.05)^2 = 293

Correction for finite population less than 10,000

$$n = \frac{n_0}{1 + \frac{(n_0 - 1)}{N}}$$

n_0 = calculated sample size for known population

N = the population size

n= the desired sample size

n= 293/ 1+ {(293-1)/1124) = 232

Calculated non-response at 10%

*0.1*232 + 232 = 255.2/ 255*

According to the formula above which is used for known populations, to achieve 80% statistical power, a sample size of not less than 232 is required. After adding a non-response rate of 10% the final sample size was 255.

3.5 Sampling Procedure

Systematic sampling method was used until the required sample size was determined. Sampling frame (N) was 1124 (Hospital Records – total number of hypertension patients at Mpeketoni sub-County Hospital December 2019). The sampling interval was obtained by the calculation: K=Sampling frame (N)/Sample size (n) = 1124/255=4. After the first respondent drawn by simple random sampling, every 4th patient was sampled until the sample size was reached.

The 255 patients participated in the study were the adults aged eighteen years and above who gave their consent and met the eligibility criteria.

3.6 Eligibility Criteria

Inclusion criterion

Residents of Lamu County for at least six months, who were 18 years and above and attended the outpatient medical clinic at Mpeketoni sub-County Hospital.

Exclusion criteria

The following categories of patients were excluded:

i. Psychiatric illness
ii. Conditions that were known to cause secondary hypertension for example kidney failure, thyroid disease, Cushing's syndrome.

iii. Serious illness requiring admission. Acutely ill patients for example severe asthmatic attack, acute injury, head injuries

iv. Pregnancy (women)

3.7 Study Variables

The study assessed socioeconomic variables that included age, marital status, monthly income, occupation, and education level, behavioral that included smoking, alcohol use, salt intake, diet, physical exercise and walking and metabolic variables which were obesity, diabetes, BMI, family high blood pressure and waist circumference.

3.8 Data quality control

A pilot study using 10% of the desired sample size was conducted in Witu sub-County Hospital in Lamu County in order to detect any unclear statement, misleading and highly sensitive questions. The pilot study demonstrated that the questions were valid and reliable.

The number of research assistants were limited to only two to reduce intra and inter observer variations. The principal investigator supervised the entire data collection process for the period it was conducted.

3.8.1 Data collection

The files of the general clinic patients who had been booked for outpatient services were identified by the research assistants with the assistance of medical records personnel at the records department. The files were marked to enable healthcare workers to send every 4^{th} patient who met the inclusion criteria to the interviewing room. Patients with psychiatric illness, conditions with secondary hypertension such

as kidney failure, serious illness requiring admission, acute injury and head injuries and pregnant women were excluded from the study. This was ascertained by checking the medical records. A trained research assistant administered a structured questionnaire. The interview was done in a closed room to ensure privacy with patients who consented to the study.

3.8.2 Data collection tool

A structured interviewer-administered questionnaire adapted from The WHO STEPwise Approach to Non-communicable disease Risk Factor surveillance (STEPS) was used to collect the data related with socio-demographic characteristics. A check list adapted from the above-mentioned tool was used to collect data from physical examination findings such as body weight, height, hip, and waist circumferences and three blood pressure records were taken and recorded by the research assistants.

A research assistant measured brachial blood pressure and pulse rate using a validated battery powered automated blood pressure machine (OMRON M2 device; Omron Healthcare Co. Kyoto, Japan) with universal cuffs. Blood pressure and pulse rate measurements were taken after 5 minutes' rest. Three blood pressure and pulse rate measurements were taken 5 minutes apart while the participant was seated. The average of the last two readings was considered as the final reading for analysis (Kasper et al. 2015). Participants with systolic and/or diastolic blood pressure of 140/90 mmHg or more were considered to be hypertensive.

A research assistant measured the height in centimeters. The participants were advised to remove their shoes and the height was taken using a wooden platform and a height rule. Weight was measured (to the nearest 0.5 kg) with the use of an automated scale. Participants were allowed to keep on light clothing and without footwear. Body mass index (BMI) was calculated as body weight (kg) divided by height squared (M^2).

3.9 Data analysis plan

The questionnaires were stored under lock and key after data collection and checking for accuracy, completeness, and uniformity. For the incomplete questionnaires, the questions that were answered and those that were not, were considered in data analysis. A record of the decision was kept. The questionnaires were then coded and entered into the computer for analysis. The data was cleaned, edited, and entered into a computer and analyzed using SPSS version 23.0.

Data was analyzed using both inferential and descriptive statistics. Prevalence of hypertension was calculated as the percentage of participants classified as hypertensive, with all study participants as the denominator. The significance between independent variables and the dependent variable which was hypertension was determined using Chi square test. A logistic regression analysis was done to determine the association between hypertension (dependent variable) and the risk factors or independent variables which remained significant after doing the chi-square. Variables which remained significant at P-values of < 0.05 in the logistic regression were considered as independently associated with hypertension.

3.10 Ethical considerations

Ethical approval for the study was given by Institutional Research and Ethics Committee (IREC) of Moi University and Moi Teaching and Referral Hospital (MTRH). A permit from the National Council for Science, Technology, and Innovation (NACOSTI) was also obtained.

Authority to conduct the study was sought and obtained from the Director of Health Services of Lamu County and from the administration of Mpeketoni sub-County Hospital. Written consent (Appendix I) was sought from individual participants after the purpose of the study was explained to them, and they were then allowed to participate voluntarily. One potential risk of participating in the study was loss of privacy and the embarrassment the participant may have gone through by talking about certain aspects of their lifestyle. This was mitigated by conducting the interview in a private room that ensured privacy. In addition, the participants were free to leave the interview, without any repercussions, at any point they felt uncomfortable, and they were not coerced to answer any question.

All study staff and interviewers were trained to conduct the interviews. For confidentiality, all information was processed anonymously without using participants' names. Follow up care for clinical conditions (those with high blood pressure) detected was facilitated by referral to Mpeketoni sub-County Hospital. Coded interview schedules were used to ensure confidentiality of the participants in the research.

CHAPTER 4

RESULTS

4.1 Demographic and socio-economic characteristics of study population

Two hundred and fifty-five participants (255), comprising 124, (48.6%) males and 131, (51.4%) females were enrolled over a 3 months' period. The response rate was 85%, whereby out of the 300 adults sampled for the study, 255 were eligible and gave agreed to participate in the study by giving their consent. Forty-five participants were excluded; among these twenty-three of them did not meet the inclusion criteria and twenty-two did not give consent. The participants' age ranged from 19 to 74 years with a mean of 38±12.5 years. A higher proportion (28%) were in 25-34 years' age group as indicated in the graph below.

Most of the participants were married (59.6%), followed by those who were single (22.4%), the least were those who had separated (3.5%).

Table 1: Marital Status

Variable	Categories	Frequency n=255	Percentage (%)
Marital Status	Married	152	59.6
	Separated	9	3.5
	Single	57	22.4
	Widowed	24	9.4
	Divorced	13	5.1
	Total	255	100

Only 2.8% of the participants had no formal education, a majority 42.7%, had secondary school education.

Table 2: Level of education.

Variable	Categories	Frequency n=255	Percentage (%)
Level of education	None	7	2.8
	Primary	53	20.8
	Secondary	109	42.7
	Tertiary	86	33.7
	Total	255	100

Most of the respondents were earning a salary of more than 20,000 Kshs, (38.4%).

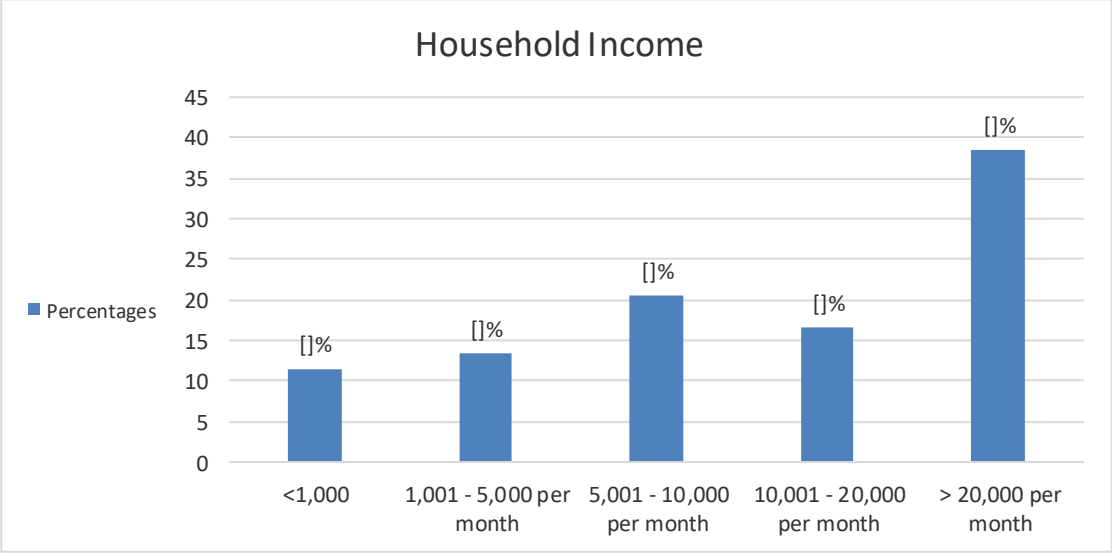

Figure 2: Household income

Majority of the participants were in government service. (31%)

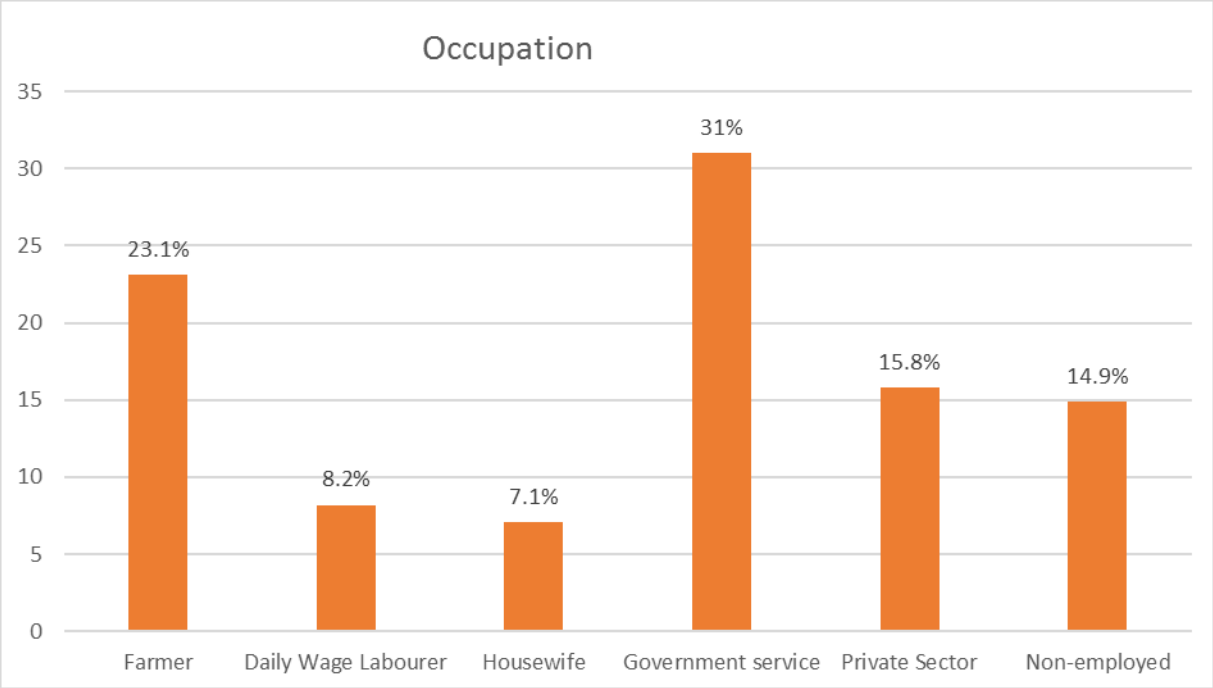

Figure 3: Occupation

4.2 Behavioral characteristics of the respondents'

Among the participants, 12.2% were current smokers while 44.3% reported that they have ever consumed alcohol. Majority of the participants (71%) always added salt in their food. A smaller percentage of the participants (25.5%) were involved in vigorous and intense activities compared to those involved in moderate intensity sports (54.1%).

Most **(**79.6%) of the respondents, walked for at least 10 minutes continuously to get to and from places.

Table 3*:* Behavioral characteristics of the respondents' n = 255

Variable	Categories	Frequency n=255	Percentage (%)
Dietary salt consumption	Never	5	2.0
	Rarely	9	3.5
	Sometimes	21	8.2
	Often	39	15.3
	Always	181	71.0
	Total	255	100
Walking for at least 10 minutes continuously to get to and from places	Yes	203	79.6
	No	52	20.4
	Total	255	100
Vigorous intensity Sports	Yes	65	25.5
	No	190	74.5
	Total	255	100
Moderate intensity sports	Yes	138	54.1
	No	117	45.9
	Total	255	100

4.3 Metabolic characteristics of the respondents

Participants who had a normal weight were forty-five-point seven percent (45.7%) while 52.3% were obese; 2% of the participants were underweight. Majority of the respondents (65.9%) had a family history of high blood pressure. Majority (69%) of the study subjects had ever had their blood sugar measured, 18.4% of them had been told by a health worker that they had raised blood sugar of whom 68.8% had taken diabetes medication 2 weeks prior to the interview as prescribed by a health worker. About 37.5% were currently on insulin and 43.8% were on herbal remedy for diabetes. Majority (72.9%) of the respondents had a normal waist circumference. Hypertension and diabetes were common comorbidities; hypertension being twice as frequent among the diabetic compared to those who were not.

Table 4*:* Metabolic characteristics of the respondents n=255

Variable	Categories	Frequency n=255	Percentage (%)
BMI	Underweight	5	2.0%
	Normal weight	112	45.7%
	Pre-Obesity	78	31.8%
	Obesity Class I	39	15.9%
	Obesity Class II	7	3.0%
	Obesity Class III	4	1.6%
	Total	245	100%
Family history of high blood pressure	Yes	168	65.9%
	No	87	34.1%
	Total	255	100%
Diabetes	Yes	34	19.4%
	No	141	80.6%
	Total	175	100%
Waist circumference	Normal	186	72.9%
	High/ Elevated	69	27.1%
	Total	255	100%

4.4 Prevalence of Hypertension

The overall prevalence of hypertension was 34.1%, (87/255). This was higher in females (41.2 %), (54/131) than in males (26.6%), (33/124) with a significant association between gender and hypertension (X^2 = 5.361, df= 1, p= 0.014).

Married respondents had a higher prevalence (40.9%), n=72 as compared to those who were not married which was 19% n=19, there was a significant relationship between marital status and hypertension (X^2 = 33.36, df= 4, p=<0.001).

The prevalence increased with the increase in age as shown in the figure below; those who were aged 55 years and above had the highest prevalence at 70%.

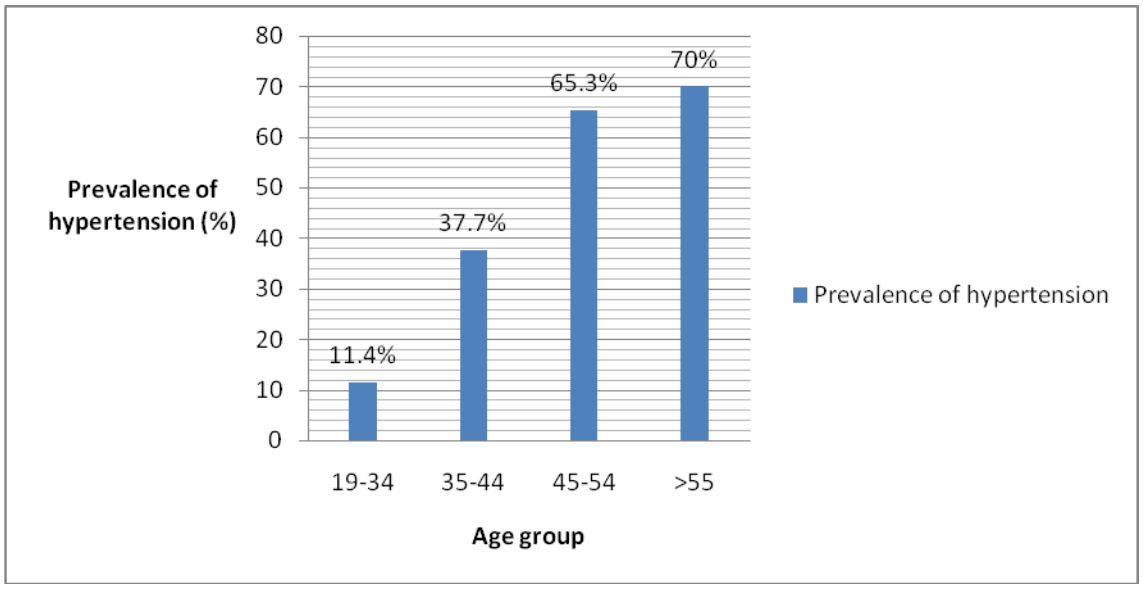

Figure 4: Prevalence of hypertension – Age Group

The level of literacy among the respondents was high (93.1%) with either primary, secondary, or tertiary education, n=248.

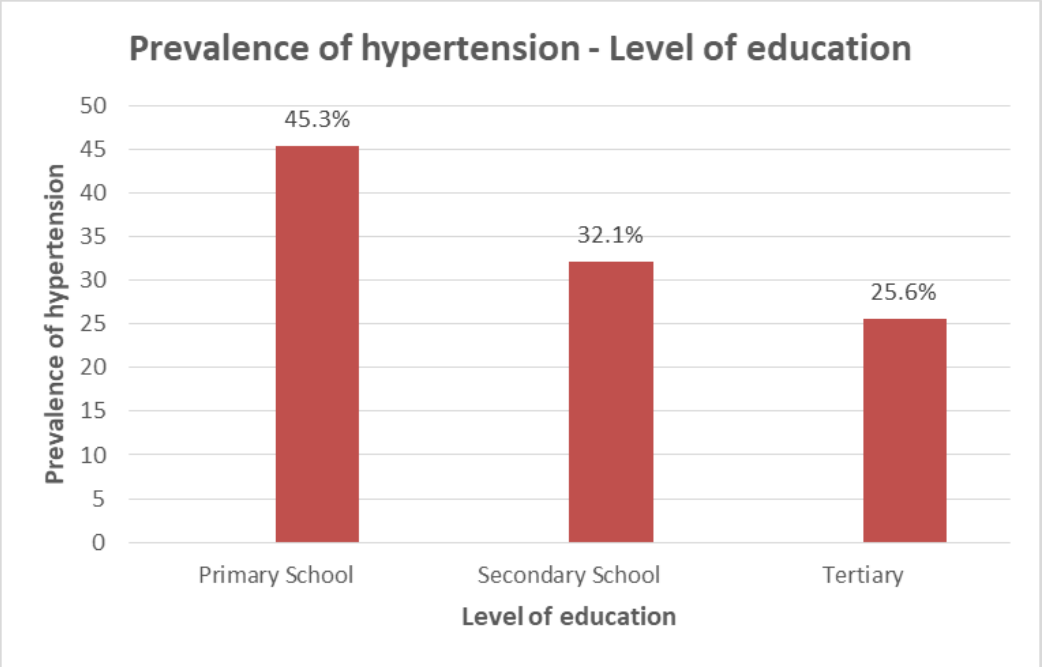

Figure 5: Prevalence of hypertension – Level of education

Prevalence of hypertension was high among the participants with primary school level of education, (45.3%), n= 24/53, followed by those with secondary school level of education, (32.1%), n=35/109. There was a significant relationship between the level of education and hypertension. (X^2 = 11.65, d.f =3, p=0.009).

Prevalence of hypertension was higher among the unemployed (35.8%) n= 39/80 than the employed (35.3%), n=48/136. However, there was no significant relationship between occupation and hypertension. There was no significant association between household income and prevalence of hypertension; prevalence of hypertension tends to increase with decrease in household income.

Majority of the non-smokers (88.9%), n=168 were not hypertensive, and among those who took alcohol were hypertensive (43.9%), n= 29. Smoking and alcohol

consumption ware not significantly related with hypertension with p-values being 0.387 and 0.943 respectively.

Respondents who always took salt showed lower prevalence (28.3%) of hypertension than those who took little or no salt at all (31.4%) (p=<0.001).

Individuals with an elevated waist circumference were more likely to have hypertension than those with normal waist circumference (aOR=3.3; 95% CI=1.6-6.8).

Respondents with a family history of high BP were more likely to develop hypertension compared to those without a family history of raised BP (aOR=2.7; 95% CI=1.2-6.2).

Respondents who had their blood pressure measured by a health worker or a doctor was 71.8%, 36.6% of them had a high BP. Among those with elevated BP, 74.6% had taken high blood pressure medication two weeks prior to the interview.

4.5 Bi-variate Analysis

Chi-Square test was performed to test association between the dependent variable (hypertension) and the independent categorical variables (gender, marital status, education, occupation, household income, smoking, alcohol consumption, salt intake, processed food intake, genetic BP, physical activities, body mass index, fruit, and vegetable servings per day).

Gender p-value (p = 0.014), age (p≤.001), marital status, (p≤.001), education, (p=0.003), salt intake, (p≤.001), family BP history, (p≤.001), BMI, (p≤.001), waist circumference, (p≤.001), diabetes, p-value (p≤.001) and vigorous intensity activities (p = 0.042) were found to be significantly associated with hypertension. These variables were therefore included in the logistic regression model.

The table below shows the prevalence of socio-demographic factors associated with hypertension; prevalence of those who were 55 years and above was the highest with a prevalence of 70%. The married participants had the highest prevalence at 40.9% compared to those who were not married, (19%).

Table 5*:* Bivariate analysis of association between socio-demographic factors of hypertension and hypertension.

Variables	Categories	Presence of Hypertension		P value
		Yes	No	
Gender	All participants	87 (34.1)	168 (66.9)	0.014
	Male	33 (26.6)	91 (73.4)	
	Female	54 (41.2)	77 (58.8)	
Age	19-34	14 (11.4)	109 (88.6)	p≤.001
	35-44	20 (37.7)	33 (62.3)	
	45-54	32 (65.3)	17 (34.7)	
	>55	21 (70.0)	9 (30.0)	
	Total	87 (34.1)	168 (65.9)	
Marital Status	Married	72 (40.9)	104 (59.1)	p≤.001
	Not married	15 (19)	64 (81)	
	Total	87 (34.1)	168 (65.9)	
Education	None	6 (85.7)	1 (14.3)	0.003
	Primary	24 (45.3)	29 (54.7)	
	Secondary	35 (32.1)	74 (67.9)	
	Tertiary	22 (25.6)	64 (74.4)	
	Total	87 (34.1)	168 (65.9)	
Occupation	Employed	39 (32.8)	80 (67.2)	0.672
	Unemployed	48 (35.3)	88 (64.7)	
	Total	87(34.1)	168(65.9)	
Household Income	<1,000	13 (44.8)	16 (55.2)	0.225
	1,001 - 5,000 per month	8 (23.5)	26 (76.5)	
	5,001 - 10,000 per month	22 (42.3)	30 (57.7)	
	10,001 - 20,000 per month	15 (35.7)	27 (64.3)	
	> 20,000 per month	29 (29.6)	69 (70.4)	

Table 6: Bivariate analysis of association between suspected risk factors of hypertension and Obesity, family history of hypertension, diabetes and an elevated waist circumference were highly associated with hypertension.

Variables	Categories	Presence of Hypertension		P value
		Yes	**No**	
BMI	Non-obese	56 (27.3)	149 (72.7)	**p≤.001**
	Obese	31 (62.0)	19 (38.0)	
	Total	87 (34.1)	168 (65.9)	
Alcohol Consumption	Yes	29 (43.9)	84 (44.4)	**0.943**
	No	37 (56.1)	105 (55.6)	
Smoking	Yes	10 (15.2)	21 (11.1)	**0.387**
	No	56 (84.8)	168 (88.9)	
Family history of hypertension	Yes	71 (42.3)	97 (57.7)	**p≤.001**
	No	16 (18.4)	71 (81.6)	
Vigorous intensity activities	Yes	27 (30.7)	61 (69.3)	**0.042**
	No	60 (35.9)	107 (64.1)	
Diabetes	Yes	23 (67.6)	11 (32.4)	**p≤.001**
	No	48 (34)	93(66.0)	
Waist Circumference	Normal	46 (24.7)	140 (75.3)	**p≤.001**
	Elevated	41 (59.4)	28 (40.6)	
Salt	Little to none	24 (68.6)	11 (31.4)	**p≤.001**
	Often-always	63 (28.3)	157 (71.4)	
	Total	87 (34.1)	168 (65.9)	

4.6 Factors associated with hypertension.

Logistic regression was done to find out effects of age, gender, marital status, education, family history of BP, salt intake, vigorous intensity activities, diabetes, and BMI and waist circumference on the likelihood that participants were hypertensive.

The factors that were found to be associated with hypertension after performing the logistic regression were age, elevated waist circumference, and a family history of high blood pressure.

Increasing age was associated with an increased likelihood of developing hypertension. Age was an independent predictor of hypertension; respondents aged 50-74 years were 15 times more likely to be hypertensive compared to respondents below 30 years (aOR=15.1; 95% CI=5.6-40.5; p<.001). Individuals with an elevated waist circumference were 3.293 times more likely to have hypertension than those with normal waist circumference (aOR=3.3; 95% CI=1.6-6.8; p=.001).

Respondents with a family history of raised BP were 2.7 times more likely to develop hypertension compared to those without a family history of raised BP (aOR=2.7; 95% CI=1.2-6.2; p=.018).

Table 7*:* Table showing the summary of the risk factors significantly associated with hypertension (logistic regression).

Reduced Model					
Variable	AOR (95%CI)	S.E.	Wald	Df	P value
Age					
19-29	Reference		37.482	3	p≤.001
30-39	1.548 (0.526-4.554)	0.551	0.63	1	0.427
40-49	6.252 (2.304-16.965)	0.509	12.954	1	p≤.001
50-74	15.06 (5.598-40.515)	0.505	28.849	1	p≤.001
Waist circumference					
Normal	Reference				
Elevated	3.293 (1.584-6.844)	0.373	10.193	1	p≤.001
Family history of BP					
No	Reference				
Yes	2.706 (1.183-6.188)	0.422	5.563	1	0.018

CHAPTER 5

DISCUSSION

5.1 Prevalence of hypertension

The overall hypertension was 34.1%. This was comparable to the prevalence of 36.9% of a hospital-based study done in Yala in 2015 (Olack 2015); and higher than a community-based study with a prevalence of 23.8% done in Kenya (urban and rural) in 2015, (STEPWise Report, 2015). However, prevalence was comparable to other studies done in various regions and in different population groups in Kenya (6.7-50%). It was almost similar to a hospital-based survey done in Ethiopia in 2019 (Selamawit and Walelegn, 2019). However, it was comparable with the prevalence in studies done in Northern Africa and Southern Africa which were 34.6% and 33.3% respectively (Adeloye D. et.al, 2015). This high rate of prevalence in this study may be explained by increased awareness of hypertension and an increased prevalence of modern lifestyles. (Omar et.al 2020). This prevalence rate is comparable to a prevalence rate of 30% in a study done in Nairobi among call centre workers.

The differences in prevalence could be brought about by the varying characteristics of the populations within these groups because this was a hospital-based study while other studies were community-based studies. The exposure of the population to the associated factors of hypertension could be different. In addition, different populations could be having different age groups and different behavioural characteristics (Walekhwa and Kisa, 2021).

5.2 Factors associated with hypertension.

According to CDC, more males are likely to have high blood pressure until 45 years of age. However, the percentages of hypertensive females and males with aged 45 to 54 and 55 to 64 are similar. As from the age of 65 and more, a higher percentage of females are at a higher risk to be hypertensive than males.

According to the findings in this study, females had a higher prevalence than men. According to a study done by Joshi et.al in 2015, the prevalence of high blood pressure among females was higher than males in the age group 35 and above. This could be due to the fact that it is culturally acceptable in the African set up for women to be overweight and most of them do not desire for change to have a healthy weight. This could also be due to the family planning methods used by the women which may cause an increase in weight. However, according to a study done by Awino et, al in 2016 and Mugambi et.al, in 2016, hypertension was not associated to gender.

The study findings reported a higher prevalence among the married participants compared to those who were single, divorced separated or widowed. This is contrary to the expectation that the other groups in the marital status apart from the married may have a higher prevalence due to the stigma they may face in the society. According to a study by Awino et.al in 2016, the widowed respondents had a higher prevalence than the married this may be due to the challenges they face due to their status. In another study done in Bhutan in 2019 by Segawa et.al, the married or cohabiting women and separated, divorced, or widowed women had a higher prevalence than men. A study in done in Nigeria 2017 to 2018, marital status was

significantly associated with hypertension, whereby, the married had a higher prevalence than those who were unmarried.

Prevalence was higher among participants with primary school level than those with secondary school and tertiary levels of education, but the relationship between the level of education and hypertension was not significant. This could be attributed to the low awareness on the preventive measures of hypertension by those with a lower level of education. In a study done by Pengpid et. al in Kenya in 2020, hypertension was associated with a higher level of education, contrary to the findings in this study, this may be attributed to living a sedentary lifestyle due to a higher income, as a result of a higher level of education.

Prevalence was higher among farmers followed by the private sector workers, and it also increased with decrease in household income with those earning an income of less than Ksh 1000 having the highest prevalence. This may be due lack of eating healthy foods such as fruits and vegetables and also high intake of fatty foods. However, the association between occupation and level of hypertension was not significant. The findings in the study concurs with findings in a study conducted by Pengpid et.al in 2020, whereby, the likelihood of developing hypertension was associated with lower income. However, Mohammed et.al in 2018, established that the prevalence increased with increase in income with the richest households having a higher prevalence than the poorest households. This concurs with findings by Osman et. al in Sudan which established that there was notable difference in prevalence rates with socio-economic factors which were education and household wealth. Prevalence rates were higher among the participants with higher education and a higher wealth

index. Mwagi et.al in 2017 established that the working population had a high level of prevalence among the working population. The high prevalence among farmers compared to the participants in formal employment may be due to low awareness on a healthy lifestyle among the farmers. This could also be due to low income among the farmers causing them to adopt a high fat and carbohydrate diets which are cheaper.

There was also a high prevalence among the diabetic and among those who were not involved in vigorous intensity activities. According to a study done at Tenwek Hospital in 2018 by Ondimu et. al, physical inactivity was positively associated with hypertension. Physically inactive people are more likely to be obese. Obesity is a significant risk factor for NCDs including hypertension (Humphreys, 2017). Diabetes and high blood pressure are co-related, and they both attribute to the spread of atherosclerotic cardiovascular disease within populations. A diabetic patient has an accelerated formation of non-enzymatic advanced glycosylation products that accumulate in the vessel wall proteins, causing vascular rigidity and resistance which ultimately lead to hypertension (Alsaadon, et.al, 2022).

The participants who did not take alcohol and did not smoke, had a higher prevalence than those who consumed alcohol and those who were smokers. This could be attributed to adopting healthy lifestyles by those who were diagnosed with hypertension.

The prevalence rate increased with increase in age, the highest rate was among those who were 50 years and above. The prevalence of hypertension was highest among the age group strata of 50 years and above. This concurs with a study by Solomon et.al,

2015, whereby, relationship between hypertension and advanced age was significant. According to Addo et.al, adults aged 40 years and above were more likely to develop hypertension compared to those who were 40 years and below. In a study in Kenya by Mohammed, et.al, the likelihood of respondents aged 50 years and above to develop hypertension was higher than those who were aged 18-24 years. The findings from a study done in Ethiopia in 2021 showed that the prevalence of hypertension increased with aging. Respondents who were 70 years and above had an increased likelihood of being hypertensive by almost two times compared to those who were aged 50-59 years. Studies done in Ghana, Zambia and Taiwan and India showed that advanced age was associated with of hypertension (Shukuri et.al, 2019). According to a study done in China in 2021, the prevalence was higher among middle aged and elderly people. Structural changes in the arteries, especially with large artery stiffness was highly associated with increase in blood pressure (Pinto, 2007).

The prevalence of hypertension increased with increase in age due to a higher likelihood of predisposition to the associated risk factors as one ages.

Aging causes an increase in the likelihood of predisposition to the associated risk factors of high blood pressure this may therefore explain the increase in prevalence with hypertension with increase in age.

Prevalence was high among individuals with an elevated waist circumference (59.4%). The association between waist circumference and prevalence in hypertension was statistically significant. According to a study done by Pazin et.al in 2017, increased waist circumference was associated with elevated blood pressure. In another study by Andeasah et.al done in 2011, there was correlation between the waist

circumference and hypertension. The same finding an increase of hypertension with the increase in waist circumference was observed in Ethiopia by Abebe et., al in 2015. In Kenya, participants whose BMI was higher than 25 were had a higher likelihood of developing high blood pressure compared to those with a BMI of 25 or lower. Therefore, having normal BMI or losing weight for those who are obese or overweight would reduce the likelihood of being hypertensive (Owino et.al, 2016).

Respondents with a family history of raised BP were 2.7 times more likely to develop hypertension compared to those without a family history of raised BP. This is a similar finding in a study done by Onyango et.al in 2017 in Kenya at a call center whereby, there was an association between family histories of high blood pressure was and high blood pressure.

Participants who had a family history of hypertension were 2 to 4 times more likely to be hypertensive. Findings from other studies showed that the prevalence of high blood pressure increased with the number of hypertensive relatives. Additionally, research has showed that mothers with high blood pressure contributed more than fathers and first-degree relatives with hypertension were linked to higher risk of getting hypertension compared with second-degree relatives (Miao et.al, 2015).

The association between family history of high blood pressure and hypertension could be due to family members to adopting similar lifestyles. According to the World Heart Federation, an individual’s risk of developing hypertension increases with the history of occurrence of cardiovascular disease in a family. Family history is a significant non-modifiable risk factor for high blood pressure, the hereditary nature of

hypertension is well established by many family studies that show associations of hypertension among siblings and between children and parents.

5.3 Limitations of the study

Considering this is a hospital based cross-sectional study, the overall prevalence of high blood pressure could be higher than the findings, due to white coat hypertension, sick people coming to the hospital with signs of hypertension, and some are actually hypertensive and are coming for follow-up.

This being a cross-sectional study, the cause-effect relationship cannot be explained. Self- reported answers in the questionnaire for example smoking and drinking may have resulted to social desirability bias, hence under reporting of these risk factors.

Patients with known hypertension but with good control were not included in the prevalence calculation hence the possibility of underestimating the actual prevalence.

The possibility of having included pregnant women in the study because pregnancy test was not done and inclusion of females who are taking contraceptives might have caused an overestimation of the prevalence among females.

There could be confounding factors like patients who have conditions which cause hypertension but may not have been diagnosed. However, the use of the WHO STEPwise questionnaire gives room for comparison of the risk factors present between various communities, regions, and countries.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Conclusion

In conclusion, hypertension affects at least one in three adult outpatients. Respondents who were forty-five years and above had an increased likelihood of developing high blood pressure compared to the younger respondents. The prevalence was higher among the female respondents in comparison to their male counterparts. Those who were either employed or had a family history of hypertension were more likely to be hypertensive.

Respondents who were either obese or participated in less vigorous activities had a high likelihood of developing hypertension.

6.2 Recommendation

The Public Health Department of Lamu County needs to put in strategies to ensure residents engage in physical exercise and maintain healthy weight by sensitizing the residents on the importance of exercising and providing accessible fitness centers and sports grounds. This will reduce the risk of residents developing hypertension by being obese or by participating in less vigorous activities.

There is need to sensitize residents on the importance of screening to monitor their blood pressure regularly especially for the females, those who have had a family history of hypertension and those who are 45 years and above.

Public health education needs to be done to educate the residents (especially the unemployed - farmers, daily wage laborers and housewives) on the risk factors associated with hypertension, this will enable the residents to live a healthy lifestyle so as to reduce the developing hypertension.

Further studies need to be done in the other sub-counties in Lamu County to establish the associated risk factors so that the county can come up with prevention strategies that can be applied to the whole county.

REFERENCES

Abebe, S. M., Berhane, Y., Worku, A., & Getachew, A. (2015). Prevalence and Associated Factors of Hypertension: a Cross sectional Community Based Study in Northwest Ethiopia. *PloS one*, *10*(4), e0125210. https://doi.org/10.1371/journql.pone.0125210

Adeke S., Chori, B., Neupane, D., Sharman, E., & Odili, A. (2022). Socio-demographic and lifestyle factors associated with hypertension in Nigeria: results from a country-wide survey. *Journal of human hypertension*. https://doi.org/10.1038/s41371-022-00673-1

Adeloye, D., Basquill, C., Aderemi, A.V., Thompson, J.Y., &Obi, F. A. (2015). An estimate of the prevalence of hypertension in Nigeria: a systematic review and meta-analysis. *Journal of hypertension*, *33*(2), 230-242. https://doi.org/10.1097/HJH.0000000000000413

Addo, J., Smeeth, L., & Leon, D. A. (2007). Hypertension in Sub-Saharan Africa: a systematic review. *Hypertension (Dallas, Tex. :1979), 50(6),* 1012-1018. https://doi.org/10.1161/HYPERTENSIONAHA.107.093336

Akalu Y., & Belsti, Y. (2020). Hypertension and its associated factors among type 2 diabetes mellitus patients at Debre Tabor general hospital, northwest Ethiopia. *Diabetes Metab Syndr Obes. 2020 (13*), 1621-1631.

Akpa, O. M., Okekunle, A. P., Ovbiagele, B., Sarfo, F. S., Akinyemi, R. O., Akpalu, A., Wahab, K. W., Komolafe, M., Obiako, R., Owolabi, L. F., Ogbole, G., Fawale, B., Fakunle, A., Asaleye, C. M., Akisanya, C. O., Hamisu, D. A., Ogunjimi, L., Adeoye, A., Ogah, O., Lackland, D., SIREN Study as part of the H3Africa Consortium. (2021). Factors associated with hypertension among stroke-free indigenous Africans: Findings from the SIREN study. *Journal of clinical hypertension (Greenwich, Conn.)*, *23*(4), 773-784. https://doi.org/10.1111/jch.14183

Alsaadon, H., Afroz, A., Karim, A., Habib, S. H., Alramadan, M. J., Billah, B., & Shetty, A. N. (2022). Hypertension and its related factors among patients with type 2 diabetes mellitus-a multi-hospital study in Bangladesh. *BMC public health*, *22*(1), 198.

Ataklte, F., Erqou, S., Kaptoge, Taye, B., Echouffo-Tcheugui, J.B., & Kengne A. P. (2015). Burden of undiagnosed hypertension in sub-Saharan Africa: a systematic review and meta-analysis. Hypertension (Dallas, Tex. :1979), 65(2), 291–298. https://doi.org/10.1161/HYPERTENSIONAHA.114.04394

Awino, B. O., Ogonda, L. A., Barno, G. C., & Magak, N. G. (2016). Awareness Status and Associated Risk Factors for Hypertension among Adult Patients Attending Yala Sub-County Hospital, Siaya County, Kenya. Kenya. *Public Health Research, 6(4),* 99-105. https://doi.org/10.1186/s12889-022-12509-1

Bauman AE, Ries R S, Sallis JF, Wells JC, Loos RJ, Martin BW. (2012). Correlates of physical activity: why some people are physically active and others not? *Lancet (London, England), (380),* 9838, 258-271. https://doi.org/10.1016/s0140-6736(12)60735-1

Bloomfield, G. S., Mwangi, A., Chege, P., Simiyu, C. J., Aswa, D. F., Odhiambo, D., & Khwa-Otsyula, B. O. (2013). Multiple cardiovascular risk factors in Kenya: evidence from a health and demographic surveillance system using the WHO STEPwise approach to chronic disease risk factor surveillance. *Heart (British cardiac Society),* 99(18), 1323-1329. https://doi.org/10.1136/heartjnl-2013-303913

Bonsa, F., Gudina, E. K., & Hajito, K. W. (2014). Prevalence of hypertension and associated factors in Bedele Town, Southwest Ethiopia. *Journal of health sciences, 24(1),* 21-26. https://doi.org/10.4314/ejhs.v24i1.3

Bromfield, S., & Muntner, P. (2013). High blood pressure: the leading global burden of disease risk factor and the need for worldwide prevention programs. *Current hypertension reports, 15(3),* 134-136. https://doi.org/10.1007/s11906-013-0340-9

Buford T. W. (2016), Hypertension and aging. *Ageing research reviews, 26,* 96-111. https://doi.org/10.1016/j.1rr.2016.01.007

Center for Disease Control and Prevention (CDC) (2012). *Principles of Epidemiology in Public health practice, third edition.* An introduction to Applied Epidemiology and Bio-statistics.

Center for Disease control and Prevention (CDC) (2015). *Data from National health and Nutrition Examination Survey*. Hypertension among Adults in the United States, 2009-2010.

Chow, C. K., Teo, K. K., Rangarajan, S., Islam, S., Gupta, R., Avezum, A., & Kazmi, K., Lanas, F., Wei, L., Lopez-Jaramillo, P., Fanghong, L., Ismail, N.H., Puoane, T., Rosengren, A., Szuba, A., Temizhan, A., PURE (Prospective Urban Rural Epidemiology) Study investigators (2013). Prevalence, awareness, treatment, and control of hypertension in rural and urban

communities in high, middle, and low-income countries. *JAMA, 310*(9), 959-968.
https://doi.org/10.1001/jama.2013.184182

Chowdhury, M. A. B., Epnere, K., Hague, M. A., & Mkuu, R. S. (2021). Urban rural differences in prevalence and risk factors of self-reported hypertension among Kenyan women: a population based study. *Journal of Hypertension,* 35(10), 912-920.
https://doi.org/10.1038/s41371-020-00435

Dalal S, Beunza J.J., Volmink, J., Adebamowo C., Bajunirwe F., Njelekela, M., Mozaffarian, D., Fawzi, W., Willet, W., Adami, H.O., & Holmes, M.D. (2011). Non-communicable diseases in sub-Saharan Africa: What we know now. *International journal of epidemiology 40(4),* 885–901.
https://doi.org/10.1093/ije/dtr050

Feng R. N., Zhao C., Wang C., Niu Y.-C., Li K., Guo F.-C, Li S.-T., Sun C.-H., and Li Y. (2012). BMI is strongly associated with hypertension and waist circumference is strongly associated with type 2 diabetes and dyslipidemia, in northern Chinese adults. *Journal of epidemiology, 22(4),* 317-323.
https://doi.org/10.2188/jea.je20110120

Ferdinand K.C. (2020). Uncontrolled hypertension in sub-Saharan Africa: Now is the time to address a looming crisis. *Journal of clinical hypertension (Greenwich, Conn.), 22*(11), 2111-2113.
https://doi.org/10.1111/jch.14046

Fottrell, E., Ahmed, N., Shaha, S. K., Jennings, H., Kuddus, A., Morrison, J., Akter, K., Nahar, T., Haghparast-Bigdoli, Khan, A. K. A., Costello, A., & Azad K. (2018). Distribution of diabetes, hypertension and non-communicable disease risk factors among adults in rural Bangladesh: a cross-sectional survey. *BMJ global health, 3*(6), e000787.
https://doi.org/10.1136/bmjgh-2018-000787

Gamage, A.U., Seneviratne, R.d.A. (2021). Physical inactivity, and its association with hypertension among employees in the district of Colombo. *BMC Public Health (21),* Article number: 2186.
https://doi.org/10.1186/s12889-012-12013

Gatimu, S.M., & John, T. W. (2020). Socioeconomic inequalities in hypertension in Kenya: a decomposition analysis of 2015 Kenya STEPwise on non-communicable diseases risk factors. *International journal for equity in health, 19*(1), 213.
https://doi.org/10.1186/s12939-020-01321-1

Gebremichael, G. B., Berhe, K. K., & Zemichael, T. M. (2019). Uncontrolled hypertension and associated factors among adult hypertensive patients in Ayder comprehensive specialized hospital, Tigray, Ethiopia. *BMC cardiovascular disorders, 19*(1), 121. https://doi.org/10.1186/s12872-019-1091-6

Gómez-Olivé F. X., Ali S. A., Made F., Kyobutungi, C., Nonterah, E., Micklesfield, L., Alberts, M., Boua, R., Hazelhurst, S., Debpuur, C., Mashinya, F., Dikotope, S., Sorgho, H., Cook, I., Muthuri, S., Soo, C., Mukomana, F., Agongo, G., Wandabwa, C., Afolabi, S. (2017). Regional and Sex differences in the Prevalence and Awareness of Hypertension. Global Heart, 2017: An H3Africa AWI-Gen Study Across 6 Sites in Sub-Saharan Africa. *Global heart, 12*(2), 81-90. https://doi.org/10.1016/j.gheart.2017.01.007

Grillo, A., L., Coruzzi, P., Salvi, P., & Parati, G. (2019). Sodium Intake and Hypertension. *Nutrients, 11*(9), 1970. https://doi.org/10.3390/nu11091970

Guwatudde, D., Nankya-Mutyoba, J., Kalyesubula, R., Laurence, C., Adebamowo, C., Ajayi, I., Bjunirwe, F., Njekela, M., Chiwaga, F. S., Reid, T., Volmink, J., Adami, H. O., Holmes, M. D., & Dalal, S. (2015). The burden of hypertension in Sub-Saharan Africa: A four- country cross sectional study. *BMC Public Health, (15),* 1211. https://doi.org/10.1186/s12889-015-2546-z

Guthold R., Stevens, G. A., Riley, L. M., & Bull, F. C. (2018). Worldwide trends in insufficient physical activity from 2001 to 2016; a pooled analysis of 358 population surveys with 1.9 million participants. *The Lancet Global health,* 6(10). https://doi.org/1016/s2214-109X(18)30357-7

Hasan, M., Sutradhar, I., Akter, Das Gupta, R., Joshi, H., Haider, M. R., & Sarker, M. (2018). Prevalence and determinants of hypertension among adult population in Nepal: Data from Nepal Demographic and Health Survey 2016. *PloS one, 13*(5), e0198028. https://doi.org/10.1371/journal.pone.0198028

Humphreys, B. R., McLeod, L., & Ruseski, J. E. (2017). Physical activity and health outcomes: Evidence from Canada. *Health Economics, 23*(1):33-54. https://doi.org/10.1002/hec.2900

Husain, K., Ansari, R.A., & Ferder, L. (2014). Alcohol-induced hypertension: Mechanism and prevention. *World journal of cardiology, 6*(5), 245-252. https://doi.org/10.4330/wjci5.245

Ibebuike J.E.I., Chinelol, V., Chinwedu N. O., and Oluchi. E., (2021). Research Article Studies on Hypertension and Associated Risk Factors in Ifakal Community, Nworieubi in Mbaitolu Local Government Area Imo State, Nigeria. Revisited [Electronic Version]. *EAS Journal of nursing and Midwifery, 3,* (6), 261-267.

Jenson A., Omar A. L., Omar M. A., Rishad A. S., Khoshnood, K. (2011). Assessment of hypertension control in a district of Mombasa, Kenya. *Global public health, 6*(3), 293-306. https://doi.org/10.1080/17441692.2010.510478

Ji, A., Lou, P., Dong, Z., Xu, C., Zhang, P., Chang, G. & Ting Li. (2018). The prevalence of alcohol dependence and its association with hypertension: a population based cross-sectional study in Xuzhou city, China. [Electronic Version] *Published online 2018 Mar 16.* 5276-1.

Joshi, M. D., Ayah, R., Njau, E. K., Wanjiru, R., Kayima, J. K., Njeru, E. K., & Mutai, K. K. (2014). Prevalence of hypertension and associated cardiovascular risk factors in an urban slum in Nairobi, Kenya: a population-based survey. *BMC public health, 14*, 1177. https://doi.org/10.1186/1471-2458-14-1177

Kanegae, H., Oikawa, T., Okawara, Y., Ohoshide S., Kario, K., (2017). Which blood pressure measurement, systolic or diastolic, better predicts future hypertension in normotensive young adults? *Journal of Clinical Hypertension (19),*6. 603-610.

Kasper DL, Fauci AS, Hauser SL, Longo DL, Jameson JL, Loscalzo J. Harrison's. (2015). *Principles of Internal Medicine. New York: McGraw-Hill*.

Kearney, P. M., Whelton, M., Reynolds, K., Muntner, P., Whelton, P. K., & He, J. (2005). Global burden of hypertension: analysis of worldwide data. *Lancet (London, England), 365*(9455), 217-223. https://doi.org/10.1016/S0140-6736(05)17741-1

Kenya National Guidelines for Cardiovascular Diseases Management. Hand-book-Cardiovascular, 2018. *Ministry of Health.*

Kenya Stepwise Survey for Non-Communicable Diseases Risk factors 2015 Report. *Ministry of Health.*

Kirschbaum, T.K., Sudharsanan, N., Manne-Goehler, J., De Neve, J.W., Neve, Lemp, J.M., Theilmann, M., Marcus, M.E., Ebert, C., Cheen, S., Yoosefi, M., Sibai, A. M., Rouhifard, M., Moghaddam, S. S., Mayige, M. T., Martins, J. S.,

Lunet, N., Jorgesen, J. M. A., Houehanou, C., Farzadfar, F., Damasceno, A., Geldsetzer, P. (2022). The Association of Socioeconomic status with hypertension in 76 Low -and Middle-Income Countries. *Journal of the American College of Cardiology, 80*(8), 804-817. https://doi.org/10.1016/j.jacc.2022.05.044

Kohler, I.V., Sudharsanan, N., Bandawe, C., & Kohler, H. P. (2022). Aging and hypertension among the global poor –Panel data evidence from Malawi. *PLOS global public health, 2*(6).

Kotwani, P., Kwarisiima, D., Clark, T.D., Kabami, J., Geng, E. H., V., Chamie, G., Petersen, M. L., Thirumurthy, H., Kamya, M. R., Charlebois, E. D., Havlir, D.V., & SEARCH Collaboration (2013). Epidemiology and awareness of hypertension in a rural Ugandan community: a cross-sectional study. *BMC public health, 13(1*), 1151. https://doi.org/10.1186/1471-2458-13-1151

Krtalic, B., Knezevic, T., Zelkovic-Vrkic, T., Kos, J., Pecin. I., Gellineo, L., Golubic, I. Jelakovic. A., Dika, Z, Jug, J., Jelakovic, B. (2019). Family History Blood Pressure and Lifestyle Results from EHUH study. *Journal of Hypertension 37*, 230.

Lackland, D. T., & Weber, M. A. (2015). Global burden of cardiovascular disease and stroke: hypertension at the core. *Canadian Journal of Cardiology, 31*(5), 569-571. https://doi.org/10.1016/j/cjca.2015.01.009

Lakshman, A., Rahim, A Anilakumari. V.P. (2014). Prevalence and Risk Factors of Hypertension among Male Occupational Bus Drivers in North Kerala, South India: A Cross-Sectional Study. *ISRN preventive medicine,* 2014, 318532. https://doi.org/10.1155/2014/318532

Lamu County Health Strategic & Investment Plan (LCHSI) 2018, *County Government of Lamu*.

Landi, F., Calvani, R., Picca, Tosato, M., Martone, A.M., Ortolani, E., Sisto, A., D'Angelo, E., Serafini, E., Desideri, G., Fuga, M. T., & Marzetti, E. (2018). Body Mass Index is strongly associated with hypertension: Results from the Longevity Check-Up 7+ Study. *Nutrients, 10 (12),* 1976. https://doi.org/10.3390/nu10121976

Lee, H.A., & Park, H. (2018). Diet-related Risk Factors for Incident Hypertension During an 11- Year Follow-Up: The Korean Genome Epidemiology Study. *Nutrients, 10*(8), 1077. https://doi.org/10.3390/nu10081077

Liu, M., He, Y., Jiang, B., Wang, J., Wu, L., Wang, Y., Zhang, D., Zeng, J., Yao, Y. (2015). Association between Family History and Hypertension among Chinese Elderly. *Medicine, 94*(48), e2226. https://doi.org/10.1097/MD.0000000000002226

Mathenge W, Foster A, Kuper H. (2010). Urbanization, ethnicity and cardiovascular risk in a population in transition in Nakuru, Kenya: a population-based survey. *BMC Public Health. (10)*, 569. https://doi.org/10.1186/1471-2458-10-569

Mills, K. T., Bundy, J. D., Kelly, T. N., Reed, J. E., Kearney, P. M., Reynolds, K., & He, J. (2016). Global disparities of hypertension prevalence and control: a systematic analysis of population-based studies from 90 countries. *Circulation, 134*(6), 441-450. https://doi.org/10.1161/CIRCULATIONAHA.115.018912

Mills, K.T., Stefanescu, A., He, J. (2020). The global epidemiology of hypertension. *Nature reviews. Nephrology, 16*(4), 223-237. https://doi.org/10.1038/s41581-019-0244-2

Minda, Z., Lencha, B., Wordofa, D., & Lemessa, F. (2018). Determinants of Hypertension Among Patients in Bale Zone, Southeast Ethiopia: A Case Control Study. *Acute Chronic Dis, (2), 1*, 104.

Mogaka, J.N., Sharma, M., Temu., Masyuko, S., Kinuthia, J., Osoti, A., Zifodya, J., Nkanjako, D., Njoroge, A., Otendo, A., Page, S., & Farquhar, C. (2022). Prevalence and factors associated with hypertension among adults with and without HIV in Western Kenya. *PloS one, 17*(1), e0262400. https://doi.org/10.1371/journal.pone.0262400

Mohamed, S. F., Mutua, M. K., Wamai, R., Wekesah, F., Haregu, T., Juma, P., & Ogola, E. (2018). Prevalence, awareness, treatment and control of hypertension and their determinants: results from a national survey in Kenya. *BMC public health, 18*(Suppl 3),1219. https://doi.org/10.1186/s12889-018-6052-y

Mohammed, S. F., Mutua, M. K., Wamai, R., Wekesah, F., Haregu, T., Juma, P., Nynanjau, L., Kyobutungi, C., & Ogola, E. (2018). Prevalence, awareness, treatment and control of hypertension and their determinants: results from a national survey in Kenya. *BMC public health, 18* (Suppl 3), 1219. https://doi.org/10.1186/s12889-018-6052-y

Montazer S, Gharacheh M., Mohammadi N., Alaghband Rad J., & Eftekhar Ardabili H. (2016). Determinants of early marriage from married girls' perspectives in Iranian setting; a qualitative study. *Journal of Environmental and public health,* 2016, 8615929. https://doi.org/10.1155/2016/8615929

Muhammad, A., Hadyana, A. (2017). Correlation between Waist Circumference and Hypertension in Jatinangor. *Journal of Hypertension: June 2015, (33)* 14.

Mugambi, L. K., Department of Public Health, Mount Kenya University, Kenya, J.K Karonjo, J. K., Some, E.S. Risk factors for hypertension among adults attending health centres in Ruiru Sub-County, Kiambu County, Kenya. (2016). *Researchjournali's Journal of Public Health, 2(12),* 1-16.

Mundan VK, Muiva MN. (2011). Prevalence and risk factors associated with Hypertension among armed-forces personnel in Kenya. *Cardiovascular Journal of Africa. 22*(3), S15-S16.

National Heart Lung and Blood institute (2015) Health topic: High Blood pressure.

NCD Risk Factor Collaboration (NCD-RisC) (2021). Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. *Lancet (London, England), 398*(10304), 957-980. https://doi.org/10.1016/S0140-6736(21)01130-1

NCD Risk Factor Collaboration (NCD-RisC) (2017). Worldwide trends in blood pressure from 1975 to 2015: a pooled analysis of 1479 population-based measurement studies with 19·1 million participants. *Lancet (London, England), 389*(10064), 37-55. https://doi.org/10.106/S0140-6736(16)31919-5

Nshirimana AD, Gikonyo AK, Gikonyo DK, Ponoth PM, Gikonyo BM (2019). Prevalence of Systemic Hypertension in Kenya: A Multicenter Analysis of the Karen Hospital Database. Original Paper.

Ogola, E. N., Barasa, F., Barasa, A. L., Gitura, B. M., Njuguna, B., Beaney, T., Xia, X., & Poulter, N. R. (2019). May Measurement Month 2017: the results of blood pressure screening of 14 845 individuals in Kenya—Sub-Saharan Africa. *European Heart Journal Supplements: journal of the European Society of Cardiology, 21,* (Suppl D), D71-D73.

Okello, S., Muhihi, A., Mohammed, S. F., Ameh, S., Ochimana, C., Oluwasanu, A. O., Bolarinwa, O. A., Sewankambo N., Danaei, G. (2020). Hypertension prevalence, awareness, treatment, and control and predicted 10-year CVD risk: a cross-sectional study of seven communities in East and West Africa. (SevenCEWA). *BMC Public Health 20,* (1) 1706 https://doi.org/10.1186/s12889-020-09829-5

Olack, B., Wabwire-Magen, N., & Smeeth, L., Montgomery, J.M., Kiwanuka, N., & Breiman. R.F. (2015). Risk factors of hypertension among adults aged 35-64 years living in an urban slum in Nairobi, Kenya. *BMC Public Health, 15,* 1251. https://doi.org/10.1186/s12889-015-2610-8

Omar, S. M., Musa, I. R., Osman O. E. & Adam, 1. (2020). Prevalence and associated factors of hypertension among adults in Gadarif in eastern Sudan: a community-based study. *BMC Public Health, 20(1),* 291. https://doi.org/10.1186/s12889-020-8386-5

Ondimu, D.O., Kikuvi, G.M., Otieno, W.N. (2018). Risk factors for hypertension among young adults (18-35) years attending in Tenwek Mission Hospital, Bomet County, Kenya in 2018. *The Pan African medical journal, (33),* 210. https://doi.org/10.11604/pamj.2019.33.210.18407

Onyango, M. J., Kombe, I., Nyamogo, D. S., & Mwangi, M. (2017). A study to determine the prevalence and factors associated with hypertension among employees working at a call centre Nairobi Kenya. *The Pan African medical journal, (27),* 178. https://doi.org/10.11604/pamj.2017.27.178.13073

Osman, S., Costanian, C., Annan, N.B., Fouad, F., Jaffa and Sibai, A.M. (2019). Urbanization and Socioeconomic disparities in Hypertension among Older Adult women in Sudan. *Annals of Global Health, 85*(1), *p.29,* https://doi.org/10.5334/aogh.2404

Owolabi, E. O., Ter Goon, D., Adeniyi, O. V., & Seekoe, E. (2017). Social epidemiology of hypertension in Buffalo City Metropolitan Municipality (BCMM): cross-sectional study of determinants of prevalence, awareness, treatment and control among South African adults. *BMJ open,* 7(6), e014349. https://doi.org/10.1136/bmjopen-2016-014349

Pazin, D.C., Rosaneli, C.F., Olandoski, M., Olieveira, E.R.N., Baena, C.P., FIGUEREDO, A.S., Baraniuk, A.O., Kaestner, T. L. D. L., Guarita-Souza, L. C., & Faria-Neto, J.R. (2017). Waist Circumference is associated with Blood Pressure in Children with Normal Body Mass Index: A Cross-Sectional

Analysis of 3,417 School Children. *Arquivos brasileiros de cardiologia, 109*(6), 509-515. https://doi.org/10.5935/abc.20170162

Pengpid, S., & Peltzer, K. (2020). Prevalence, awareness, treatment and control of hypertension among adults in Kenya: a cross-sectional national population based survey. *Eastern Mediterranean health journal, 26*(8), 923-932. https://doi.org/10.26719/emhj.20.063

Peng M., Wu, S., Jiang, X., Jin, C., Zhang, W., & Kailuani Cardiovascular Survey Group (2013). Long-term alcohol consumption is an independent risk factor of hypertension I northern China; Evidence from Kailuan Study. *Journal of hypertension 31*(12), 2342-2347. https://doi.org/10.1097/HJH.0b013e3283653999

Petrie, J. R., Guzik, T.J., & Touyz, (2018). Diabetes, Hypertension, and Cardiovascular Disease: Clinical Insights and Vascular Mechanisms. *The Canadian journal of cardiology, 34*(5), 575-584. https://doi.org/10.1016/j.cjca.2017.12.005

Pinto E. (2007). Blood pressure ageing. *Postgraduate medical journal, 83*(976), 109-114. https://doi.org/10.1136/pgmj.2006.048371.

Princewel, F., Cumber, S. N., Kimbi, J. A., Nkfusai, C. N., Keka, E. I., Viyoff, V. Z., Beteck, T. E., Bede, F., Tsoka-Gwengweni, J. M., & Akum, E. A. (2019). Prevalence and risk factors associated with hypertension among adults in a rural setting: the case of Ombe, Cameroon. *The Pan African medical journal, (34),* 147. https://doi.org/10.11604/pamj.2019.34.147.17518

Ramezankhani, A., Azizi, F., & Hadaegh, F. (2019), Associations of marital status with diabetes, hypertension, cardiovascular disease and all-cause mortality: A long term follow-up study. *PloS one, 14*(4), e0215593. https://doi.org/10.1371/journal.pone.0215593

Ranasinghe, P., Cooray, D. N., Jayawardena, R., & Katulanda, P. (2015). The influence of family history of Hypertension on disease prevalence and associated metabolic risk factors among Sri Lankan adults. *BMC public health, 15, 576.* https://doi.org/10.1186/s12889-015-1927-7

Riley, L., Guthold, R., Cowan, M., Savin, S., Bhatti, L., Armstrong, T., & Bonita, R. (2016). The World Health Organization STEPwise approach to non-communicable disease risk-factor surveillance: methods, challenges, and opportunities. *American journal of public health, 106*(1), 74-78. https://doi.org/10.2105/AJPH.2015.302962

Salehmohamed Juma Suheil. (2010). Risk factors for hypertension among urban males in Mombasa Kenya. Clinical Publication of the Tanzania Medical Students' Association.

Santosa, A., Zhand, Y., Weinehall, L., Zhao, G., Wang, N., Zhao, Q., Wang, W., & Nawi N. (2020). Gender differences and determinants of prevalence, awareness, treatment and control of hypertension among adults in China and Sweden. *BMC Public Health 20,* Article number: 1763

Sanuade, O. A., Boatemaa, S., & Kushitor, M. K. (2018). Hypertension prevalence, awareness, treatment and control in Ghanaian population: Evidence from the Ghana demographic and health survey. *PloS one, 13*(11), e0205985. https://doi.org/10.1371/journal.pone.0205985

Sarki, A. M., Nduka, C.U., Stranges, S, Kandala, N. B., & Uthman O. A. (2015). Prevalence of Hypertension in Low- and Middle: A Systematic Review and Meta-Analysis. *Medicine,94*(50), e1959. https://doi.org/10.1097/MD.0000000000001959

Segawa, H. K., Uematsu, H., Dorji, N., U., Dorjee, C., Yangchen, P., Kunisawa, R., & Sakamoto, R., Imanaka, Y. (2019), Gender with Marital status, cultural differences and vulnerability to hypertension: Findings from the national survey for non-communicable disease risk factors and mental health using WHO STEPS in Bhutan. *PloS one, 16*(8), e0256811. https://doi.org/10.1371/journal.pone.0256811

Shukuri, A., Tewelde, T., & Shaweno, T. (2019). Prevalence of old age hypertension and associated factors among older adults in rural Ethiopia. *Integrated blood pressure control, (12),* 23-31. https://doi.org/10.2147/IBPC.S212821

Sookram, C., Munodawafa, D., Phori, P.M., Varenne, B., Alisalad, A. (2015). WHO's supported interventions on salt intake reduction in the sub-Saharan Africa region. *Cardiovascular diagnosis and therapy, 5*(3), 186-190. https://doi.org/10.3978/j.issn.2223-3652.2015.04.04

Soubeiga, J. K., Millogo, T., Bicaba, B. W., Doulougou, B., & Kouanda, S. (2017). Prevalence and factors associated with hypertension in Burkina Faso: a countrywide cross-sectional study. *BMC Public Health*, *17*(1), 64. https://doi.org/10.1186/s12889-016-3926-8

Tuoyire, D.A., & Ayetey, H. (2018). Gender differences in the association between marital status and hypertension in Ghana. *Journal of biosocial science*, 51(3), 313-334. https://doi.org/10.1017/S0021932018000147

Walekhwa, S.N., & Kisa A. (2021), Tobacco Use and Risk Factors for Hypertensive Individuals in Kenya. *Healthcare (Basel, Switzerland)*, 9(5), 591. https://doi.org/10.3390/healthcare9050591

Van de Vijver, S., Akinyi, H., Oti, S., Olajide, A., Agyemang, C., Aboderin, I., Kyobutungi, C. (2013) Status report on hypertension in Africa: Consultative review for the 6th Session of the African Union Conference on Ministers of Health on NCD's. *The Pan African medical journal*, *16*, 38. https://doi.org/10.11604/pamj.2013.16.38.3100

Virdis, A., Giannarelli, C., Neves, M., S Taddei, S., Ghiadoni, L., Cigarette smoking and hypertension. (2010). *Pubmed Current Pharmaceutical Design 16 (23),* 2518-25.

World Health Organization. *Healthy Heart Beat-Healthy Blood pressure.* (Retrieved on 19th October 2021). https://www.who.int/healthopics/ hypertension#tab= tab_1 (Accessed: 20th July 2022).

World Health Organization (2020). *World Hypertension Day 2020*. https://www.paho.org/en/campaigns/world-hypertension-day-2020 (Accessed 21th July 2022).

World Health Organization. (2014) *World Health Statistics. Geneva*, *Switzerland*: WHO https://www.who.int/news/item/15-05-2014-world-health-statistics-2014. (Accessed 20th June 2022).

World Health Organization. (2017). Cardiovascular disease fact-sheet details. (cvds) *Geneva:WHO*.https://www.who.int/news-room/fact-sheets/detail/ cardiovascular-diseases-(cvds) (Accessed 20th June 2022).

World Health Organization (2017). Draft comprehensive global monitoring framework and targets for the prevention and control of non-communicable diseases.https://apps.who.int/gb/ebwha/pdf_files/WHA66/A66_8-en.pdf (Accessed 17th June 2022).

World Health Organization. Global action plan for the prevention and control of noncommunicable diseases 2013-2020. Geneva: World Health Organization: 2013.https://www.who.int/publications/i/item/9789241506236 (Accessed 18th June 2022).

World Health Organization. WHO guidelines on physical activity and sedentary behavior 2020. Available at: https://www.who.int/publications/I/item/97892400 15128 (Accessed: 30th July 2022).

World Health Organization. WHO, 2022. The Global Health Observatory. *Explore a world of health data.* https://www.who.int/data/gho (Accessed 20th June 2022).

Yoon, S. S., Carroll, M. D. & Fryar, C. D. (2015). Hypertension prevalence and control among adults: United States, 2011-2014. *NCHS data brief*, (220), 1-8. (1-8).

Zhang, Y., Hua Yang, H., Ren, M., Wang, R., Zhao, F., Liu, T., Zhang, Y., Guo, Z., & Cong. H., (2021). Distribution of risk factors of hypertension patients in different age groups in Tianjin. *BMC public health*, *21*(1), 247. https://doi.org/10.1186/s12889-021-10250-9

APPENDICES

APPENDIX 1*:* CONSENT FORM

PARTICIPANT INFORMATION AND CONSENT FORM

ADULT CONSENT

FOR ENROLLMENT IN THE STUDY

(To be administered in English or any other appropriate language e.g. Kiswahili translation)

TITLE OF STUDY: ASSESSMENT OF RISK FACTORS ASSOCIATED WITH HYPERTENSION AMONG ADULT OUTPATIENTS IN MPEKETONI SUB COUNTY

Principal Investigator\and institutional affiliation: Gladys Mbuno, Moi University

Introduction:

I would like to tell you about a study being conducted by the above listed researchers. 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 all your questions have been answered to your satisfaction, you may decide to be in the study or not. This process is called 'informed consent'. We will give you a copy of this form for your records. May I continue? YES / NO

WHAT IS THIS STUDY ABOUT?

The researcher listed above is interviewing outpatient at Mpeketoni Sub-County Hospital. The purpose of the interview is to determine the risk factors associated with hypertension. Participants in this research study will be asked questions about their dietary and behavioral character. They will also have the choice to undergo some clinical measurements. There will be approximately 279 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 15 minutes. The interview will cover topics such as smoking, alcohol consumption and diet. After the interview, counseling service will be availed to all participants.

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. We might contact you for verification in case any question was missed or asked wrongly.

ARE THERE ANY RISKS, DISCOMFORTS ASSOCIATED WITH THIS STUDY?

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 completely 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.

It may be embarrassing for you to talk about certain aspects of your lifestyle. 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. 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 testing and counselling. We will refer you to a hospital for care and support where necessary. Also, the information you provide will help us better understand the risks associated with hypertension.

WHAT IF YOU HAVE QUESTIONS IN FUTURE?

If you have further questions or concerns about participating, please call or send a 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 my supervisor, Dr. Ndege on Mobile phone number 0722842927.

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

Participant's statement

I have read this consent form. I have had the chance to discuss this research study with a study counselor. 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 have test indicated in the study		
I agree to provide contact information for follow-up:	Yes	No

Participant signature / Thumb stamp _____

Date _____Participant printed name: _____

APPENDIX II: FOMU YA RIDHARA

HABARI YA MSHIRIKI NA FOMU YA RIDHARA

UKUBALI WA WATU WAZIMA KWA UANDIKISHAJI KATIKA UTAFITI

(Kusimamiwa kwa Kiingereza au lugha nyingine yoyote inayofaa mfano tafsiri ya Kiswahili)

CHEO CHA UTAFITI: UPIMAJI WA VITU VYA HATARI VINAVYOUNGANISHWA NA USHINIKIZI WA DAMU MIONGONI MWA WAGONJWA WA WAKUU KATIKA KATA YA SUB YA MPEKETONI

Mchunguzi Mkuu \ na Ushirika Wa Kitaasisi: Gladys Mbuno, Chuo Kikuu cha Moi

Utangulizi:

Ningependa kukuambia juu ya utafiti unaofanywa na mtafiti aliyeoorodheshwa hapo juu. Madhumuni ya fomu hii ya idhini ni kukupa habari utakayohitaji kukusaidia kuamua ikiwa ni mshiriki wa utafiti huo au la. Jisikie huru kuuliza maswali yoyote juu ya kusudi la utafiti, nini kinatokea ikiwa unashiriki katika utafiti, hatari na faida zinazowezekana, haki zako kama mshiriki, na chochote kingine juu ya utafiti au fomu hii ambayo haijulikani wazi. Wakati maswali yako yote yamejibiwa kwa kuridhika kwako, unaweza kuamua kuwa kwenye utafiti au la. Utaratibu huu unaitwa 'idhini ya habari' Tutakupa nakala ya fomu hii kwa kumbukumbu zako. Naweza kuendelea? **NDIO AU LA.**

UTAFITI HUU UNAHUSU NINI?

Mtafiti aliyeorodheshwa hapo juu anahoji mgonjwa wa nje katika Hospitali ya Kaunti Ndogo ya Mpeketoni. Kusudi la mahojiano ni kuamua sababu za hatari zinazohusiana na shinikizo la damu. Washiriki katika utafiti huu wataulizwa maswali juu ya tabia yao ya lishe na tabia. Pia watakuwa na uchaguzi wa kupitia vipimo vya kliniki. Kutakuwa na takriban washiriki 367 katika utafiti huu waliochaguliwa kwa mpangilio. Tunaomba idhini yako kuzingatia kushiriki katika utafiti huu.

NINI KITATOKEA UKIAMUA KUWA KWENYE UTAFITI HUU?

Ikiwa unakubali kushiriki katika utafiti huu, mambo yafuatayo yatatokea:

Utahojiwa na mhojiwa aliyefunzwa katika eneo la kibinafsi ambapo unahisi raha kujibu maswali. Mahojiano hayo yatachukua takriban dakika 15. Mahojiano yatashughulikia mada kama vile kuvuta sigara, unywaji pombe na lishe. Baada ya mahojiano, huduma ya ushauri itapatikana kwa washiriki wote.

Tutauliza nambari ya simu ambapo tunaweza kuwasiliana nawe ikiwa ni lazima. Ikiwa unakubali kutoa anwani yako ya mawasiliano, itatumika tu na watu wanaofanya kazi kwa utafiti huu na hawatashirikiwa na wengine kamwe. Tunaweza kuwasiliana nawe ili uthibitishe ikiwa swali lolote litakosa au kuulizwa vibaya.

KUNA ATHARI ZOZOTE, HASARA ZINAZOHUSIANA NA UTAFITI HUU?

Hatari moja ya kuwa katika utafiti ni kupoteza faragha. Tutaweka kila kitu unatuambia kama siri iwezekanavyo. Tutatumia nambari ya kukutambulisha kwenye hifadhidata ya kompyuta inayolindwa na nywila na tutaweka rekodi zetu zote za karatasi kwenye kabati la faili lililofungwa. Walakini, hakuna mfumo wowote wa kulinda usiri wako ambao unaweza kuwa salama kabisa kwa hivyo bado inawezekana

mtu anaweza kugundua kuwa ulikuwa kwenye utafiti huu na angeweza kupata habari kukuhusu. Ikiwa kuna maswali ambayo hautaki kujibu, unaweza kuyaruka. Una haki ya kukataa mahojiano au maswali yoyote yanayoulizwa wakati wa mahojiano.

Inaweza kuwa aibu kwako kuzungumza juu ya mambo kadhaa ya mtindo wako wa maisha. Tutafanya kila tuwezalo kuhakikisha kuwa hii inafanywa kwa faragha. Kwa kuongezea, wafanyikazi wote wa utafiti na wahojiwa ni wataalamu wenye mafunzo maalum katika mitihani / mahojiano haya. Ikiwa kuna jeraha, ugonjwa au shida zinazohusiana na utafiti huu, wasiliana na wafanyikazi wa utafiti mara moja kwa nambari iliyotolewa mwishoni mwa waraka huu. Wafanyakazi wa utafiti watakutibu kwa hali ndogo au kukuelekeza inapobidi

Je kuna faida gani ya kuhusika katika utafiti huu?

Unaweza kufaidika kwa kupata upimaji wa bure na ushauri. Tutakupeleka kwa hospitali kwa matunzo na msaada pale inapobidi. Pia, habari unayotoa itatusaidia kuelewa vizuri hatari zinazohusiana na shinikizo la damu.

NINI KAMA UNA MASWALI BAADAYE?

Ikiwa una maswali zaidi au wasiwasi juu ya kushiriki, tafadhali piga simu au tuma ujumbe mfupi wa maandishi kwa wafanyikazi wa utafiti kwa nambari iliyotolewa chini ya ukurasa huu.

Kwa habari zaidi juu ya haki zako kama mshiriki wa utafiti unaweza kuwasiliana na msimamizi wangu, Dkt. Ndege kwa simu ya rununu 0722842927.

Wafanyakazi wa utafiti watakulipa malipo yako kwa nambari hizi ikiwa simu ni ya mawasiliano yanayohusiana na utafiti.

CHAGUO ZAKO ZINGINE NI NINI?

Uamuzi wako wa kushiriki katika utafiti ni wa hiari. Uko huru kukataa kushiriki katika utafiti na unaweza kujiondoa kutoka kwa utafiti wakati wowote bila udhalimu au kupoteza faida yoyote.

Fomu ya Idhini

Taarifa ya mshiriki

Nimesoma fomu hii ya idhini. Nimekuwa na nafasi ya kujadili utafiti huu wa utafiti na mshauri wa utafiti. Nimejibiwa maswali yangu kwa lugha ambayo ninaelewa. Hatari na faida zimeelezewa kwangu. Ninaelewa kuwa ushiriki wangu katika utafiti huu ni wa hiari na kwamba ninaweza kuchagua kujiondoa wakati wowote. Ninakubali kwa hiari kushiriki katika utafiti huu wa utafiti.

Ninaelewa kuwa juhudi zote zitafanywa kutunza habari kuhusu kitambulisho changu binafsi kuwa siri.

Kwa kusaini fomu hii ya idhini, sijatoa haki yoyote ya kisheria ambayo ninayo kama mshiriki katika utafiti wa utafiti.

Ninakubali kushiriki katika utafiti huu: Ndio/ Hapana

Ninakubali kuwa na mtihani ulioonyeshwa kwenye utafiti Ndio/ Hapana

Ninakubali kutoa habari ya mawasiliano kwa ufuatiliaji: Ndio/ Hapana

Saini ya mshiriki / Muhuri wa Kidole cha Gumba

Tarehe……. Jina La Mshiriki…….…….

APPENDIX III: QUESTIONNAIRE

(Adapted from The WHO STEP wise approach to non-communicable disease risk factor surveillance (STEPS)

SOCIODEMOGRAPHIC INFORMATION

1. Age in years ☐

2. Gender

- Male ☐
- Female ☐

3. Marital status

- Single ☐
- Married ☐
- Divorced ☐
- Widowed ☐
- Separated ☐

5. Level of education completed

- None ☐
- Primary ☐
- Secondary ☐
- Tertiary ☐

6. Occupation ☐

- Farmer ☐

Daily wage laborer ☐

House wife ☐

Government service ☐

Private sector ☐

Non - employed ☐

7. How much income do you your household earn per month?

<1000 ☐

1,001-5,000 per month ☐

5,001-10,000 per month ☐

10,001-20,000 per month ☐

More than 20000 per month ☐

BEHAVIOURAL MEASUREMENTS

Tobacco use

A1). Do you currently smoke any tobacco products such as cigarettes, cigars or pipes?

Yes ☐

No ☐

If no go to question (VI)

A2). Do you currently smoke any tobacco products daily?

Yes ☐

No ☐

A3). Do you remember how long ago it was?

In years ☐ If known go to the next question

Or in Months ☐ If known go to the next question.

Or in weeks ☐

A4). On average, how many of the following products do you smoke each week?

Manufactured cigarettes ☐

Hand rolled cigarettes ☐

A5). During any visit to a doctor or other health worker in the past 12 months, were you advised to quit smoking alcohol?

Yes ☐

No ☐

No visit during the past 12 months

A6). In the past did you ever smoke any tobacco products?

Yes ☐

No ☐

A7). In the past did you ever smoke daily?

Yes ☐

No ☐

a) Alcohol consumption

B1). Have you ever consumed any alcohol such as beer, wine, spirits or ‘mnazi’?

Yes ☐

No ☐

B2). Have you consumed any alcohol within the past 12 months?

Yes ☐

No ☐

B3). Have you stopped drinking due to health reasons, such as a negative impact on your health or on the advice of your doctor or other health worker?

Yes ☐

No ☐

B4). During the past 12 months, how frequently have you had at least one standard alcoholic drink?

Daily 1 [ ]

5 -6 days per week 2 [ ]

3 -4 days per week 3 [ ]

1-2 days per week 4 [ ]

1-3 days per month [ ]

Less than once a month 6 [ ]

B5). Have you consumed any alcohol within the past 30 days?

Yes ☐

No ☐

B6). During the past 30 days, on how many occasions did you have at least one standard alcoholic drink?

Number……...

B7). During the past 30 days, when you drank alcohol, how many standard drinks on average did you have during one drinking occasion?

Number ……

b) Diet

C1). How many days do you eat fruits in a week? (If zero go to C3)

Number of days …….

Don't know…….

C2). How many servings of fruit do you eat on one of those days?

Number of servings…….

Don't know…

C3). How many days do you eat vegetables in a week? (If zero go to C5)

Number of days …….

Don't know…….

C4). How many servings of vegetables do you eat one of those days?

Number of servings…….

Don't know……

Dietary salt

C5). How often is **salt, salty seasoning or a salty sauce added** in cooking or preparing foods in your household?

Always ☐

Often 2 ☐

Sometimes 3 ☐

Rarely 4 ☐

Never 5 ☐

Don't know ☐

C6). How often do you eat processed food high in salt? By processed food in salt, I mean foods that have been altered from their natural state, such as packaged salty snacks, canned salty food including pickles and preservatives, salty food prepared at a fast food restaurant, cheese, bacon and processed meat.

Always ☐

Often ☐

Sometimes ☐

Rarely ☐

Never ☐

Don't know ☐

c) Family history of high blood pressure

D1). Is there any one in your family who has high blood pressure?

Yes ☐

No ☐

d) Physical activity

E1). Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like (walking, running, carrying or lifting heavy loads, digging or construction work) for at least 10 minutes continuously?

Yes ☐

No ☐ If no go to (E4)

E2). In a typical week, on how many days do you do vigorous-intensity activities as part of your work?

Number…….

E3). How much time do you spend doing vigorous – intensity activities at work on a typical day?

Number of days……...

E4). Does your work involve moderate-intensity activity that causes small increases in breathing or heart rate such as brisk walking (or carrying light loads) for at least 10 minutes continuously?

Yes ☐

No ☐ If no go to (E7)

E5). In a typical week, on how many days do you moderate-intensity activities as part of your work?

Number of days…….

E6). How much time do you spend doing moderate-intensity activities at work on a typical day?

Hours, minutes……

E7). Do you walk for at least 10 minutes continuously to get to and from places?

Yes ☐

No ☐ If no go to (E10)

E8). In a typical week, on how many days do you walk for at least 10 minutes continuously to get to and from places?

Number of days……...

E9). How much time do you spend walking on a typical day?

Hours, minutes……...

E10). Do you do any vigorous –intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like (running or football) for at least 10 minutes?

Yes ☐

No ☐ If no go to (E13)

E11). In a typical week, on how many days do you do vigorous- intensity sports, fitness or recreational or leisure activities?

Number of days……...

E12). How much time do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day?

Hours, minutes……

E13). Do you do any moderate-intensity sports, fitness or recreational (leisure) activities that cause a small increase in breathing such as brisk walking, (cycling, swimming, volleyball) for at least 10 minutes continuously?

Yes ☐

No ☐

E14). In a typical week on how many days do you do moderate-intensity sports, fitness or recreational (leisure) activities?

Number of days …….

E15). How much time do you spend doing moderate-intensity sports, fitness or recreational (leisure) activities on a typical day?

Hours, minutes……...

f) History of high blood pressure

F1). Have you ever had your blood pressure measured by a doctor or other health worker?

Yes ☐

No ☐ If no go to section g...

F2). Have you ever been told by a doctor or other health worker that you have raised blood pressure or hypertension?

Yes ☐

No ☐ If no go to section g, if Yes go to sections F3, F4

F3). In the past two weeks, have you taken any drugs (medication) for raised blood pressure prescribed by a doctor or other health worker?

Yes ☐

No ☐

F4). Are you taking the medication as recommended?

Yes ☐

No ☐

F5). Have you remained in care as it is required?

Yes ☐

No ☐

g) History of Diabetes

G1). Have you ever had your blood sugar measured by a doctor or other health worker?

Yes ☐

No ☐

G2). Have you ever been told by a doctor or other health worker that you have raised blood sugar or diabetes?

Yes ☐

No ☐

G3). In the past two weeks, have you taken any drugs (medication) for diabetes prescribed by a doctor or other health worker?

Yes ☐

No ☐

G4). Are you currently taking insulin for diabetes prescribed by a doctor or other health worker?

Yes ☐

No ☐

G5). Are you currently taking any herbal or traditional remedy for your diabetes?

Yes ☐

No ☐

Physical measurements

Question	**Response**
Interviewer ID	⌊__⌋⌊__⌋⌊__⌋
Cuff size used	Small 1 Medium 2 Large 3
Reading 1	Systolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋
	Diastolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋
Reading 2	Systolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋
	Diastolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋
Reading 3	Systolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋
	Diastolic (mmHg) ⌊__⌋⌊__⌋⌊__⌋
During the past two weeks, have you been treated for high blood pressure with drugs (medication) prescribed by a doctor or other health worker?	Yes 1 No 2
	No 2
Interviewer ID	⌊__⌋⌊__⌋⌊__⌋
	Weight ⌊__⌋⌊__⌋
Height	in Centimetres (cm) ⌊__⌋⌊__⌋⌊__⌋ . ⌊__⌋
Weight	in Kilograms (kg) ⌊__⌋⌊__⌋⌊__⌋ . ⌊__⌋
BMI	
Waist circumference	in Centimeters (cm) ⌊__⌋⌊__⌋⌊__⌋ . ⌊__⌋

APPENDIX IV: IREC APPROVAL

INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE (IREC)

MOI TEACHING AND REFERRAL HOSPITAL
P.O. BOX 3
ELDORET
Tel: 33471//2/3

MOI UNIVERSITY
COLLEGE OF HEALTH SCIENCES
P.O. BOX 4606
ELDORET
Tel: 33471/2/3

Reference: IREC/2020/195
Approval Number: 0003883

26th May, 2021

Gladys Mkabane Mbuno,
Moi University,
School of Public Health,
P.O. Box 4606-30100,
ELDORET-KENYA.

Dear Ms. Mbuno,

PREVALENCE AND RISK FACTORS ASSOCIATED WITH HYPERTENSION AMONG ADULT OUTPATIENTS IN MPEKETONI SUB-COUNTY HOSPITAL, LAMU COUNTY, KENYA

This is to inform you that ***MTRH/MU-IREC*** has reviewed and approved your above research proposal. Your application approval number is ***FAN: 0003883.*** The approval period is **26th May, *2021- 25th May, 2022.***
This approval is subject to compliance with the following requirements;

i. Only approved documents including (informed consents, study instruments, Material Transfer Agreements (MTA) will be used.
ii. All changes including (amendments, deviations, and violations) are submitted for review and approval by ***MTRH/MU-IREC***.
iii. Death and life threatening problems and serious adverse events or unexpected adverse events whether related or unrelated to the study must be reported to ***MTRH/MU-IREC*** within 72 hours of notification.
iv. Any changes, anticipated or otherwise that may increase the risks or affected safety or welfare of study participants and others or affect the integrity of the research must be reported to ***MTRH/MU-IREC*** within 72 hours.
v. Clearance for export of biological specimens must be obtained from ***MOH at the recommendation of NACOSTI*** for each batch of shipment.
vi. 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.
vii. Submission of an executive summary report within 90 days upon completion of the study to ***MTRH/ MU-IREC.***

Prior to commencing your study; you will be required to obtain a research license from the National Commission for Science, Technology and Innovation (NACOSTI) https://oris.nacosti.go.ke and other relevant clearances from study sites including a written approval from the CEO-MTRH which is mandatory for studies to be undertaken within the jurisdiction of Moi Teaching & Referral Hospital (MTRH) and its satellites sites.

INSTITUTIONAL RESEARCH & ETHICS COMMITTEE
26 MAY 2021
APPROVED
P. O. Box 4606 - 30100 ELDORET

Sincerely,

PROF. E. WERE
CHAIRMAN
INSTITUTIONAL RESEARCH AND ETHICS COMMITTEE

cc CEO - MTRH Dean - SOP Dean - SOM

APPENDIX V: RESEARCH LICENCE – NACOSTI PERMIT

REPUBLIC OF KENYA

NATIONAL COMMISSION FOR SCIENCE. TECHNOLOGY & INNOVATION

Ref No ***146684***

Date of Issue: ***24/June2021***

RESEARCH LICENSE

This is to Certify that Miss. GLADYS MKABANE MBUNO of Moi University, has been licensed to conduct research in Lamu on the topic: ***PREVALENCE AND RISK FACTORS ASSOCIATED WITH HYPERTENSION AMONG ADULT OUTPATIENTS IN MPEKETONI SUB COUNTY HOSPITAL. LAMU COUNTY. KENYA for the period endina: 24/June/2022.***

License No: ***NACOSTI/P/21/11332***

146684

Applicant Identification Number

Director
NATIONAL COMMISSION FOR SCIENCE. TECHNOLOGY & INNOVATION

Verification QR Code

NOTE: This is a computer generated License. To verify the authenticity of t
Scan the QR Code using QR scanner application.

THE SCIENCE, TECHNOLOGY AND INNOVATION ACT, 2013

The Grant of Research Licenses is guided by the Science, Technology and Innovation (Research Licensing) Regulations, 2014

CONDITIONS

1. The License is valid for the proposed research, location and specified period
2. The License any rights thereunder are non-transferable
3. The Licensee shall inform the relevant County Director of Education, County Commissioner and County Governor before commencement of the research
4. Excavation, filming and collection of specimens are subject to further necessary clearence from relevant Government Agencies
5. The License does not give authority to tranfer research materials
6. NACOSTI may monitor and evaluate the licensed research project
7. The Licensee shall submit one hard copy and upload a soft copy of their final report (thesis) within one year of completion of the research
8. NACOSTI reserves the right to modify the conditions of the License including cancellation without prior notice

National Commission for Science, Technology and Innovation off Waiyaki Way, Upper Kabete,

P. O. Box 30623, 00100 Nairobi, KENYA

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