EVALUATION OF THE MANAGEMENT OF HYPERTENSION AMONG ADULT PATIENTS IN MURANG'A SOUTH SUB-COUNTY HOSPITAL.

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NOVEMBER 2018

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I dedicate this dissertation to my beloved husband Gabriel and to my children Lynn, Daniel and Jacob for their constant support during my studies

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ABBREVIATIONS

ACEI	Angiotensin Converting Enzyme Inhibitor
ARB	Angiotensin 2 Receptor Blocker
ASH	American Society of Hypertension
BB	Beta blocker
BP	Blood Pressure
CAD	Coronary artery disease
CCB	Calcium Channel Blocker
CKD	Chronic Kidney Disease
CV	Cardiovascular
CVD	Cardiovascular Disease
DBP	Diastolic Blood Pressure
ESC	European Society of Cardiology
ESH	European Society of Hypertension
ESRD	End Stage Renal Disease
HBP	High Blood Pressure
ISH	Isolated Systolic Hypertension
JNC	Joint National Committee
KNH	Kenyatta National Hospital
KNH/UoN	ERC Kenyatta National Hospital/ University of Nairobi Ethics and Research committee
SBP	Systolic Blood Pressure
WHO	World Health Organization

DEFINITION OF TERMS

Adequate blood pressure control	Maintaining blood pressure levels below those considered for diagnosis of hypertension (140/90 mmHg for <60 years and 150/90 for those ≥60 years).
Adherence	The extent to which a patient continues an agreed–on mode of treatment without close supervision.
Blood pressure	Force exerted by blood against the walls of arteries as a result of the pumping action of the heart.
Co-morbidity	Is the presence of one or more additional disease(s) or disorder co-occurring with the primary disease in this case hypertension.
Compelling indications	Certain high-risk clinical conditions that require selection of certain drug classes based on favorable outcome data from clinical trials.
Diastolic blood pressure	The minimum arterial pressure during relaxation and dilatation of the ventricles of the heart when the ventricles fill with blood.
Hypertension	Prolonged elevated blood pressure with a systolic pressure above 140 mmHg or a diastolic pressure above 90 mmHg.
Lifestyle modifications	Involves altering long-term habits such as eating and physical activities and maintaining new behavior for months or years in order to prevent, treat or manage a disease such as hypertension.
Systolic blood pressure	The maximum arterial pressure during contraction of the left ventricle of the heart.

ABSTRACT

Background

The rising numbers of hypertension globally and in Kenya is a major public health issue. Several studies have revealed that the control of blood pressure among adult patients is suboptimal. Despite high prevalence of hypertension in Murang'a County, there has not been a single published study done on the level and pattern of its control.

Study objective

The main objective was to evaluate the management of hypertension among adult patients in Murang'a South Sub-County Hospital, Kenya.

Methodology

It was a rural hospital based cross-sectional study which was conducted in an outpatient hypertensive medical clinic in Murang'a South Sub-County Hospital. This was after seeking ethical approval from the Kenyatta National Hospital and University of Nairobi Ethics and Research Committee. Simple random sampling was employed to recruit 198 adult outpatients who were hypertensive. Customized pretested data collection forms and interview guides were used for abstracting the data on participant's demographic characteristics, details of drugs prescribed, adherence to medication and lifestyle practices. Descriptive and exploratory analysis was carried out using STATA version14 and presented as numbers, proportions, tables and figures. Inferential statistical tests were also carried out comparing traits of participants with controlled and uncontrolled BP using Fischer's exact or Pearson's chi square test.

Results

Out of 167participants, 124(74.0%) were females. The mean age was 62 years with standard deviation of 12.1. Majority of the participants were overweight (73, 43.7%) and had gone up to primary level of education (94, 56.3%). Among the participants, 102 (61.1%) had hypertension for 1-5 years. Diuretics were the commonest at 129(77.3%) among the classes of drugs used for management of hypertension. Slightly over half of the participants were on two drug regimens (93, 56.9%) a third of which comprised of angiotensin converting enzyme inhibitors plus a diuretic (33, 34.0%). Use of triple therapy was less common at 43 (25.8%). Multivariate analysis revealed that

the independent predictors of blood pressure control included adherence to medication (COR=4.6, 95% CI=2.09-9.95, P=0.001), salt restriction (COR 3.6 CI-1.29-10.04, P=0.014) and concurrent use of three drug combinations (COR 0.81 CI-0.67-0.98, P=0.031) The independent predictors for non-adherence to medication were lack of finances by the patients (COR=0.084, 95% CI= 0.388-0.180, P=0.001), inadequate knowledge on antihypertensive treatment (COR=0.213, CI=0.061-0.742, P=0.015), among others.

Conclusion

Diuretics and angiotensin converting enzyme inhibitors were the most preferred pharmacotherapy for patients in Muranga South Sub County Hospital. Blood pressure control rate was below fifty percent and the adherence rate was high. The major determinants of non-adherence were lack of finances and forgetfulness. In addition, proper lifestyle practices among the participants were inadequate.

Recommendations

Although the adherence to antihypertensive medication is high among adult patients at Muranga Sub county hospital, it is unclear why the adequacy of blood pressure control is low. As such, other factors which may improve the blood pressure control need to be explored through further and elaborate research.

In order to improve on the BP control there should be frequent continuous medical educations on ways of optimizing BP management to healthcare workers and consistent patient education about their illness and medications.

CHAPTER ONE: INTRODUCTION

1.1: Background

Hypertension by definition is systolic BP of ≥140 mmHg or diastolic BP of ≥ 90 mmHg or both more than two occasions. Hypertension is further defined in different groups: adults aged < 60 years, diabetic patients and CKD patients should have blood pressure of < 140/90mmHg. In patients aged 60 years and older the blood pressure (BP) should be < 150/90 (1). Hypertension a great risk factor for stroke, cardiovascular diseases, kidney disease and premature mortality (2).

Guidelines and protocols have been developed with the aim of curbing hypertension(6–12). The Joint National Committee (JNC) on detection, evaluation, prevention and treatment of increased blood pressure (HBP) eighth report (JNC 8) gives specific recommendations on management of HBP (9). For the blacks' ≥ 18 years with no compelling indications, treatment should be initiated with thiazide diuretics or CCB or in combination, in addition to lifestyle modifications. For patients with either diabetes or kidney failure, treatment should be initiated with ARB or ACE inhibitor alone or in combination with another class of drug (9). If goal BP is not achieved clinicians should reinforce lifestyle modification and adherence, then maximize dosages or consider adding a third class of drug (9). Despite all this information studies have shown that clinicians do not fully adhere to these guidelines (13).

Outcome of therapy is basically indicated by the measure of BP levels. To have adequate BP control one should have the normal BP levels of < 140/90mmHg for people below 60 years of age and <150/90mmHg for patients above the age of 60 years. In most cases, this is not achieved as shown by various studies(13–15). In a recent study done in a tertiary referral hospital in Kenya, 70 % of the study population had inadequate BP control(14). Poorly controlled blood pressure can lead to damage of target organ such as the brain; leading to cerebral vascular accident or the heart; leading to heart failure, left ventricular hypertrophy, coronary revascularization, angina in a previous myocardial infarction. HBP may also cause chronic kidney injury, retinopathy and peripheral artery disease (11).

Studies have revealed varied prescribing patterns and different choices of treatment regimens with poor outcome of therapy (16–18). In a study done in rural Kenya, only 7.3% of participants had

adequate BP control (13). In that study ACE inhibitors were the most commonly prescribed monotherapy at 20.2% and ACE inhibitor and thiazide diuretic were the most commonly prescribed combined therapy at 14.2% (13). In another study done in India, the most commonly prescribed antihypertensive medications were diuretics followed by ARBs (16).

One of the major patient related factors that affect BP management is adherence to antihypertensive treatment. Other factors may also impact on the management of BP, such as demographic characteristics which include age and sex, co morbidities such as hyperlipidemia, diabetes and ischemic heart disease amongst others.

This present study evaluated the management of hypertension among adult outpatients in Murang'a south Sub-county hospital. It specifically aimed at describing the prescription patterns of drugs used in hypertension among clinicians, determined the level of BP control among hypertensive patients and the adherence level to antihypertensive therapy. In addition, it determined the lifestyle practices among hypertensive patients.

1.2: Problem statement

Prevalence of hypertension has been on the rise both globally and locally (19–21) being as high as 56% in some parts of Kenya (22). High prevalence is characterized by low awareness, poor management of hypertension and low control rates (15,23,24). In low resource settings where specialists are few, the level of blood pressure control remains poor and patients easily progress to end organ damage (25–28). These studies reflect the magnitude of inadequacy in management of hypertension in hospitals. Patients attend clinics and are put on drugs but still the BP control remains poor and this clearly indicate of a gap in management. Failure to optimally control hypertension results in complications which are more costly to manage and precarious (2). In addition, Patients become unproductive economically and this affects the community at large. There are many factors that can lead to poor BP management and identifying the specific ones can point towards better BP control. This study looked into identifying the gaps in BP management and sensitize clinicians and patients on areas of improvement so that proper measures can be taken towards improving the level of hypertension management.

1.3: Study justification

Findings from clinical trials indicate that antihypertensive drugs can adequately control blood pressure and also prevent end organ damage (29–33). However, BP control remains low. In efforts to optimize management of hypertension, guidelines have been developed(6,9,16) but not all clinicians use these guidelines (13) even though their use have been shown to improve outcomes(34). Several studies have been done evaluating BP management, a few of them being local and mostly from referral hospitals(13,14,16,17,35). With majority of our hospitals being in low resource settings, there was need for more studies to be carried out in these areas. Murang'a south hospital was one of such areas where the number of hypertensive patients had been rising steadily but management remained poor. This particular study helped in identifying the gaps in management of hypertension, deviations to the local and international guidelines in clinicians' prescribing habits, medication adherence level and lifestyle practices in hypertensive patients. Knowledge in these areas will see a rise in the level of BP control and overall patient care improvement.

1.4: Research questions:

1. What are the types of drugs used in management of hypertension in adult patients?
2. What is the BP control level among hypertensive adult patients?
3. What is the rate and the determinants of adherence to antihypertensive drugs in adult patients?
4. What are the lifestyle practices of adult hypertensive patients?

1.5: Study objectives

1.5.1: The general Objective

To evaluate the management of hypertension in adult patients at Murang'a South sub- county hospital.

1.5.2: Specific objectives:

1. To find out the drugs used for the management of hypertension among adult patients in Murang'a Sub-County hospital
2. To determine the adequacy of blood pressure control among hypertensive adult patients.

3. To determine the rate of adherence and determinants of non-adherence to antihypertensive drugs in adult patients.
4. To describe the lifestyle methods for the management of hypertension among adult patients in Murang'a Sub-County hospital.

CHAPTER TWO: LITERATURE REVIEW

2.1: Classification and description of hypertension

High blood pressure is generally defined by many guidelines as systolic blood pressure (SBP) of ≥140 mmHg or diastolic blood pressure (DBP) of ≥90 mmHg or both on more than two occasions(1,6,12). The classification of blood pressure differs slightly in different local and international guidelines. The 2013 Joint European Society of Hypertension (ESH) and European Society of Cardiology (ESC) guidelines on management of hypertension classify hypertension as shown in the table 2.1 (6).

Table 2.1: Classification of levels blood pressure levels (mmHg)

Category	Systolic		Diastolic
Optimal	<120	and	<80
Normal	120–129	or/and	80–84
High normal	130–139	or/and	85–89
Grade1 hypertension	140–159	or/and	90–99
Grade2 hypertension	160–179	or/and	100–109
Grade3 hypertension	≥ 180	or/and	≥ 110
Isolated systolic hypertension	≥ 140	and	< 90

2.2: Etiology of hypertension

Hypertension mostly arises from unknown causes and about 85-95% of cases is referred to as primary or essential hypertension. If it arises from a known cause such as kidney disease, it is referred to as secondary hypertension and accounts for 5-15% of cases(38). Risk factors of high blood pressure include: not eating enough fruits and vegetables, consumption of food with too much fat and salt, harmful levels of alcohol use, poor management of stress and physical inactivity. In addition, there are a number of metabolic factors that increase the risk of high blood pressure complications such as being obese or overweight, diabetes and high cholesterol (2). Tobacco interacts with hypertension to raise further the risk of cardiovascular disease. Other factors include

genetic factors, social economic factors which mainly raise stress levels. If one is above 40 years there may be secondary factors like endocrine disease, kidney injury and malformations of blood vessels(2).

2.3: Epidemiology of hypertension

Globally, approximately 17 million deaths per year are due to cardiovascular diseases which is one third of the total (21). Out of these, hypertension complications account for 9.4 million deaths worldwide every year (21). Hypertension is a global health issue and the biggest contributor to disease burden and mortality globally and global mortality (39) and is responsible for 51% deaths due to stroke and 45% or more deaths due to heart disease (2).

A survey done in 2015 by WHO pointed out that the prevalence of hypertension has risen over the last 20 years (22). Among the WHO regions, the prevalence of hypertension in 2008 was highest in Africa, at 46% for both males and females. In a study done in sub-Saharan Africa the prevalence of raised blood pressure was found to be 25.9 % among teachers, nurses and pre-urban dwellers (40) and a systematic review-meta-analysis of studies done in sub-Saharan Africa indicated the prevalence of CKD secondary to HTN was 13.9% (25). In Kenya, prevalence is estimated to be as high as 50% in specific communities (41).

2.4: Management of hypertension

The ultimate goal for public health of antihypertensive therapy is reducing cardiovascular and renal morbidity and mortality(37). Treating SBP and DBP to targets <140/90 mmHg with several classes of drugs (ACEI, ARBs, BB, CCB and thiazide diuretics) is associated with a reduction in cardiovascular complications(29,33,37). Classes of antihypertensive drugs used are shown in appendices 1 adapted from JNC- 8 guidelines(11).

Hypertensive patients with certain co morbidities need to be followed up and special attention by clinicians(37). On the other hand, for high risk conditions, patients with compelling indications require specific antihypertensive classes, JNC-8 recommends the following treatment as shown in table 2.2 below(9)

Table 2.2: Compelling indications in hypertension

Indication	Treatment of choice
Heart failure	ARB/ACEI + BB + Spironolactone +diuretic
Post MI / clinical CAD	ARB/ARB and BB
CAD (coronary artery disease)	ACEI, Diuretic, BB and CCB
Diabetes	ARB/ACEI, diuretic and CCB
CKD	ARB/ACEI
Recurrent stroke	Diuretic, ACEI
Pregnancy	Labetolol (first line), methyldopa, nifedipine

The JNC 8 guidelines further recommends treatment according to age, race, BP goal and co morbidities as shown in the algorithm figure 2.1 below(9).

For most patients, thiazide diuretics should be used as initial therapy either alone or in combination with a drug from one of other classes (CCB, ACEI, BB, ARBs)(9,37)

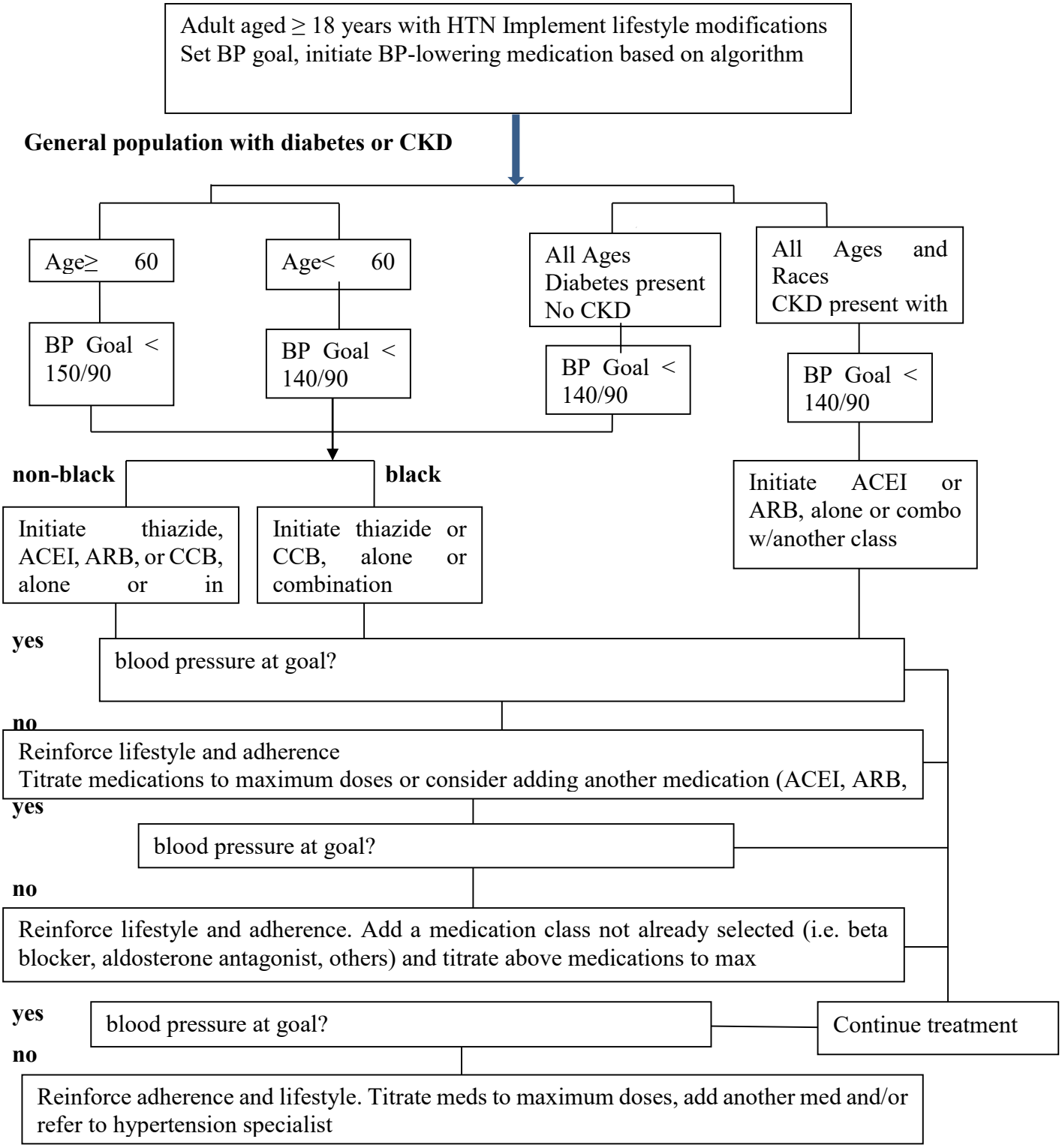


Figure 2.1: algorithm on hypertension management, adapted from JNC- 8 guidelines(9).

2.5: Prescribing patterns of antihypertensive drugs

Hypertension drugs prescribed by clinicians can be influenced by several factors and considerations such as; other medications in use, desired blood pressure targets, level of tolerance, available medications, compelling indications, guidelines recommendations and many others(37). Studies done on prescribing patterns of antihypertensive drugs vary greatly in various regions and hospitals (13,16–18,36,42,43). In a study done in Bangladesh, 61.6% participants received monotherapy and 38.4% combined therapy. Among mono-therapy, the most commonly prescribed drugs were angiotensin receptor blockers (ARB) at 37.3% and calcium channel blockers (CCB) at 32.8%. The most commonly prescribed combination therapy was ARB+CCB at 28.1% and CCB +beta blocker BB at the same rate of (28.1%), followed by ARB + Diuretics at 25% (36). The factors that influenced prescribing patterns were co-morbidities and duration of hypertension but not sex(36). In a study done in North India, diuretics were the most prescribed class of drug at 53.4% followed by ARBs at 42.6%. Patients who received mono-therapy were 42% while 57.4 % received combined therapy(16). In this study all treatment were in line with JNC-7 guidelines(16).

In a study done in rural Kenya, 40.5% of patients received mono-therapy while 43.7% received 2-drug regimen. Among mono-therapy, the mostly prescribed drug class was ACE inhibitor at 20.2% and in 2-drug regimen, the mostly prescribed drug classes were ACE inhibitor and thiazide diuretic at 14.2% (13). These studies have revealed great variation in management strategies. Furthermore, they have shown inconsistencies with the treatment protocols as well as guidelines and have not correlated the management with the level of BP control among the patients.

2.6: Blood pressure control

Adequate BP control is achieved by treating SBP and DBP to targets < 140/90 mmHg. The relationship between BP and cardiovascular risk is consistent and independent of other risk factors, the higher the BP the greater the risk of heart failure, myocardial infarction, kidney injury and stroke (37). Recent clinical trials have demonstrated that effective blood pressure control can be achieved in most of the patients with hypertension when treated with antihypertensives(29,33). However, in reality, studies have revealed that the level of BP control among hypertensive patients is very low (13,15,18,44). For example, in a tertiary referral hospital in Kenya, 70% of patients

studied had inadequate blood pressure control (14) and a third of participants had BP within the recommended limits in a regional referral hospital in central Kenya (15). WHO 2015 study pointed out that more than half (56%) of Kenyans have never had their BP measured. Among the people who reported to have been diagnosed with raised blood pressure previously, only 22.3% were currently on medication that had been prescribed by a health worker (22). In addition, in a survey done in 2015, eighty per cent of Kenyans in the 40-69 years age group were shown to have a CVD risk of 30% with only 6.2% receiving medication and counseling to prevent strokes and heart attacks (22).

One of the studies carried out in Nairobi slums- Kenya demonstrated awareness of 19.5% among the hypertensive patients, 47% of those were on treatment and among those on treatment only 21.5% had their BP controlled. The overall BP control rates was 2.3% which is very low (23). The reasons for uncontrolled BP were cited as complex and arising from a number of factors related to the way physicians treat raised BP, poor adherence and properties of antihypertensive medications (45). There could be clinicians inertia in that they are conservative in their approach, not making alterations to therapy even when BP remain elevated, some may focus on DBP other than prognostic SBP claiming that SBP is too variable to be reliable(45). The other factor could be drug related in that persistence with therapy varies between different classes of drugs, for example ARBs have higher persistence due to tolerability(45,46). In a study done in a central referral hospital- Kenya which demonstrated a BP control rate of 33.4%, using CCB was associated with good BP control. In that study being diabetic, old age (≥60 years), use of 3 or more antihypertensive drugs was associated with reduced BP control(15).

Cardiovascular risk factors can influence the levels of blood pressure and can result to uncontrolled BP. They include; cigarettes smoking, obesity (BMI ≥30), physical inactivity, dyslipidemia, diabetes mellitus, micro albuminuria or estimated glomerular filtration rate (GFR) of <60ml/min(11).

Consequences of uncontrolled BP are fatal with high mortality due to increased cardiovascular and cerebrovascular events. A study done in Japan showed that there was a rise in incidences of cardiovascular and cerebrovascular events along with rising BP levels(30). This was significantly

higher when SBP was ≥140mmHg and DBP ≥85mmHg. The incidence of stroke was strongly correlated with BP. In this same study, CV mortality increased with elevation of SBP. It was 6 folds higher with patients who had SBP ≥160mmHg than patients with SBP <130mmHg(30).

2.7: Adherence to antihypertensive therapy

Adherence is defined as the extent to which a person's behavior such as following a diet, taking medication and applying lifestyle changes, corresponds with agreed recommendations from a health care provider(47). It is further described as the extent to which a patient acts in accordance with prescribed dose, interval, and dosing regimen. It is measured overtime and reported as a percentage(47). Non adherence is very common and usually estimated to present in almost half of the patients with high blood pressure (47). The JNC-7 points out that adherence to antihypertensive medication is influenced by patients' attitude, cultural beliefs, previous unpleasant health experiences and low motivation(11). Non adherence is increasingly affected by misunderstanding of medication therapy or condition, denial of presence of illness due to lack of symptoms, perception of drugs as a symbol of ill health, unexpected side effects from drugs, not involving patient in the care plan, cost of medication or complexity of care(11). All health care workers including nurses, physicians, clinicians, pharmacists and dietitians, must work as a team and reinforce instructions to improve patient lifestyle and BP control(11).

Adherence is influenced by interplay of five sets of factors described by WHO as follows:
Social and economic factors: These includes; low level of education, poverty, unemployment, illiteracy, lack of effective support from social networks, high transport cost, unstable living conditions, high medication cost, long distance from centers of treatment, change in environmental situations, culture and lay beliefs about treatment and illness and dysfunctional families (47).
Health care team and system related factors such as: Health services that are poorly developed with health insurance plans with nonexistence reimbursement or inadequate, overworked health care providers, poor distribution systems of medication, not enough knowledge and training for providers of health care on management of chronic diseases or overworked, lack of feedback on performance, lack of incentives, inadequate consultations, weak capacity of the systems to educate patients and give follow-up, not able to establish community support and management of capacity, inadequate adherence knowledge and interventions for improving it(47).

Factors related to condition are those that relate to a particular illness faced by the patient. Adherence can be influenced by severity of symptoms, level of disability (physical, psychological, social and vocational), rate of progression and severity of the disease, and the availability of effective treatments(47).

Therapy related factors include adherence which is influenced by: treatment duration, complex medical regimen, treatment changes and previous therapy failures, beneficial effects immediacy, side-effects and the availability of medical support to deal with them.
Factors related to patients are: beliefs, knowledge, patient expectations, attitudes and perceptions. They particularly include: forgetfulness; low motivation, psychosocial stress, anxieties of possible adverse effects, inadequate knowledge and skill on how to manage the symptoms of the disease and treatment, lack of perceived treatment effect, lack of self-perceived treatment need, and negative beliefs on the treatment efficacy. They also include; not believing in the diagnosis, not accepting the disease, misunderstanding instructions about treatment, lack of acceptance of monitoring, low treatment expectations, low attendance at follow-up, or at counseling or psychotherapy classes, hopelessness and negative feelings, fear of dependence and anxiety over the complexity of the drug regimen (47).

Studies have shown that a combination of the above factors influence adherence and consequently blood pressure control(4,48–50). For example a study done in a rural hospital in Kenya, among the factors that influenced adherence were sex, total monthly income, knowledge of hypertension and its treatment and number of pills(4). In a study done in Ethiopia, sex, knowledge about hypertension, distance from the hospital and number of co morbidities were found to be the factors that influenced adherence(48).

Adherence is a primary determinant of successful BP management. Non-adherence hinders optimum clinical benefits. Good adherence improves on the effectiveness of most interventions aimed at improving healthy lifestyles such as increased physical activity, such as diet modification, positive behavioral characteristics and pharmacological benefits(47). The primary cause of inadequate blood pressure control has been identified as low adherence (4,5,51). In a study done

in Italy, incidences of complications (deaths, strokes, ischemic heart diseases and kidney diseases) decreased with increase in the rate of adherence to antihypertensive therapy and the risks of complications increased with decrease in adherence, advancing age, male sex and it was lower in the presence of lipid lowering agents(49).

Various studies have been done on adherence both internationally and locally (4,5,37,48,49,51–54). The findings differ in the adherence rates in different regions and settings and also the factors influencing non-adherence vary greatly. In a meta-analysis survey of seventeen studies on adherence the pooled mean adherence by drug class ranged from 28% for BB to 65% for ARBs. BB and diuretics had the lowest adherence while ARBs and ACEIs had the highest adherence rates, however adherence was suboptimal regardless of drug class(46). Adherence also decline with duration of treatment and pill burden for example, among the study participants who were on concomitant antihypertensives and lipid lowering therapy, percentage of patients adherent to both medication declined sharply following initiation with 35.8%, 35.9% and 44.7% of patients adherent at 12, 6 and 3 months respectively(55).

Non adherence is directly associated with uncontrolled blood pressure (4,51,56,57) and it is very common in patients considered to have treatment resistant hypertension according to a study(51). Among cohort of patients with resistant hypertension who were on 3 or more antihypertensive drugs, only half (50%) had truly resistant hypertension after being given medication under direct observation for some time. The other half were non adherent to medication(51). In another study done in a teaching hospital in Nigeria, 32.1% of participants were low adherers, 52% had medium adherence while 15% had high adherence. Among the high adherers 80.3% had blood pressure under control. In this study, patients with positive social support of family members, adequate knowledge of medical regimen, well satisfied with medical care, coping behavior that is strong had high adherence levels(56).

Co morbidities such as diabetes, ischemic heart disease and dyslipidemia have an association with the rate of adherence(58). With increasing number of co morbid conditions a study showed that proportion of patients with high adherence decreased successively from 20% in those without co morbid disease to 14.1% in those with one or two co morbid conditions and 11.1% in those with3

to 5 co morbid conditions(58). Also the risk of all cause of mortality, stroke and ischemic heart disease decrease progressively as adherence to antihypertensive therapy increases(49). Other studies showed significant relationship between adverse effects and non-adherence (52,53). Adherence therefore is a major factor that impact on optimal hypertension management. However, in some studies that showed high adherence rates, the level of BP control was suboptimal(4), this shows that for us to achieve optimal hypertension management, several factors must come into play. This will involve the entire health care team to ensure correct prescribing habits, implementing lifestyle modifications, compliance with the guidelines, regular BP measurements and ensuring adherence to antihypertensive.

2.8: Lifestyle modifications

Lifestyle modifications are the cornerstone and the first line of intervention for all hypertensive patients. They are important, though they should not delay pharmacological therapy in high risk patients but instead they should be combined(59,60). They are shown to lower BP levels, enhance antihypertensive efficacy and decrease cardiovascular risk(37).They are applied in hypertension management to control progress and prevent short term and long term complications. They are therefore performed before initiation of antihypertensive therapy and also after to improve outcome(59). Lifestyle modifications also help in preventing hypertension from developing in non-hypertensive people(59).

These lifestyle modifications include the following: salt restriction, dash diet, moderation of alcohol, cessation of smoking, weight reduction and regular physical activity(11). The JNC-7 guidelines, ESH/ESC-2013 practice guidelines and adult hypertension guidelines recommends the following(11,60,61): Salt restriction to <6g per day (sodium chloride) or 2.4g/day (sodium) to lowers SBP by approximately 2-8 mmHg, moderation of alcohol consumption to not more than 2drinks (20-30g/ day) in men and not more than 1 drink (10-20g) per day in women to lowers SBP by approximately 2-4 mmHg. Also high consumption of vegetables and fruits and low fat dairy products with reduced content of saturated and total fat to lower SBP by approximately 8-14mmHg and reduction of weight to a BMI of <25kg/m2 and waist circumference to <102cm in men and <88cm in women to reduce SBP by approximately 5-20mmHg per every 22Ibs weight loss. At least 30 minutes of moderate dynamic exercise on 5 to 7 days per week to reduce SBP by 4-

9mmHg. Maintain adequate dietary potassium to more than 90mmol (3500mg) per day to reduce SBP by 2-4mmHg. Other factors are quitting smoking and avoidance of passive smoking and managing emotional stress to reduce the overall CV risk.

In most developed countries hypertensive patients' level of awareness of majority of lifestyle modifications is high and implementation of the same is average. For example, in a study done in Switzerland, 96% of participants were aware that consumption of alcohol and obesity are associated with hypertension while 79% knew the benefits of exercise on hypertension(62). In developing countries the level of awareness and practice vary in different setups(63–66) for example in a study done in India, 72% of participants did not consume alcohol, 89% were non-smokers, 89% were active with more than 30 min exercise per day but 25% were adding extra salt in their diet(67). In another study done in Nigeria, only 9.3% of participants did regular exercises(65). In a study done in Ethiopia, only 14% of participants did regular exercises and a large majority (94.6%) were having salt restriction(64).

Lifestyle modifications are associated with reduced overall mortality and also CV mortality brought about by quitting smoking and having regular exercise as shown in a study done in United States (68). In a study done in male health professional hypertensive patients in India, that was determining the frequency of lifestyle factors in association with cardiovascular diseases, 62% of all coronary events would have been avoided had all men adhered to a low risk lifestyle of not smoking, regular exercise, dash diet, moderation in alcohol consumption and weight reduction(66). In another study done in USA on effects of lifestyle modifications on BP status, a dash diet and weight reduction were applied in obese hypertension patients against controls, the study showed that BP changes were great in hypertensive patients than non- hypertensive patients(69).

2.9: Overview of literature

The common major gap globally and locally is that there is poor BP control. In a study done at a rural hospital in Kenya(13), the BP control of 46% was better than the Studies done previously which had ≤ 30% control rate(15,24). This improvement could have been due to compliance with treatment guidelines which was 80%. However, the study focused more on the clinician related factors. The other factors that could have led to control rate of < 50% were not identified which

could be patient related as well as medication related. Other studies have focused on the awareness and the knowledge level which were also found to partly affect BP control, for example, one of the study showed that only a third of the participants knew that they had hypertension(70). The effects of lifestyle modifications have not been studied extensively especially in low resource setting hospitals. As seen in one of the studies above, these non-pharmacological interventions may play a vital role in BP reduction and prevention of complications(67). However, this study focused only on male health care workers and therefore cannot be generalized to the community. WHO 2015 study pointed out that more than half (56%) of Kenyans have never been measured for raised blood pressure(22). Without regular BP measurements even for hypertensive patients uncontrolled BP cannot be captured and will lead to complications and target organ damage.
This present study evaluated the effect of various factors on management and these included: adherence, lifestyle practices, types of drugs used and the level of blood pressure control.

2.10: Conceptual framework

The ultimate goal in hypertension management is to have optimal BP control in all hypertensive patients. With optimal BP there will be low risk of developing complications and end organ damage; there will be also low morbidity and low mortality among the hypertensive patients. This will impact positively on their quality of life and they will be more productive economically. Various factors influence BP management either positively or negatively. Type of drugs prescribed by the clinicians' impact on the management depending on the number of drugs prescribed, effectiveness of particular combinations and class of antihypertensive drug preferred on the majority of patients. This affects compliance to medication by patients and the ability of the medication to effectively reduce BP.

Adherence to medication directly affects hypertension management. Non-adherence to prescribed medication by the patients could arise due to a variety of factor such as: unavailability of medication and high cost, adverse effects of the medications, social economic factors such as poverty, low level of education and unemployment.

Management of blood pressure involves also non-pharmacological interventions. Lifestyle practices are essential in the control of blood pressure. Weight reduction, salt restriction, regular

exercise, moderation of alcohol consumption, cessation of smoking and diet observation are measures that greatly lead to reduction in BP and enhance hypertension management.

The level of BP control indicates whether the management is optimal or uncontrolled.

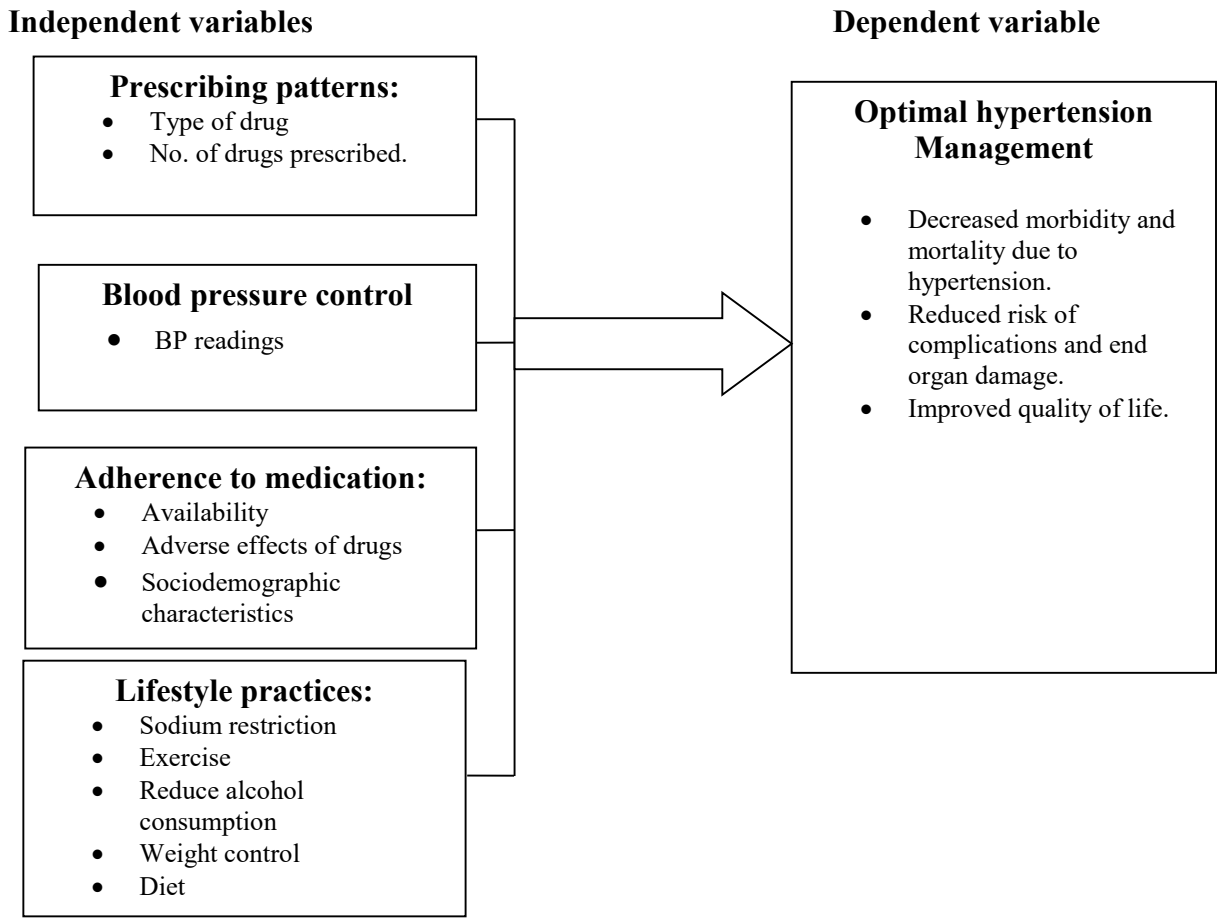


Figure 2.2: Conceptual framework for the management of hypertension

CHAPTER THREE: METHODOLOGY

3.1: Study design

A cross-sectional study design was used which was suitable since the study population was considerably large and the study did not require follow up. It entailed extracting relevant information from patients' records using customized data collection tool.
Interview guide were used to collect data from patients who attended medical outpatient clinic (MOPC) and met the eligibility criteria.

3.2: Study area and site

The study was carried out in Murang'a south sub-county Hospital which is one of the referral hospitals in Murang'a County. It serves several outstation hospitals, health centers and dispensaries. It is located in a semi-urban area along Makuyu Murang'a road about 45 km from Thika town and about 80 km from Nairobi city center.

The hospital serves a catchment population of 321,320 according to 2009 Kenya population and housing census report (71). At the time of the study, the hospital had an inpatient bed capacity of 124 which consisted of adult general ward, maternity and pediatrics wards. The outpatient department served about 3027 patients in a month. The MOPC was one of the outpatient clinics which was open 2 days in a week and had 410 active hypertensive patients. These patients were usually assessed and treated by physicians, medical officers and clinical officers. Their clinical records were kept in the hospital's record department and retrieved during each visit. The target population involved adult hypertensive patients. Therefore, medical outpatient clinic where the study was conducted was a suitable site where majority of these patients were met.

3.3: Study population

The study involved adult hypertensive patients who were on treatment with at least one antihypertensive drug. The hypertensive patients who had attended MOPC clinic actively for at least three months at the time of study. This time frame was important for assessing patient response to medication and captured management trend.

3.4: Sample size determination

The sample size calculation was derived from the Cochran formula (72). In a study on evaluation of hypertension management carried out at KNH in 2015, a BP control rate of 30% was reported(14). Since our primary endpoint was adequate BP control, 30% was used as the expected estimated proportion in calculating the sample size. Hence the following formula was used:

$n= Z^2 (p) (q)/d^2$

Where:

n= sample size

z= z statistic for 95% level of confidence which conventionally is 1.96

p= estimated prevalence or proportion in the population was 30%

q=1-p

d= level of precision used in the study set at 5%

$$n= \frac{1.96^2 \times 0.3 \times 0.7}{0.05 \times 0.05} = 321$$

The formula yielded a sample size of 321 participants. However, this sample size was close to the target population of 410 which was less than 1000. Since sample size was small, the following reduction formula was used to calculate sample size.

$n= n'/ (1+ (n'-1/N))$

Where:

n=sample size

n'=unadjusted sample size which was 321

N= target population size which was 410

The above formula gave a sample size of 180 participants. Adjusting for files with incomplete information or patients who gave incomplete information estimated at 10%, gave a target sample size of 198 which was used for the study.

3.4.1: Sampling procedure

The sampling frame included all adult hypertensive patients who were on follow up at the hospital MOPC clinic and who met the eligibility criteria. Universal sampling on all the available participants was employed to get a sample size of 167. The participants were informed on the need to participate once in the study and obtain their informed consent to participate. The participants were allowed to be reviewed by a clinician after whom they were interviewed. Their medical records were assessed for completeness and used to extract the data into collection form. In order to avoid confusion in enrollment, each participant's file had a sticker and it was given a unique number which would differentiate it from others.

3.5: Inclusion and exclusion criteria

3.5.1: Inclusion criteria

Inclusion criteria was adult hypertensive patients who were18 years and older and who consented to participate in the study. The patients had to have been enrolled in MOPC clinic with not less than three visits to the clinic in order to assess the course of management. They should have been on at least one antihypertensive drug at the time of data collection.

3.5.2: Exclusion criteria

The exclusion criteria were pregnancy and incomplete clinical records as well patients who declined consent for participation.

3.6: Research instruments

A data collection form was used for each patient to fill in the information obtained from the medical records. This information included: prescribing patterns which consisted of the antihypertensive drugs the patient was on, their class, dosages and frequency of administration. Socio demographic characteristics of a patient which included age, sex, weight and height were also recorded. It also captured other disease related information such as co-morbidities and duration of the illness. The form also had a part on BP measurements of the baseline and the most current one. I interviewed patients with the help of a research assistant and filled in an interview guide form. The interview guide had three sections. Section I consisted of Morisky Medication

Adherence Scale-8 (MMAS-8) which measured adherence(73).This was a validated tool used to measure adherence in patients with hypertension. It consisted of 8 questions which assessed different behavioral aspects by answering 'yes' or 'no'. A score of ≥3 'yes' was considered non-adherence while a score of <3 'yes' was considered good adherence. Adherence to hypertension treatment was defined as the extent to which a patient complied with antihypertensive pills prescribed by a clinician. The patients were described as either adherent or non-adherent.

The factor(s) which influenced non-adherence were captured in section II: They included patient factors, disease related, therapy related or socioeconomic factors.
Section III entailed good lifestyle practice questions which were defined as salt restriction, dash diet, moderation of alcohol, cessation of smoking and regular physical activity.

3.7: Pilot study

The pretest interview guide was used on ten hypertensive patients in the hospital and data collection forms filled from their medical records. These patients were not part of the final study. Necessary adjustments to the interview guide were made as it was informed by the findings of the pilot study that improved on the reliability of the data that was collected in the main study.

3.8: Validity and reliability

Measures were taken to ensure that there were minimal errors, no bias and confounding thus improving the quality and reliability of data that was collected. The interview guide questions were standardized to ensure uniformity. Part of the questions on adherence were adapted from an internationally validated scale (73). The interview guide questions were pretested before the actual study after which necessary adjustments were done. This improved on the validity of these instruments.

To improve on reliability of the data which was collected and the method used, the questions were written in English and interpreted to either Kiswahili or vernacular to the participant by either the research assistant or myself and also filled in the responses. This ensured that the questions were understood uniformly. The research assistant was trained on the objectives of the study as well as the data collection tools. This ensured uniformity in the data collection process.

Study participants were sampled randomly to avoid selection bias. Participants were advised on the importance of participating only once in the study, in addition, their files were put on a sticker and given a unique number to avoid duplication during consequent clinic days.

3.9: Data collection

One research assistant was obtained from staffs working at the MOPC clinic that was available for the entire data collection period. She was trained on the objectives of the study and collection tools.

During study, interviews were conducted to patients who met the eligibility criteria. The questions captured the patients' bio data, MMAS-8 for adherence and lifestyle practices.
The data collection forms collected data on the socio demographic characteristics (age, sex, weight and height), BP readings: baseline and the most current one, co morbidities present and details on antihypertensive drugs prescribed. Patients' confidentiality was ensured at all times.

3.10: Data processing and analysis:

The collected data was entered into Microsoft Excel spread sheet after every clinic day. It was then screened for errors and inconsistencies. At the end of data collection period the entire spreadsheet was exported to STATA 14 for statistical analysis.
Descriptive statistics, frequency distribution tables, pie charts and graphs were used to present data. Continuous data was presented as mean and median while categorical data was presented as numbers and percentages. Bivariate analysis ($\chi 2$ test) was performed to examine the relationship between blood pressure control and sex, age, number of drugs in the antihypertensive regimen, class of antihypertensive drug, adherence rate and lifestyle modifications. Pearson's chi square test or fisher's exact test were used to compare distribution across arms of categorical variables. Multivariable logistic regression analysis was carried out using key variables influencing BP control. P-values of 0.05 or less were considered statistically significant.
Both the raw data and the processed data was backed up in the Google drive. Passwords were created both in the computer containing the data files and Google drive to limit access and to ensure data security. The data collection forms and questionnaires were coded to further improve on data security.

3.11: Logistical and ethical considerations:

The study was carried out after clearance from Kenyatta National Hospital/University of Nairobi Ethics and Research Committee (KNH/UoN-ERC). Approval from Murang'a South Sub-County Hospital management team was sought to conduct the study. Patients were offered explanation on the purpose of the study and were assured of confidentiality of their information. The participants were recruited after obtaining an informed consent from each one of them. All medical requirements and ethical standards related to research were observed at all times throughout the study. The consent form is shown in appendix 3.

CHAPTER FOUR: RESULTS OF THE STUDY

This chapter consist of the presentation of analyzed results obtained on sociodemographic characteristics, comorbidities, BP measurements, years of hypertension and antihypertensive medications used. It also contains analyzed results obtained from interview guide on adherence to medication and lifestyle practices. A total of 167 participants were used after universal sampling on all eligible participants.

4.1: Sociodemographic and clinical characteristics of the participants

The mean age of study participants was 61.7years (SD 12.1) and the median age was 63 (range 27 to 87 years). The majority (96, 57.5%) were in the age group of 36-65 years **(Table 4.1)**. Among the participants, 124 (74.3%) were females. Seventy-three (43.7%) were overweight while 52 (31.1 %) were obese. Patients who had education up to primary school level were the majority, at 94 (56.3%).

The participants who had uncontrolled BP were classified as either having mild, moderate or severe hypertension. Those who had mild hypertension were 50 (49.0%), while those with moderate hypertension were 36 (15.7%) and the participants with severe hypertension were the least at 16 (15.0%).

Out of 167 patients, 68 (40.7 %) had adequate BP control where both systolic and diastolic pressures were normal. Seventy-two (43.1 %) had only their systolic blood pressure controlled while 120(71.9 %) had diastolic pressure within the normal range.

Table 4.1: Sociodemographic and clinical characteristics of the study participants (n=167)

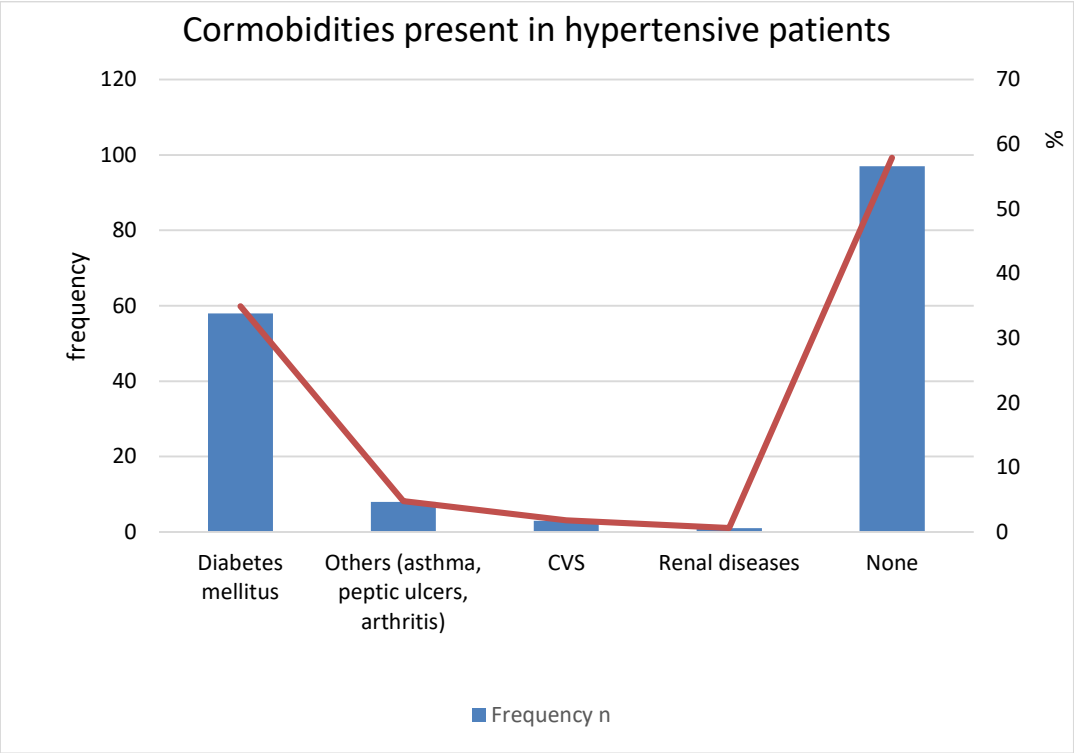
Variable	Category	Frequency (n)	Percentage (%)	Mean (SD	Median (range)
Age (years)				**61.7(12.1)**	63(27,87)
	18-65	98	**58.7**		
	≥65	69	41.3		
Sex	Male	43	25.8		
	female	124	**74.3**		
BMI	< 18.5	3	1.8		
	18.6 - 24.9	39	23.4		
	25 - 29.9	73	**43.7**		
	≥ 30	52	**31.1**		
Education level	Informal	37	22.2		
	Primary	94	**56.3**		
	Secondary	36	21.6		
Marital status	Single	6	3.6		
	Married	161	**96.4**		
Employment status	Formal	6	3.6		
	Non-formal	161	96.4		
Denomination	Christian	165	98.8		
	Muslim	2	1.2		
Monthly income (KES)	< 5000	138	**82.6**		
	>5000	29	17.4		
BP Control	Systolic	72	43.1		
	Diastolic	120	71.9		
	Both systolic and diastolic	68	**40.7**		
Levels of hypertension	Mild	50	**49.0**		
	Moderate	36	35.3		
	Severe	16	15.7		

BMI= body mass index KES=Kenya shillings

4.2: Comorbidities among the study population

Slightly over half of the participants did not suffer from any comorbidity (97, 57.9%). For the ones with other diseases the most common comorbidity was diabetes mellitus, at 58 (34.9 %), a single

patient had renal problem and 3(1.8%) of them had heart diseases. Others were asthma, peptic ulcers and arthritis 8 (4.8%) participants as indicated in figure 4.1.



CVS= Cardiovascular system disease

Figure 4.1: Comorbidities present in hypertensive patients

4.3: Duration of treatment among the study patients

Most patients (122, 73.0%) had been receiving antihypertensive drugs for less than five years and more than a quarter (45, 27.0%) for more than five years **(Fig 4.2**).

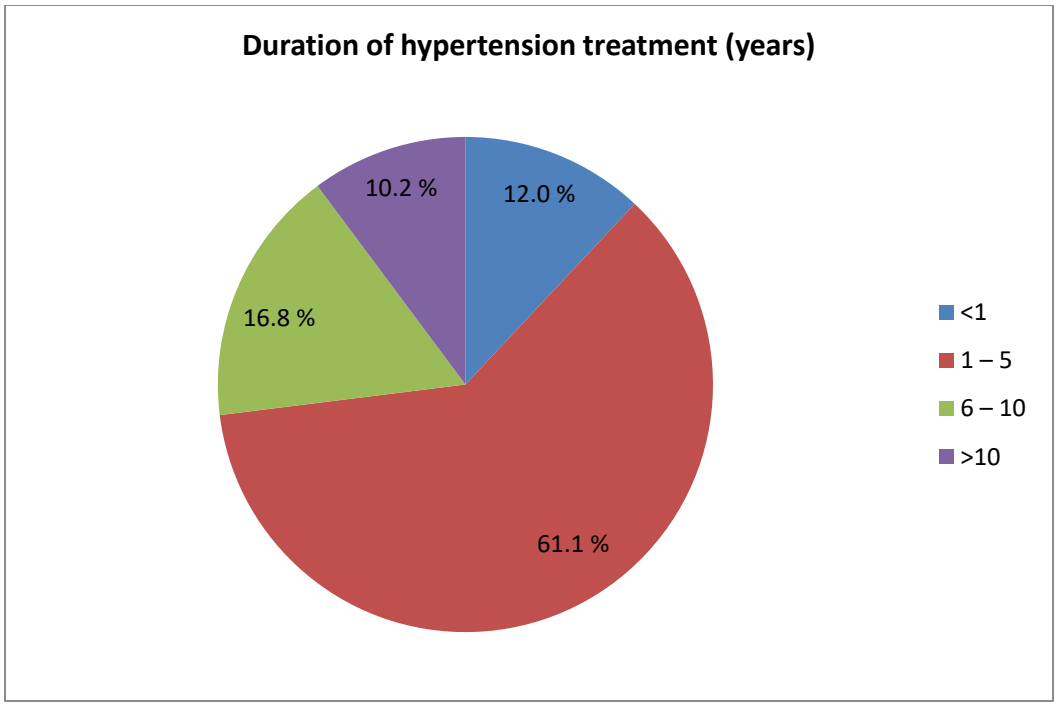
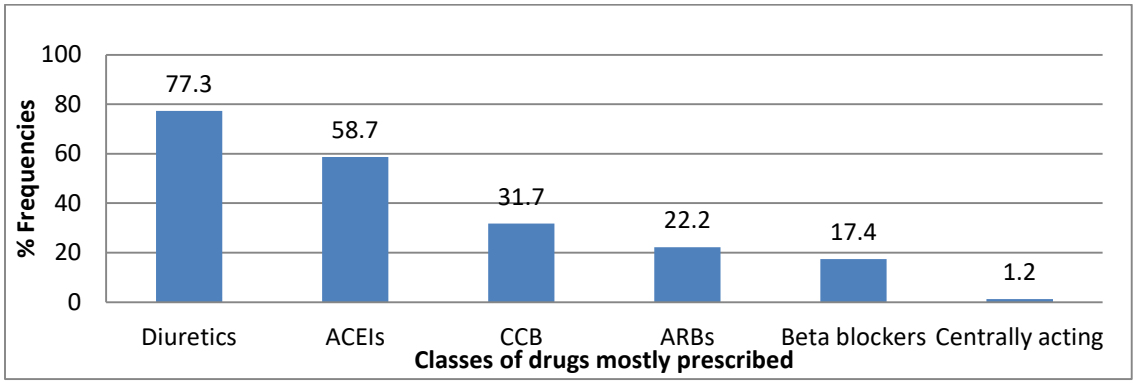


Figure 4.2 Duration (years) of antihypertensive therapy.

4.4: Prescribing patterns of antihypertensive drugs

Classes of antihypertensive drugs prescribed are as shown in figure **4.3**. Majority (129, 77.3%) of the participants had a diuretic in their regimen. ACEIs were being used by 98 (58.7%) participants while 37(22.2%) were on ARBs.



ACEIs-angiotensin converting enzyme inhibitor, CCB-calcium channel blockers, ARBs-angiotensin receptor blockers

Figure 4.3: Classes of antihypertensive drugs prescribed

Among the drugs used, thiazide diuretics were the most common124 (74.3%)followed by enalapril (98,58.7%) and nifedipine (39, 23.4%) as illustrated in **table 4.2**.

Table 4.2: Specific antihypertensive drugs prescribed for hypertension treatment

Drugs	Frequency (n)	Percentage (%)
Diuretics		
Thiazide	124	74.3
Frusemide	6	3.6
ACEIs		
Enalapril	98	58.7
CCB		
Nifedipine	39	23.4
Amlodipine	13	7.8
ARBs		
Lorsatan	37	22.2
Telmisartan	1	0.6
Beta blockers		
Atenolol	28	16.8
Carvedilol	2	1.2
Centrally acting		
Methyldopa	2	1.2

ACEIs-angiotensin converting enzyme inhibitor, CCB-calcium channel blockers, ARBs-angiotensin receptor blockers

The participants were either on monotherapy, two drug combinations and three or more drugs in a regimen. Most patients (93, 56.9%) were on two and three drugs (43, 25.8%). Only one patient was on more than three drugs. The various drug combinations are shown in **table 4.3.** Among the patients on monotherapy, the most commonly prescribed drug was ACEI (16, 51.6%), followed by a CCB (6, 19.4%). Among those on two drugs regimen, the most common combination was diuretic plus an ACEI 33(34%) followed by diuretic plus CCB at 21(22%). The other 4(4%) combinations included BB plus ACEI and BB plus ARB. For those prescriptions with three drugs, the most frequent combination was diuretic, BB and ACEI at 12(28%), followed closely by a

combination of diuretic, CCB and ACEI (11, 26%) and combinations with both ARB and ACEI plus any other drug (10, 23%).

Table 4.3: Specific regimens prescribed for hypertension treatment

Regimen	Drugs	Frequency	% Percentage
Monotherapy	ACEI	16	**51.6**
	CCB	6	19.4
	Diuretic	5	16
	Centrally acting	2	6.5
	ARB	2	6.5
Dual therapy	Diuretic+ ACEI	33	**34.4**
	CCB+ diuretic	21	21.9
	Diuretic+ ARB	17	17.7
	CCB+ ACEI	13	14.6
	Diuretic+ BB	5	5.2
	CCB+ ARB	2	2.0
	BB + ACEI	2	2.0
	CCB+ BB	1	1.0
	BB+ARB	1	1.0
	ACEI+ARB	1	1.0
Triple therapy	Diuretic +BB+ ACEI	12	**28.0**
	Diuretic +CCB+ ACEI	11	26.0
	ACEI+ ARB+ Diuretic	4	7.5
	ACEI+ ARB+ CCB	3	7.0
	ACEI+ ARB+ BB	3	7.0
	Diuretic +CCB+ ARB	3	7.0
	Diuretic +CCB+ BB	3	7.0
	Diuretic +BB+ ARB	3	7.0
	BB +CCB+ ACEI	1	2.3

ACEIs-angiotensin converting enzyme inhibitor, CCB-calcium channel blockers, ARBs-angiotensin receptor blockers, BB-beta blockers

4.5: Adherence to antihypertensive therapy

The patients who were adherent to antihypertensive medication were 112(67.5%) as measured by Morisky Medication Adherence Scale 8 (MMAS-8). The patients who were non-adherent to medication cited various reasons. The leading causes of non-adherence were lack of finances (59, 35%) and forgetfulness (38, 23%) as shown in **figure 4.4**. Other causes of non-adherence as cited

by the patients included; long duration of treatment (15, 9.0%), side effects to medication (13, 7.8%), inadequate knowledge on treatment (12, 7.2%)and fear of dependence (10, 6.0%) in that order.

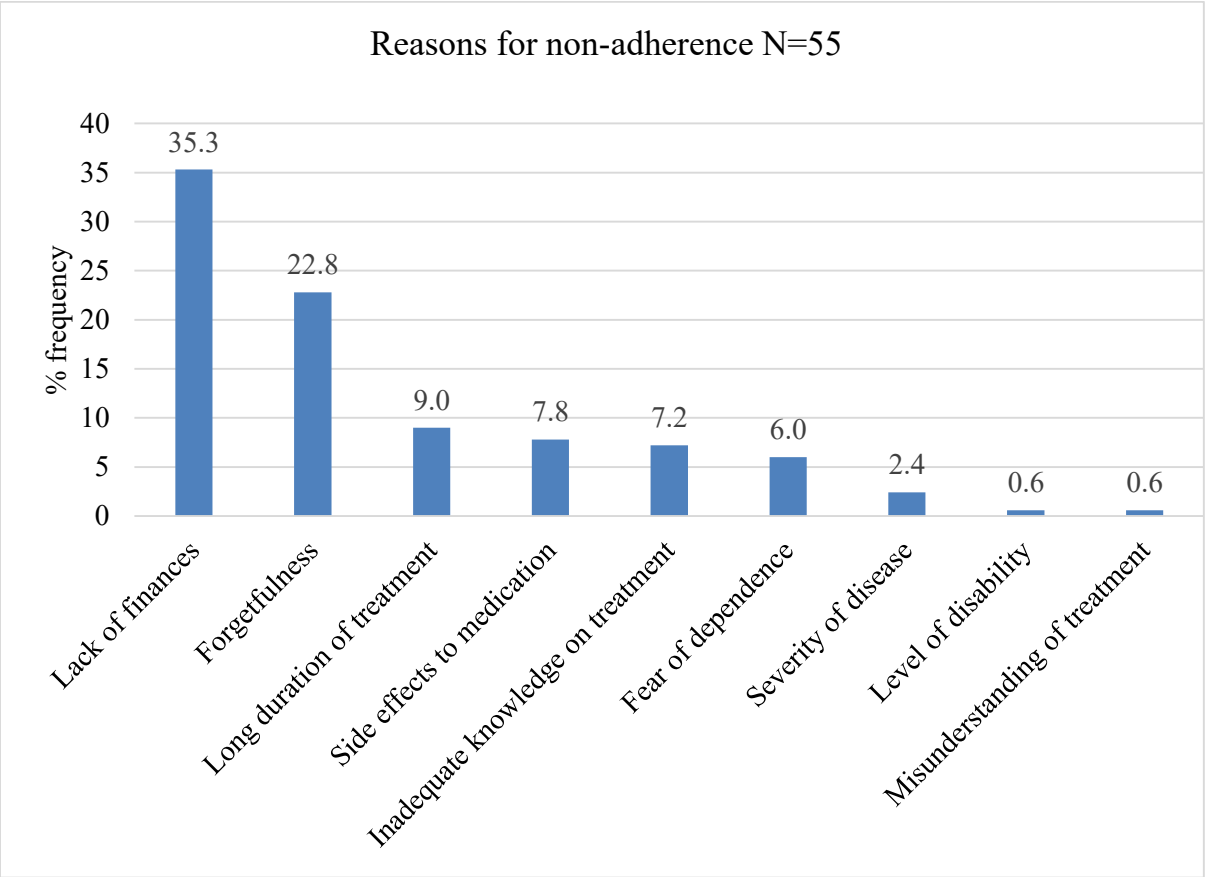


Figure 4.4: Causes of non-adherence to hypertension medication

4.6: Lifestyle modifications strategies in control of BP

The lifestyles practiced by participants that may influence the disease outcome are shown in the figure 4.5. Most patients (140, 83.8%) were restricting salt intake. Almost all patients avoided alcohol consumption and did not smoke at 166 (99.4%) and 165 (98.8%) respectively. A significant number (123,73.7%) were active for more than 30 minutes per day. However, 13 (7.8%) ate fruits daily.

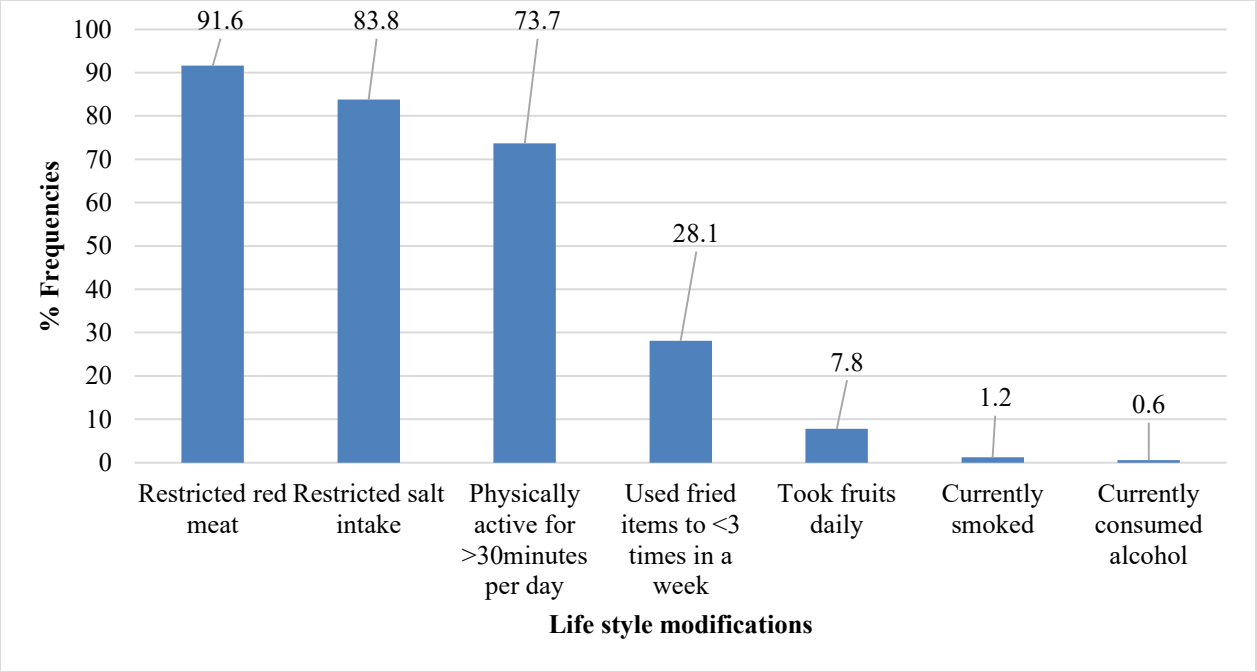


Figure 4.5: Lifestyle behavior among hypertensive patients as seen in this study

4.7: Determinants of blood pressure control among the study participants

A bivariate analysis was carried using Fischer's exact test between different predictor variables against BP control as shown in table 4.4. Adherence to medication (P=0.001), salt restriction (P=0.001) and consumption of red meat (P=0.001) to once weekly were found to be statistically significant in influencing blood pressure control. Those patients adhering to treatment were highly likely to have their BP controlled unlike those who were non-adherent (P=0.001). Most patients who consumed less salt intake and red meat had better BP control (P= 0.001). Other variables like age, sex, BMI, education level, marital status and having a comorbidity did not have a statistical significance in influencing BP control. Similarly, individual drugs taken by patients and different drug regimens were not shown to have statistical significance on BP control. A good proportion of those aged 65 years and less had their BP controlled. Higher number of males had their BP controlled than females. Being single was associated with better BP control as well as having a formal education.

Table 4.4: Relationship between blood pressure control and other study variables

Variable	Category	BP uncontrolled (n, %)	BP controlled(n, %)	P-value
Age	18-65	55 (56.1)	43 (43.9)	0.145
	≥65	44 (63.8)	25 (36.2)	
Sex	Male	24 (55.8)	19 (44)	0.595
	Female	75 (60.4)	49 (39.5)	
BMI	<25	27 (64.3)	15 (35.7)	0.88
	≥25	72 (47.4)	53 (42.4)	
Education level	Informal	25 (67.6)	12 (32.4)	0.311
	Formal	74 (56.9)	56 (43.1)	
Marital status	Single	3 (50)	3 (50)	0.668
	Married	96 (59.6)	65 (40.4)	
Adherence	Non-adherent	44 (81.5)	10 (18.5)	**0.001***
	Adherent	55 (49.1)	57 (50.9)	
Daily fruits intake	No	92 (59.7)	62 (40.3)	0.772
	Yes	7 (53.8)	6 (46.2)	
Use of fried foods	No	67 (55.8)	53 (44.2)	0.164
	Yes	32 (68.1)	15 (31.9)	
Salt restriction	No	22 (81.5)	5 (18.5)	**0.001***
	Yes	77 (55)	63 (45)	
Restriction of red meat to once weekly	No	14 (100)	0 (0)	**0.001***
	yes	85 (55.6)	68 (44.4)	
Smoking	No	97 (58.8)	68 (42.2)	0.514
	Yes	2 (100)	0 (0)	
Alcohol consumption	No	98 (59)	68 (41)	1
	Yes	1 (100)	0	
Duration of treatment	< 5 years	72 (59)	50 (41.0)	0.053
	≥5 years	67 (78.8)	18 (21.2)	
Number of antihypertensive drugs	≤2 drug	67 (54.5)	56 (45.5)	0.055
	≥3 drugs	32 (72.7	12 (27.3)	

*= statistically significant P-values

Eating fruits daily and also using fried foods less than three 3 times in a week were shown to be associated with controlled BP. However, smoking and consumption of alcohol were associated with uncontrolled BP. Being active for more than 30 minutes per day seemed to help in BP control. Though these relationships were not statistically significant. Increasing number of drugs in a regimen was associated with uncontrolled BP. Being on combination of CCB and a diuretic was associated with better BP control compared to the other combinations.

4.8: Relationship between adherence and other study variables

Bivariate analysis was carried out using Fischer's exact to find out the association between adherence and predictor variables. The results are shown in table 4.5. Some of the causes that were statistically significantly associated with non-adherence to antihypertensive therapy included: lack of finances to buy medication (P=0.001), inadequate knowledge on treatment (P=0.02), long duration of treatment (P= 0.001), side effects of the medications (P=0.004), forgetfulness and fear of dependence (P=0.001). Other factors like the number of antihypertensive drugs used, sex, age and duration of treatment were not shown to have statistically significance influence on adherence. Patients who were adherent increased with decreasing number of antihypertensive drugs used. However, as duration of treatment increased from less than five years to more than five years, adherence rate increased. Being young was associated with adherence and generally as age increased the rate of adherence decreased. Gender did not to affect adherence rate.

Table 4.5: Association between adherence and other study variables

Variable	Response	Non-adherent	Adherent	P-value
Lack of finances	No	15 (14.0)	92 (86.0)	**0.001***
	Yes	39 (66.0)	20 (33.9)	
Inadequate knowledge on treatment	No	46 (29.9)	108 (70.1)	**0.02***
	Yes	8 (66.7)	4 (33.3)	
Level of disability	No	53 (32.1)	112 (67.9)	0.325
	Yes	1 (100.0)	0 (0.0)	
Severity of illness	No	52 (32.1)	110 (67.9)	0.597
	Yes	2 (50.0)	2 (50.0)	
Long duration of treatment	No	43 (28.0)	108 (71.5)	**0.001***
	Yes	11 (73.3)	4 (26.7)	
Side effects	No	44 (29.0)	108 (71.1)	**0.005***
	Yes	9 (69.2)	4 (30.8)	
Forgetting to take medication	No	31 (24.2)	97 (75.8)	**0.001***
	Yes	23 (60.5)	15 (39.5)	
Misunderstanding of treatment instructions	No	53 (32.1)	112 (67.9)	0.325
	yes	1 (100.0)	0 (0.0)	
Fear of dependence	No	45 (28.8)	111 (71.2)	**0.001***
	Yes	9 (90.0)	1 (10.0)	
No. of antihypertensives	≤2	36 (29.5)	86 (70.5)	0.305
	≥3	18 (40.9)	26 (59.1)	
Duration of hypertension	<5 year	43 (35.2)	79 (64.8)	0.607
	≥5 years	11 (25.0)	33 (75.0)	
Age	<65	11 (25.0)	33 (75.0)	0.385
	≥65	28 (28.9)	69 (71.1)	
	Male	14 (33.3)	28 (66.7)	
Sex	Female	40 (32.3)	84 (67.7)	1.000

*= statistically significant p values

4.9 Independent Predictors of Blood Pressure control

Logistic regression analysis was carried out considering BP status as the outcome variable and the predictor variables. The results are shown in table 4.6.

Table 4.6: Independent predictors of BP control among the study population

	Bivariate regression		Multivariate regression	
Variable	**COR ratio (95% CI)**	**P - Value**	**AOR (95% CI)**	**P- Value**
Duration of HTN in years	1.08 (0.731-1.587)	0.380	0.98 (0.630-1.53)	0.94
Adherence	4.56 (2.09-9.95)	**0.001***	4.49 (1.98-10.14)	**0.001***
Salt restriction	3.6 (1.29-10.04)	**0.014***	2.92 (0.96-8.80)	0.058
Concurrent use of 2 drugs	0.62 (0.42-1.08)	0.102	0.66 (0.39-1.12)	0.128 :
Concurrent use of 3 drugs	0.81 (0.67-0.98)	**0.031***	0.86 (0.69-1.07)	0.176

*= statistically significant p values, AOR= adjusted odds ratio, COR=crude odds ratio.

Among the independent predictors of BP control were adherence to drugs, restricting salt in the diet and having a three-drug combination. Those who adhered to medications were 4.6 times more likely to have their BP controlled (COR=4.6, 95% CI=2.09-9.95, P=0.001) compared to those who did not. Those who avoided salt in their diet were 3.6 times more likely to have their BP controlled compared to those who did not (COR=3.6, 95% CI=1.29-10.04, P=0.014). Having a three-drug combination reduced the likelihood of BP control by19% (COR=0.81, 95% CI=0.67-0.98, P=0.031).

4.10: Independent predictor variables of non-adherence to antihypertensive drugs

Logistic regression was carried out to determine the predictors of adherence to medications. The status of adherence was the dependent variable and the results are shown in table 4.7.

Table 4.7. Independent predictor variables of non-adherence to antihypertensive drugs

	Bivariate analysis		**Multivariate analysis**	
Variable	**COR (95% CI**	**P -value**	**AOR (95% CI)**	**P-value**
Lack of finances	0.084 (0.388-0.180)	**0.001***	0.082 (0.031-0.221)	**0.001***
Inadequate knowledge on treatment	0.213 (0.061-0.742)	**0.015***	0.093 (0.0169-0.517)	**0.007***
Severity of disease	0.473 (0.648-3.450)	0.46	0.368 (0.0137-9.890)	0.552
Long duration of treatment	0.145 (0.0437-0.480)	**0.002***	0.068 (0.015-0.318)	**0.001***
Side effects	0.18 (0.053-0.619)	**0.006***	0.128 (0.023-0.697)	**0.017***
Forgetting to take medication	0.203 (0.969-0.448)	**0.001***	0.231 (0.082-0.651)	**0.006***
Fear of dependence	0.045 (0.005-0.366)	**0.004***	0.039 (0.004-0.424)	**0.008***

***=S**tatistically significant p values, COR=crude odds ratio, AOR= adjusted odds ratio

Among the independent predictors of non-adherence were lack of finances (COR=0.084, 95% CI= 0.388-0.180, P=0.001), inadequate knowledge on treatment (COR=0.213, CI=0.061-0.742, P=0.015), long duration of treatment (COR=0.145, 95% CI= 0.0437-0.480, P=0.002), forgetting to take medication (COR=0.203, 95% CI=0.969-0.448, P=0.001) and fear of dependence (COR=0.045, 95% CI=0.005-0.366, P=0.004).

CHAPTER FIVE: DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1: Preamble

This chapter relates the findings of the current study to others and explains the reasons behind such results on the following areas: the type of drugs used in the hypertension management, the BP control rate, rate and determinants of adherence and lifestyle practices among hypertensive patients.

5.2: Discussion

Majority of the study participants were females. This finding is consistent with other studies done in Kenya and other countries (4,13,15,64). This revelation can be attributed to the African gender behavioral differences with women more likely to seek medical help when they are unwell unlike men. However, in other parts of the world such as Bangladesh, males predominate probably due to high prevalence of hypertension among men (36,74).

Our study participants principally comprised of middle aged, obese hypertensive patients. Although studies have shown positive relationships between obesity and hypertension (13,15), we do not know whether they were obese before being diagnosed with hypertension because this was beyond the scope of the present study. In the current study, most of the participants had attained at least a primary level of education which is consistent with other studies done under the same setting (4,23,75). Almost all the hypertensive patients in the study were married and this tallies with other related studies done (14,59,75) where majority of participants had attained a primary level of education.

Diabetes was the commonest comorbidity and this finding was similar to other related studies done locally (13,14,15). Hypertension and diabetes have similar risk factors: overweight, physical inactivity, advanced age and poor diet (22) and this could explain their co-existence. Most participants had been hypertensive for less than five years. Other recent studies had similar findings (13,64) which probably could be attributed to the rising hypertension burden (20,76).

Majority of the study population, had a diuretic in their regimen and thiazide diuretic was commonly used. This was in consistent with other studies (13,15,75).. For example, a study done in a referral hospital in Nigeria found diuretics were mostly prescribed at 44% as monotherapy and 89% as combination therapy (77). Diuretics are affordable and are readily available in our public hospitals. Furthermore, the findings are in line with current guidelines which advocate for a diuretic as first line drug (9) for the black population

In this study among the participants with dual therapy, a combination of an ACEI plus a diuretic was the commonest and, in the monotherapy, ACEIs were the most popular. Similar findings have been shown by related studies done across Kenya (13,14,15). Particular ACEIs and diuretics in addition to being effective in reducing BP, are readily available in most of our public hospitals across Kenya and they are relatively cheap compared to other antihypertensives. Furthermore, the current Kenyan guidelines advocate for the use of either a diuretic or CCB as monotherapy and an ACEI as add on for stage two hypertension. Prescribing patterns differ as shown by several studies done worldwide. A study in Bangladesh on patterns of drugs prescribed for hypertension treatment found that most patients were on monotherapy at 62%, among the single drugs used ARBs were the commonest at 37% followed by CCBs at 33%, diuretics were the least common at 1.5% (36). This could be due to different economic status of different regions which affect the affordability and hence the choice of drugs.

Blood pressure control rate in this study was below average. Recent studies carried out across the country had the similar ranges and all were below average (4,13) with the highest among the being 49% (23). Previous studies recorded lower rates, for example: a study done in a regional referral hospital in central Kenya in 2013 had control rate of 33% (15) which was attributed to old age, having diabetes and being on three or more drugs. In this current study, the improvement in BP control rate was attributed to high adherence rate and improved lifestyle modifications with majority of participants restricting salt in their diets, not smoking, not consuming alcohol and restricting red meat consumption to once weekly. Having three or more drugs in the regimen significantly reduced the odds of having controlled BP as has been revealed by other studies (13,15). This is contrary to the expectations. For the patients to be put on two or three drugs

regimen they must have had consistently high BP measurements which could be due to refractory hypertension, inadequate dosing and non-adherence to medications due to pill burden.
Predictors of good BP control were adherence, eating fruits daily and restricting salt in the diet. This was in consistent with other studies that found adherence as independent predictor variable to BP control. For example a study done in Japan on hypertension related drug adherence and knowledge found that adherence was significantly associated with adequate blood pressure control (78).

The rate of adherence was above average which is comparable to a study done in Kiambu hospital which was 62.4% (4). In a teaching hospital in Nigeria the rate of adherence among hypertensive outpatients was 33% (65) and in Japan a study on hypertension related knowledge and adherence found the rate to be 37% (78). These studies show that adherence rate in Kenya was higher than other parts of the world. This could be attributed to the rising awareness through campaigns with non-governmental organizations about the illness especially in central Kenya where prevalence of BP is high (79). Lack of finances was one of the predictors of non-adherence that was independently significant. These findings are in line with studies done locally (4,65). For instance in Kiambu-Kenya research done on adherence to hypertensive medication found that the participants who earned less than KES 30,000 were 1.4 times less likely to adhere to their medication than those that earned more than that (4). The cost of medication can be relatively high in our Kenyan setting especially for patients with poly therapy and have low income. In this present study other predictor variables to non-adherence were inadequate knowledge on treatment, duration of treatment, side effects, forgetfulness and fear of dependence all of which independently influenced adherence. Related studies showed similar findings (48,65,77,78) . An example is a study done on adherence to hypertension medication which found predictor variables to adherence being male gender, low daily dose frequency, absence of side effects and knowledge on medication(53).

Lifestyle modifications are necessary in successful BP treatment. Most patients restricted salt in their diet and restricted red meat consumption to once weekly. These were statistically significant on BP control and are inconsistent with other studies (64,67,69). Extra salt raises the amount of sodium in the blood stream and this leads to extra water being retained resulting to high blood

pressure. Red meat on the other hand contains a lot of saturated fat which in turn lead to atherosclerosis and hence increased blood pressure due to raised peripheral resistance. In the current study almost all the participants avoided alcohol and did not smoke. These findings were comparable to other studies (63,67). This is because in the general population, there is understanding that if one is sick, they should neither smoke nor consume alcohol.

Other lifestyle modifications that had a role in BP control in this study were taking fruits daily and moderate exercise for more than thirty minutes per day. A randomized trial done on effects of lifestyle modifications on BP found that weight loss, reduced salt intake, increased physical activity and observing DASH diet lowered BP(69). Observing healthy lifestyle was also found to have an impact on all-cause and cardiovascular mortality after stroke in a study done in USA, where abstaining from smoking and exercising regularly had independent association on all-cause mortality reduction (68). The overall effects of lifestyle modifications on BP reduction and in prevention of cardiovascular events cannot be underestimated as outlined in the guidelines and demonstrated by the studies(1,59,79).

5.3: Conclusion

The commonly prescribed antihypertensive drugs are diuretics and angiotensin converting enzyme inhibitors. The overall BP control rate among adult patients in Murang'a Sub county hospital is poor although the rate of adherence to antihypertensive medication was above 50%. The major determinants of non-adherence were lack of finances and forgetfulness. Proper lifestyle practices were inadequate.

5.4: Limitations of the study

Records on the patients had issues with some files missing, others were there but lacking important information such as weight and BP measurements. The study was carried out in one sub-county hospital and so the results could not be inferred to the whole county or a bigger region. Due to time limit the study only concentrated on just a few variables that affect BP control, others like clinician factors were left out.

5.5: Recommendations

5.5.1 Recommendations for policy and practice

1. One of the major cause of non-adherence to medication was lack of finances, the hospital should ensure that there is constant supply of antihypertensive medicines at subsidized prices to all their clientele. There should be a waiver system to the patients who cannot afford medicines and also other clinical services.
2. There should be customized review forms that will ensure that there is proper use of medications and side effects to antihypertensive medications are captured and addressed since these were shown to affect adherence.
3. Patients should be involved in the management of their illness through education, counselling on adherence to medication and proper lifestyle practices which were shown to be inadequate.

5.5.2 Recommendations for research

1. Extensive studies to be carried out on why the patients on three drug regimens are more likely to have uncontrolled BP.
2. Studies to be carried out on the knowledge level of the patients about their illness and the management including medication they are on since not a single study is published on this from Muranga County.
3. Studies to be done to find out why among the hypertensive patients' the female gender predominate

REFERENCES

1. **Lane M.S.** treatment of hypertension: jnc 8 and more. pharmacist letter/prescribers letter. 2014;3120(february):209–472.
2. **WHO**. a global brief on hypertension. WHO press. 2013;(geneva 27):40.
3. **Osterberg L, Blaschke t**. adherence to medication. new England journal of medicine 2005;353(5):487–97.
4. **Kimuyu, Boniface M**. factors associated with adherence to antihypertensive treatment in Kiambu district hospital. uon repository.2014;
5. **Gosmanova E.O, Kovesdy C.P**. adherence to antihypertensive medications: is prescribing the right pill enough? nephrol dial transplant. 2015;30(10):1649–56.
6. **Esc C, Cifkova R, Bo M, Republic C, UkA.D, Miguel l**, et al. 2013 esh / esc guidelines for the management of arterial hypertension the task force for the management of arterial hypertension of the european society of hypertension (ESH) and of the european society. eur heart j. 2013;(34):2159–219.
7. **Committee OAdvisory.** hypertension : target blood pressure levels. guidel advis comm 2005;1–2.
8. **James P.A, Oparil S, Carter B.L, Cushman W.C, Dennison-himmelfarb C, Handler J**, et al. evidence-based guideline for the management of high blood pressure in adults. jama;1097(5):1–14.
9. **James P.A, Ortiz E.**JNC 8 hypertension guideline algorithm. jama. 2014;311(5):507–20.
10. **Mancia G, Fagard R, Narkiewicz K, Redon J, Zanchetti A, Böhm M**, et al. 2013 esh/esc guidelines for the management of arterial hypertension: the task force for the management of arterial hypertension of the european society of hypertension (ESH) and of the european society of cardiology (ESC). eur heart j. 2013;34(28):2159–219.
11. **William B. Applegate W.B, Salem W, Basile J.N, Charleston, Carey R, Charlottetsville D.V**et al. JNC 7th report on prevention , detection , evaluation , and treatment of. nih publ. 2003;7(03-5233):52.
12. **Kenya Association of Physicians, the Kenya Cardiac Society and the Kenya Renal Society**.The MOH: protocol for the identification and management of hypertension in adults in primary care. healthy heart Africa 2015;7 (32): 1-11.

13. **Mbui J, Oluka M, Guantai E.S.A**. treatment of hypertension in adult patients at Ruiru Sub-county Hospital in Kenya. uon repository, 2015;(November):70.
14. **Mongi A, Nyamu D, Karimi P, Maru s.** evaluation of the management of hypertension among diabetic and non-diabetic adult outpatients at a referral hospital in Kenya. african j pharmacol ther. 2016;5(2):93–9.
15. **Mutua E.M, Gitonga M.M, Mbuthia B, Muiruri N,Cheptum J.J, Maingi T**. level of blood pressure control among hypertensive patients on follow-up in a regional referral hospital in central kenya. pan afr med j. 2014;18:278.
16. **Bajaj J.K, Sood M, Singh S.J, Jerath P.** prescription patterns of antihypertensive drugs and adherence to jnc vii guidelines in a tertiary care hospital in north india. int j med clin res. 2012;3(2):118–20.
17. **Alba-leonel A, Carvajal A, Fierro I, Castillo-najera F,Campos-ramos O, Villa-romero A**, **et al**. prescription patterns of antihypertensives in a community health centre in mexico city: a drug utilization study. fundam clin pharmacol. 2016;30(3):276–81.
18. **Gu Q, Burt V.L, Dillon C.F, Yoon S**. trends in antihypertensive medication use and blood pressure control among united states adults with hypertension: the national health and nutrition examination survey, 2001to2010. american heart association. 2012;126(17):2105–14.
19. **Adeloye D, Basquill C.** estimating the prevalence and awareness rates of hypertension in Africa: a systematic analysis. plos one. 2014;9(8).
20. **WHO**.global health observatory data: raised blood pressure. who press. 2016. p. 39–40.
21. **World Health Organization**. world health statistics 2012. world heal stat2012;(2):33–46.
22. **Ministry of Health**. Kenya stepwise survey for non communicable disease risk factors 2015 report. knbs. 2015;2–12.
23. **Joshi M.D, Ayah R, Njau E.K, wanjiru r, kayima jk, njeru ek, et al**. prevalence of hypertension and associated cardiovascular risk factors in an urban slum in nairobi, Kenya: a population-based survey. bmc public health. 2014;14:1177.
24. **Van de vijver S.J.M, Oti So, Agyemang C, Gomez GB, Kyobutungi C.** prevalence, awareness, treatment and control of hypertension among slum dwellers in nairobi, Kenya. j hypertens. 2013;31(5):1018–24
25. **Stanifer J.W, Bing B, Tolan S, Helmke N, Mukerjee R, Naicker S, et al.** the

epidemiology of chronic kidney disease in sub-saharan africa: a systematic review and meta-analysis. lancet glob heal. 2014;2(3):174–81.

26. **Papazafiropoulou A, Skliros E, Sotiropoulos A, Papafragos C, Gikas O, Apostolou O, et al.** prevalence of target organ damage in hypertensive subjects attending primary care: c.v.p.c. study (epidemiological cardio-vascular study in primary care). bmc fam pract. 2011;12(1):75.
27. **Tiwaskar M.** end organ protection 3 : 9. med updat. 2012;22:157–63.
28. **Addo J, Smeeth L, Leon D.A.** hypertensive target organ damage in ghanaian civil servants with hypertension. plos one. 2009;4(8):1–9.
29. **Jonelle E. Wright J.E, Garth J. W. Edwards M.** major outcomes in high-risk hypertensive patients randomized to or calcium channel blocker vs diuretic. j am med assoc. 2002;288(23):2981–97.
30. **Shimamoto K, Fujita T, Ito S, Naritomi H, Ogihara T, Shimada K, et al.** impact of blood pressure control on cardiovascular events in 26,512 japanese hypertensive patients: the japan hypertension evaluation with angiotensin ii antagonist losartan therapy (j-health) study, a prospective nationwide observational study. hypertens res. 2008;31(3):469–78.
31. **Neal B, Macmahon S.C.N.** effects of ace inhibitors, calcium antagonists, and other blood pressure lowering drugs: results of prospectively designed overviews of randomised trials. lancet. 2001;10(3):28–9.
32. **Rosendorff C, Black H.R, Cannon C.P, Gersh B.J, Gore J, Izzo J.L, et al.** treatment of hypertension in the prevention and management of ischemic heart disease: am hear assoc. 2007;50(2):e28–55.
33. **Li Y, Li X, Huang Z, Yang G, Zhang G, Zhao S, et al.** a randomized, double blind, placebo-controlled, multicenter phase ii trial of allisartan isoproxil in essential hypertensive population at low-medium risk. plos one. 2015;10(2):e0117560.
34. **Grimshaw JM, Russell IT**. effect of clinical guidelines on medical practice: a systematic review of rigorous evaluations. lancet. 1993;342(8883):1317–1322.
35. **Shimamoto K, Ando K, Fujita T, Hasebe N, Higaki J, et al:**hypertension tjs. chapter 5. treatment with antihypertensive drugs. japanese soc hypertens. 2009;32(1):33–9.
36. **Hasan J.** pattern of drugs prescribed for treatment of hypertensive patients : bangladesh. acad journals. 2016;10(25):521–5.

37. **Bakris G.L, Lack HR, Cushman WC, Green LA, Izzo JL, Jones DW, et al.** clinician ' s corner the seventh report of the joint national committee on prevention , detection , evaluation , and treatment. 2003;289(19):2560–72.
38. **Robert S. Porter Justin L. Kaplan.** the merck manual. nineteenth. lane keryn ag, editor. united states: gary zako; 2011.
39. **The lancet**. hypertension: an urgent need for global control and prevention. lancet. 2014;383(9932):1861.
40. **Guwatudde D, Nankya-mutyoba J, Kalyesubula R, Laurence C, Adebamowo C, Ajayi I, et al.** the burden of hypertension in sub-saharan africa: a four-country cross sectional study. bmc public health. 2015;15:1211.
41. **Ngaruiya C.Etyang A. Kamuya D,Kapesa S.** hypertension management in Kenya : on the role of the emergency department table : sample survey questions and responses. yale-emerg med. 2015;9.
42. **Krousel-wood M, Holt E, Joyce C, Ruiz R, Dornelles A, Webber ls et al.** antihypertensive medication adherence assessment method and cardiovascular risk. j hypertens. 2014;2.
43. **Jarari N, Rao N, Peela J.R, Ellafi K.A, Shakila S, Said AR, et al.** a review on prescribing patterns of antihypertensive drugs. clin hypertens 2015;22:7.
44. **Musinguzi G, Nuwaha F.** prevalence, awareness and control of hypertension in Uganda. plos one. 2013;8(4).
45. **Lindholm LH.** the problem of uncontrolled hypertension. j hum hypertens. 2002;16:3–9.
46. **Kronish IM, Woodward M, Sergie Z, Ogedegbe G, Falzon I, Mann DM.** impact of drug class on adherence to antihypertensives. am hear assoc. 2011;123:1611–21.
47. **Sabaté OBryddcs**. adherence to long-term therapies world health organization 2003. isbn. 2003;110.
48. **Ambaw A, Alemie G, W/yohannes S, Mengesha Z.** adherence to antihypertensive treatment and associated factors among patients on follow up at university of gondar hospital, northwest ethiopia. bmc public health. 2012;12(1):282.
49. **Esposti ID, Saragoni S, Benemei S, Batacchi P, Geppetti P, Di Bari M, et al.** adherence to antihypertensive medications and health outcomes among newly treated hypertensive patients. clin outcomes res. 2011;3(1):47–54.

50. **Elliott W.J.** improving outcomes in hypertensive patients : focus on adherence and persistence with antihypertensive therapy. clin hyoertens. 2009;11(7):376–82.
51. **Hameed M.A, Tebbit I, Jacques N, Thomas M, Dasgupta I.** non-adherence to antihypertensive medication is very common among resistant hypertensives: results of a directly observed therapy clinic. j hum hypertens. 2016;30(2):83–9.
52. **Fitz-simon N, Bennett K, Feely J.** a review of studies of adherence with antihypertensive drugs using prescription databases. ther clin risk manag . 2005;1(2):93–106.
53. **Lin Y, Huang Y, Yang Y, Wu J, Chang C, Lu F.** adherence to antihypertensive medications among the elderly : a community-based survey in tainan city , southern taiwan. taiwan geriatr gerontol. 2007;3(2):176–89.
54. **Schmieder R.E, Ott C, Schmid A, Friedrich S, Kistner I, Ditting T, et al.** adherence to antihypertensive medication in treatment-resistant hypertension undergoing renal denervation. j am heart assoc. 2016;5(2):1–12.
55. **Collins S.R, Battleman D.S, Schwartz J.S.** predictors of adherence with antihypertensive and lipid-lowering therapy. arch intern med. 2005;165:1147–52.
56. **Krousel-wood M, Joyce C, Holt E, Muntner P, Webber L.S, Morisky De, et al.** predictors of decline in medication adherence: results from the cohort study of medication adherence among older adults. am hear assoc. 2011;58(5):804–10.
57. **Morisky De, Ang a, Krousel-wood M, Ward H.J.** predictive validity of a medication measure in an outpatient setting. j clin hypertens. 2008;5(10):348–54.
58. **Saadat Z, Nikdoust F, Aerab-sheibani H, Bahremand M, Shobeiri E, Saadat H, et al.** adherence to antihypertensives in patients with comorbid condition. nephrourol mon 2015;7(4):e29863.
59. **El-hay S, Mezayen Se,El.** knowledge and perceptions related to hypertension , lifestyle behavior modifications and challenges that facing hypertensive patients abstract : j nurs heal sci. 2015;4(6):15–26.
60. **Mancia GFagar RNarkiewicz K, Redo´n J,Aza et al.** 2013 practice guidelines for the management of of hypertension (ESH) and the european society of ask force for the management of arterial hypertension. j hypertens. 2013;31:1925–38.
61. **Ramanathan R, Reba W, Nandini G, Mary G, Pranav M. et al**. adult hypertension clinical practice guidelines. off healthc improv. 2013;31.

62. **Aubert L, Bovet P, Gervasoni J, Rwebogora A, Waeber B,Paccaud F.** knowledge, attitudes, and practices on hypertension in a country in epidemiological transition. am hear assoc. 1998;(31):1136–45.
63. **Marfo Afa, Mercy Fto, Addo O, Saana I.I.** innovare academic sciences ghanaian hypertensive patients understanding of their medicines and life style modification for managing hypertension. int j pharm pharm sci. 2014;6(4):165–70.
64. **Tesema S, Disasa B, Kebamo S, Kadi E.** open access knowledge , attitude and practice regarding lifestyle modification of. prim heal care. 2016;6(1):1–4.
65. **Iyalomhe G, Iyalomhe S.** hypertension-related knowledge , attitudes and life-style practices among hypertensive patients in a sub-urban nigerian community. j public heal epidemiol. 2010;2(july):71–7.
66. **Chiuve S, Mccullough M.L, Sacks FM, Rimm E.B.** healthy lifestyle factors in the primary prevention of coronary heart disease among men benefits among users and nonusers of lipid-lowering and antihypertensive medications. 2006;(114):160–7.
67. **Durai V, Muthuthandavan A.R.** knowledge and practice on lifestyle modifications among males with hypertension. ndian j community heal /. 2015;27(01):142–9.
68. **Towfighi A, Markovic D, Ovbiagele B.** impact of a healthy lifestyle on all-cause and cardiovascular mortality after stroke in the usa. j neurol neurosurg psychiatry. 2012;83(1):146–51.
69. **Svetkey L.P, Erlinger T.P, Vollmer W.M, Feldstein A, Cooper I.S, Appel L.J, et** al. effect of lifestyle modifications on blood pressure by race, sex, hypertension status, and age. j hum hypertens. 2005;19(1):21–31.
70. **Abdelraziq AE, Ibrahim M, Osama H, Aymen A.** assessment of knowledge , attitudes and practice of general public attending el shohada primary health care unit regarding hypertension. int j recent trends life sci math. 2015;2(may):16–20.
71. **Kilele M, Opiyo C, Omolo C, Kakinyi M, Mbaruku R et al.** the 2009 Kenya population and housing census - population distribution by age, sex and administrative units. knbs.2010;ic:546.
72. **Kasiulevičius V, Šapoka V, Filipavičiūtė R.** sample size calculation in epidemiological studies. gerontologija. 2006;7(4):225–31.
73. **Lin YS, Ho Y, Hu CJ, Su WW, Hsu KY, Shen WW, et al**. development of a taiwan

version of the eight-item morisky medication adherence scale and factors influencing patients' comprehension. j exp clin med [internet]. 2013;5(2):77–80.

74. **Dhanaraj E, Raval A, Yadav R, Bhansali A, TiwariPp.** prescription pattern of antihypertensive agents in t2dm patients visiting tertiary care centre in north india. int j hypertens. 2012;2012(1155):9.
75. **Hulzebosch A, Van de vijver S, Egondi T, Oti SO, Kyobutungi C.** profile of people with hypertension in nairobi's slums: a descriptive study. global health. 2015;11(1):26.
76. **Department of health and human services**.Health resources and services administration. heal resour serv adm usa. 2014;1–6.
77. I**geria N, Etuk E, Isezuo SA, Chika A, Akuche J, Ali M.** prescription pattern of a nti - hypertensive drugs in a tertiary health institution in. ann afr med. 2008;7(3):128–32.
78. **Amonov,Malik Y.Y**. hypertension-related knowledge , practice and drug adherence among inpatients of a hospital in samarkand , uzbekistan. nagoya j med sci. 2014;76:255–63.
79. K**ibachio J, Maree e, Nyanjau l, Gathecha G, Mwangi M, Ann et al.** Ministry of health Kenya national guidelines for cardiovascular diseases management division of non-communicable diseases Republic of Kenya. 2018;8–238.

APPENDICES

APPENDIX 1: CLASSES OF ANTIHYPERTENSIVE DRUGS

TABLE 2.2: CLASSES OF ANTIHYPERTENSIVE DRUGS

Class	Drug	Usual dose range in mg/day	Usual daily frequency
Thiazide diuretics	Hydrochlorothiazide	12.5-50	1-2
	Chlorothiazide	125-500	1
	Indapamide	1.25-2.5	1
Loop diuretics	bumetanide	0.5-2	2
	furosemide	20-80	2
	torsemide	2.5-10	1
Potassium-sparing diuretics	amiloride	5-10	1-2
	triamterene (Dyrenium)	50-100	1-2
Aldosterone receptor blockers	eplerenone	50-100	1
	spironolactone	25-50	1
Beta blockers	atenolol	25-100	1
	bisoprolol	2.5-10	1
	metoprolol	50-100	1-2
	propranolol	40-120	1
	timolol	60-180	1
BBs with intrinsic sympathomimetic activities	acebutolol	200-800	2
	pindolol	10-40	2
Combined alpha- and BBs	carvedilol	12.5-50	2
	labetalol	200-800	2
ACEIs	benazepril	10-40	1
	captopril	25-100	2
	enalapril	5-40	1-2
	fosinopril	10-40	1

	lisinopril	10-40	1
Angiotensin II receptor blockers	candesartan	8-32	1
	irbesartan	150-300	1
	losartan	25-100	1-2
	telmisartan	20-80	1
	valsartan	80-320	1-2
CCBs (non-dihydropyridines)	Diltiazem extended release	180-420	1
	verapamil immediate release	80-320	2
	verapamil long acting	120-480	1-2
CCBs— Dihydropyridines	amlodipine	2.5-10	1
	felodipine	2.5-20	1
	nicardipine sustained release	60-120	2
	nifedipine long-acting	30-60	1
Alpha-1 blockers	Doxazocin	1-16	1
	Prazosin	2-20	2-3
	Terazosin	1-20	1-2
Central alpha-2 agonists and other centrally acting drugs	clonidine	0.1-0.8	2
	clonidine patch	0.1-0.3	1 wkly
	methyldopa	250-1,000	2
	reserpine	0.1-0.25	1
	guanfacine	0.5-2	1
Direct vasodilators	hydralazine	25-100	2
	minoxidil	2.5-80	1-2

APPENDIX 2: DATA COLLECTION FORM

Date: _____ unique number_____

Demographic characteristics

1. Age (years) …….

2. Sex I) Male ☐

   II) Female ☐

3. Height (cm) …….....

4. Weight (Kg) ……..

5. BMI ……..

6. Education level ☐ I) Informal

   ☐ II) Primary

   ☐ III) Secondary

   ☐ IV) University/college

7. Marital status:

   a). Single ( ) b). Married ( ) c).separated ( ) d). Divorced ( )

   e). Widowed ( ) f). Other (specify)

8. Occupation status:

   a). student ( ) b).Salaried ( ) c). Self-employed ( ) d). Retired ( )

9. Denomination:

   a). Catholic ( ) b). Protestant ( ) c). Muslim ( ) d).Atheist ( ) e).other ( )

10. Approximate Monthly income in KES.

    a). <5000 ( ) b). 5000-10,000 ( ) c).11000-50,000 ( ) d).>50,000 ( )

Co-morbidities present and their duration in months (Tick if present)

Co-morbidity	duration in months
1. Diabetes ( )	……
2. Renal problems ( )	……
3. Cardiovascular disease ( )	…….
4. Others (specify)	
I. . ……..	…….
II. . ……..	…….
III. . ……..	…….
IV. . ……..	…….
V. . ……..	…….

Details of Hypertension Management

1. Date of diagnosis of HTN (DD/MM/Year) …….
2. Number of months on hypertensive treatment ……..
3. BP reading at diagnosis Systolic……. mmHg diastolic……..mmHg
4. Latest BP reading Systolic……. mmHg diastolic ……. mmHg
5. **Antihypertensive drugs prescribed (last visit only)**

Class	Specific drug	Dose

6. Designation of prescriber (Tick as appropriate)

a). Clinical Officer ( ) b).Medical officer ( ) c). Consultant ( ) d). other (specify)

APPENDIX 3: INTERVIEW GUIDE

Section 1: Morisky Medication Adherence Scale: MMAS-8 (tick yes or no)

1) Do you sometimes forget to take your pills?
   Yes ( ) no ( )
2) People sometimes miss taking their medications for reasons other than forgetting. Thinking over the past two weeks, were there any days when you did not take your medicine?
   Yes ( ) no ( )
3) Have you ever cut back or stopped taking your medicine without telling your doctor because you felt worse when you took it?
   Yes ( ) no ( )
4) When you travel or leave home, do you sometimes forget to bring along your medicine?
   Yes ( ) no ( )
5) Did you take all your medicine yesterday?
   Yes ( ) no ( )
6) When you feel like your symptoms are under control, do you sometimes stop taking your medicine?
   Yes ( ) no ( )
7) Taking medicine every day is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?
   Yes ( ) no ( )
8) How often do you have difficulty remembering to take all your medicine?
   A. Never/rarely
   B. Once in a while
   C. Sometimes
   D. Usually
   E. All the time

☐ Adherent <3 Non-adherent ≥3

SECTION II

WHAT CAUSES NON-ADHERENCE TO MEDICATION. (TICK APPROPRIATELY)

A.Social and economic factors	yes	No
1. Lack of finances		
2.culture and beliefs about illness and treatment		
3.family dysfunction		
4.Inadequate knowledge on treatment		
B.Condition-related factors		
1.level of disability (physical, psychological, social)		
2.severity of the disease		
3.availability of effective treatments.		
C.Therapy related factors		
1.duration of treatment		
2.complexity of the medical regimen		
3.frequent changes in treatment		
4.side-effects		
D.Patient related factors		
1.forgetfulness		
2.anxieties about possible adverse effects		
3.misunderstanding of treatment instructions		
4.fear of dependence		

SECTION III:

LIFESTYLE MODIFICATION PRACTICE

(Tick yes or no)

1. Do you take fruits daily

   Yes ( ) no ( )

2. Do you use fried items to less than 3 times per week?

   Yes ( ) no ( )

3. Do you restrict salt intake?

   Yes ( ) no ( )

4. Do you restrict intake of Mutton, beef, and other red meat to once weekly?

   Yes ( ) no ( )

5. Are you currently smoking?

   Yes ( ) no ( )

6. Are you currently consuming alcohol?

   Yes ( ) no ( )

7. Are you physically active for more than 30 minutes per day?

   Yes ( ) no ( )

APPENDIX 4 : KISWAHILI VERSION

MWELEZO WA MAHOJIANO

Sehemu ya kwanza: **Utafiti wa kuzingatia dawa ukitumia mwongozo wa Morisky**

1. Je, wakati mwingine huwa unasahau kukunywa dawa?

   Ndio ( ) La ( )

2. Wakati mwingine watu hukosa kunywa dawa kwa sababu zingine isipokuwa kusahau. Je, kwa wiki mbili zilizopita, kuna siku yoyote ambayo hukunywa dawa?

   Ndio( ) La ( )

3. Je, ushawahi punguza ama kusimamisha kunywa dawa kabla ya kumjulisha daktari kwa sababu ulijisikia mgonjwa Zaidi ulipokunywa?

   Ndio( ) La ( )

4. Unaposafiri au kutokanyumbani, kuna wakati mwingine huwa unasahau kubeba dawa?

   Ndio( ) La ( )

5. Je, ulikunywa dawa zako zote jana?

   Ndio( ) La ( )

6. Wakati unajisikia kana kwamba umeweza kudhibiti dalili za ugonjwa, kuna wakati huwa unaacha kunywa dawa?

   Ndio( ) La ( )

7. Watu wengine huwa wanaona kana kwamba kunywa dawa kila siku niusumbufu. Je, ushawahi jiskia unasumbuka kutii mpangilio wa matibabu?

   Ndio( ) La ( )

8. Je, mazoea yako ya ugumu wa kukumbuka kunywa dawa yako aje?

   A. Kamwe
   B. Mara moja kwa kipindi kirefu
   C. Kawaida
   D. Wakati wote

☐ Ameambatana ☐ Hajaambatana

SEHEMU YA PILI

SABABU ZA KUTO-AMBATANANA MATIBABU (JIBU NDIO AU LA)

A. sababu za kijamii na kiuchumi	Ndio	La
1. kukosa fedha		
2. utamaduni na Imani kuhusu ugonjwa na matibabu		
3. Mgogoro wa kifamilia		
4. Maarifa haba kuhusu matibabu		
B. Sababu zinazohusiana na hali		
1.kiwango cha ulemavu (kisaikologia, kimwili, kijamii)		
2.ukali wa ugonjwa		
3.kutopatikana kwa matibabu inayofaa		
C. Sababu zinazohusiana na tiba		
1.muda wa matibabu		
2.utata wakikosi cha matibabu		
3.kubadilishwa kwa matibabu mara kwa mara		
4.madhara ya matibabu		
D. sababu zinazohusiana na mgonjwa		
1.usahaulifu		
2.wasiwasi kuhusu madhara inayoweza kutokea		
3.kutoelewa maelekezo ya matibabu		
4.hofu ya utegemezi		

SEHEMU YA TATU

MAZOEA YA MTINDO WA MAISHA

1. Je, huwa unakula matunda kilasiku?

   Ndio ( ) La ( )

2. Je, huwa unakula chakula cha kukaangwa chini ya mara tatu kwa wiki?

   Ndio ( ) La ( )

3. Je, huwa unajizuia utumiaji wa chumvi?

   Ndio ( ) La ( )

4. Je, huwa unajizuia ulaji wanyama ya kondoo, ngomb'e na nyama zingine nyekundu kwa mara moja kwa wiki?

   Ndio ( ) La ( )

5. Je, kwa sasa wewe wavuta sigara?

   Ndio ( ) La ( )

6. Je, kwa sasa wewe watumia pombe?

   Ndio ( ) La ( )

7. Je, wewe unafanyisha mwili mazoezi kwa muda unaozidi dakika thelathini kila siku?

   Ndio ( ) La ( )

APPENDIX 5: INFORMED CONSENT INFORMATION

CONSENT EXPLANATION FORM

Title of the study

Evaluation of the management of hypertension among adult patients in Murang'a south Sub-County Hospital.

Institution

Department of Pharmaceutics and Pharmacy Practice
School of Pharmacy
University of Nairobi
P.O Box 30197-00400
Nairobi.

Investigator

Dr. Eunice W. Muthuki

Supervisors

Dr. David Nyamu
Department of pharmaceutics and pharmacy practice
School of Pharmacy, University of Nairobi

Dr. Peter Karimi
Department of pharmaceutics and pharmacy practice
School of Pharmacy, University of Nairobi

Dr. KefaBosire
Department of Pharmacology and Pharmacognosy
School of Pharmacy, University of Nairobi

Ethical Approval

Kenyatta National Hospital/ University of Nairobi Ethical and Research Committee
P.O Box 20723-00100,

Nairobi.
Tel 2726300/2716450 Ext 44102

Permission is requested from you to enroll in this research study. This will take about 30 minutes of your time. Your agreement to participate is voluntary. You may withdraw from the study at any point in time giving any reason for withdrawal. Feel free to ask any questions that need clarification.

Introduction

This study will seek to evaluate hypertension management. It will involve extracting information about you and medication you are on from the records. You will also be asked some questions regarding adherence to medication and life style practices.

Purpose of the study

This study will generally create awareness on some of the areas in BP management that need to be worked on in order to improve on BP control among hypertensive adult patients.

Risks

There are no risks involved in this study. In the event that there is outcome need requiring medical attention, you will be referred to the clinician.

Benefits

The results of this study will improve management in hypertensive patients. The patients' quality of life will improve and they will be more productive economically.

Confidentiality

All information obtained from you will be confidential. Data collection forms will be coded to ensure that there will be no unauthorized access to this information and also remove potential identifiers such as names from data.

Compensation

This study does not involve any invasive procedures. It will also not inconvenience you because you will be attended to during the normal clinic. Therefore, there will be no compensation involved.

Dissemination of findings

A summary of the study findings will be given to the hospital. It will also be published in an online journal and a copy handed over to the medical library. It will also fulfill the requirements by the University for acquiring a master's degree.

For any questions concerning this research study, you may contact Dr. Eunice Wangeci Muthuki at 0722703922.

If you feel like you were not treated well during this study, or have questions concerning your rights as a research participant call the KNH/UoN-ERC Chairperson on Tel. No.2726300 Ext 44102.

Your participation in this research is voluntary, and you will not be penalized if you refuse to participate. Will you participate?

I certify that I have consented the participant (Unique no.) …….

Researchers name …….

Signature----------Date ----------

THE KISWAHILI VERSION:

RIDHAA MAELEZO

Mada ya utafiti

Tathmini ya usimamizi wa shinikizo la damu kwa watu wazima kwenye hospitali ya Murang'a Kusini Kati Ndogo.

Taasisi

Idara ya Dawa na mazoezi ya madaku ya dawa

Shule ya madaku ya dawa

Chuo kikuu cha Nairobi

Saduku la posta 30197-00400
Nairobi.

Uchunguzi wa Dr. Eunice W. Muthuki

Wasimamizi
Dr. David Nyamu
Idara ya dawa na mazoezi ya madaku ya dawa
Shule ya madaku ya dawa
Chuo kikuu cha Nairobi

Dr. Peter Karimi
Idara ya dawa na mazoezi ya madaku ya dawa
Shule ya madaku ya dawa
Chuo kikuu cha Nairobi

Dr. KefaBosire
Shule ya madaku ya dawa
Chuo kikuu cha Nairobi
Idhini ya kimaadili
Hospitali ya Kitaifa ya Kenyatta/ Chuo kikuu cha Nairobi kamati ya kimaadili na utafiti
Saduku la posta 20723-0100
Nairobi
Namba ya simu: 2726300/2716450 ugani 4402

Naomba ruhusa ya kukushirikisha katika utafiti huu, nitatumia muda wako takribani dakika thelathini hivi. Utashiriki kwa hiali yako. Unaweza jiondoa katika utafiti huu wakati wowote kwa sababu yoyote. Kua hulu kuuliza swali lolote linalohitaji ufafanuzi.

Kuanzishwa

Utafiti huu utanuia kutathmini usimamizi wa shinikizo la damu. Utahusu kutafuta habari kukuhusu madawa unayotumia. Pia nitakuuliza maswali kuhusu unavyotumia madawa na unavyoishi.

Sababu ya utafiti

Utafiti huu utaleta ufahamu zaidi katika usimamizi washinikizo la damu; ilituboreshe udhabiti wa shinikizo la damu kati ya watu wazima. Pia utaniwezesha kuhitimu masomo.

Hatari

Hakutakuwa na hatari yoyote katika utafiti huu. Tukio lolote litakalohitaji matibabu litakabiliwa na daktari.

Benefiti

Matokeo ya utafiti huu itaimarisha usimamizi wa shinikizo la damu. Pia haliya wagonjwa itaimarika hivi kwamba wataendelea na uzalishaji uchumi.

Fidia

Utafiti huu hautakua na malipo.

Usambazaji wa matokeo

Muhutasari wa utafiti utapewa hospitali. Na pia utachapishwa na nakala yake kuwekwa kwenye maktaba ya matibabu.

Mawasiliano

Kwa swala lolote wasiliana name mchunguzi mkuu kutoka chuo kikuu cha Nairobi
Shule ya madaku ya dawa. Namba ya simu: 0722703922

Ukihisi kana kwamba hujashugulikiwa ipasavyo wakati wa utafiti ama ukona maswali kuhusu haki zako kama mshiriki wa kujitolea wa utafiti, wasiliana na mwenye kiti katika kamati ya kimaadili na utafiti Hospitali ya Kitaifa ya Kenyatta/ Chuo kikuu cha Nairobi (KNH/UON ERC) namba ya simu 2726300/2716450 ugani 44102.

Kushiriki kwako katika utafiti huu nikujitolea, hakuna adhabu ya kutoshiriki au kujitoa wakati wa utafiti. Je, utashiriki?

Nimedhibitisha ridhaa ya mshiriki. Nambari ya kipekee……

Jina la mtafiti……..

…….. …….

Sahihi Tarehe

APPENDIX 6: PARTICIPANT CONSENT FORM

I have fully understood the objectives of this study and hereby sign as a show of my willingness to participate as a volunteer.

Signature……. Date…….

Witnessed by:

Signature……. Date…….

If you have questions about this research study, you may contact the principal investigator Dr. Eunice W. Muthuki at 0722703922.

In case you feel as if you were not treated well during this study, or have questions Concerning your rights as a research participant call the KNH/UoN-ERC Chairperson on Tel. No.2726300 Ext 44102 or the lead supervisor Dr. David Nyamu at 0722403671.

Kiswahili version

Ridhaayamshiriki

Nimeelewalengo la utafitihuunandiposanatiasahihikwambanitashirikikwahialiyangu.

Sahihi ……. Tarehe …….

Msimamizi

Sahihi …… Tarehe …….

Kama ukonamaswaliyoyotekuhusuutafitihuuwasilianamchunguzimkuu Dr. Eunice W. Muthukikupitianambarihii:- 0722703922.

Kama unajihisiumebebwavibayawakatiwautafitiamaukonamaswalikihusuhakizakokamamshirikiwakujitoleawasilianamwenyekitikatikakamatiyakimaadilinautafitiHospitaliyaKitaifaya Kenyatta/ Chuo kikuu cha Nairobi nambariyasimu:- 2726300 ugani 44102.

Pia unawezawasilianamsimamizimkuuwautafitihuu Dr. D. Nyamukwanambari: 0722403671