



**UNIVERSITY OF NAIROBI, COLLEGE OF HEALTH SCIENCES  
DEPARTMENT OF CLINICAL MEDICINE AND THERAPEUTICS**

**ADHERENCE LEVEL AND ADEQUACY OF BLOOD PRESSURE  
CONTROL AMONG HYPERTENSIVE PATIENTS ATTENDING A  
TERTIARY HOSPITAL IN SOMALIA.**

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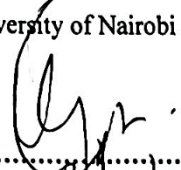
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## LIST OF ABBREVIATIONS

<b>ABPM</b>	Ambulatory blood pressure monitoring
<b>ACCA</b>	American College of Cardiology
<b>ACE</b>	Angiotensin converting enzymes
<b>AHA</b>	American Heart Association
<b>ARB</b>	Angiotensin receptor blocker
<b>ARIC</b>	Atherosclerosis Risk in Communities
<b>BP</b>	Blood pressure
<b>CVD</b>	Cardio-vascular disease
<b>DASH</b>	Dietary Approaches to Stop Hypertension
<b>ESC</b>	European Society of Cardiology
<b>ESH</b>	European Society of Hypertension
<b>HBPM</b>	Home blood pressure monitoring
<b>HMOD</b>	Hypertension-mediated organ damage
<b>ISH</b>	International Society of Hypertension
<b>MOPC</b>	Medical out-patients clinic
<b>MMAS-8</b>	Morisky Medication Adherence Scale
<b>mmHg</b>	Millimetres of mercury
<b>MEMS</b>	Medication Events Monitoring System
<b>NICE</b>	National Institute for Health and Care Excellence
<b>NCD</b>	Non-communicable diseases
<b>SSA</b>	Sub-Saharan Africa
<b>SBP</b>	Systolic blood pressure

## ABSTRACT

**Background:** Hypertension is a prevalent condition that affects approximately one billion of people globally, leading to increased cardiovascular morbidity and mortality. Poor adherence to prescribed therapy contributes to inadequate hypertension control. Despite several studies conducted on the level of adherence of hypertension in Africa, some countries such as Somalia have not been adequately researched.

**Objective:** To assess the adherence level, adequacy of blood pressure control, and determinants of non-adherence to antihypertensive medications among hypertensive patients in Somalia.

**Methods:** The study was a cross-sectional study conducted at the medical out-patient clinic at the Somali-Turkish training and research hospital in Mogadishu. The adherence level was evaluated using the Morisky Medication Adherence Scale (MMAS-8), while the adequacy of blood pressure control was evaluated by measuring blood pressure level. Socio-demographic, patient-related, and therapy related determinants for non-adherence to antihypertensive medications were evaluated using a researcher-designed questionnaire.

**Results:** Out of the 334 patients, 53% were female. The majority of the patients lived in urban areas, 55.4%, and nearly four out of five patients, 79.6%, were married. The majority of the patients were without employment, 61.7%, and had not received formal education, 63.5%. Additionally, the majority of patients, 73.1%, had low adherence to their medication regimen. Only 38.3% of patients had controlled blood pressure as measured during their last visit to the clinic. The older age groups of 55-64 years ( $P < 0.001$ ) and 65 years and above ( $P = 0.034$ ) were more likely to be non-adherent compared to younger patients. Similarly, patients with no formal education ( $P < 0.001$ ) and primary level ( $P = 0.002$ ) of education were more likely to be non-adherent compared to those with a tertiary level of education. Patients with diabetes were 2.1 times ( $P = 0.007$ ) more likely to be non-adherent compared to those without diabetes. Patients who had nonadherent to medication were 1.7 times ( $P < 0.045$ ) the odds of being uncontrolled BP.

**Conclusion:** the study highlights the high prevalence of low adherence to antihypertensive medications and poor blood pressure control among hypertensive patients in Somalia. Several factors were found to be statistically significant in their impact on low adherence, included older age, lower education levels, diabetes, patients' knowledge about the long-term use of medication, belief that medication should only be taken when blood pressure is high, use of alternative therapies and side effect of medications.

## CHAPTER ONE: INTRODUCTION

Hypertension is a commonest cardiovascular disorder that affected roughly 1 billion individuals globally. Approximately, 26% of adult population in 2000 had hypertension with the prevalence expected to rise to 29% by 2025.(1) In Africa, the prevalence of hypertension in older adults (>50 years) was 57% in 2019.(2)

Research findings in Sub-Saharan Africa indicated that the burden of hypertension had been increasing continuously over the past few decades.(3) Roughly 650 million individuals in Sub-Saharan Africa, with 10 to 20 million of them are hypertensive.(4) However, most SSA countries are still lacking comprehensive fundamental data on the prevalence of hypertension and its distribution in diverse SSA individuals. In Kenya, the findings of hypertension showed a prevalence of 24.5% among a variety of populations, with only 15.6% being aware of their hypertension condition.(5) High blood pressure is the most common cardiovascular risk factor affecting Somalis.(6)

Hypertension is still the main risk factor of heart disease and stroke, which are the leading causes of morbidity and mortality globally.(7) The impact of hypertension is upsetting if not controlled and can lead to cardiac failure, myocardial infarction, stroke, and renal failure.(8) Antihypertensive medications reduce morbidity and mortality related to hypertension like heart failure, stroke and myocardial infarction.(8)

Medication adherence is the degree to which a patient consumes drugs prescribed by the medical practitioner.(9) In a United States study including 149 patients with uncontrolled hypertension (monitored with electronic pillboxes), 42% were non-adherent to treatment, consuming not more than 80% of antihypertensive drugs.(10) Abegaz *et al* conducted a review and established that 45.3% of patients with high BP worldwide were not adherent to their medications with 62.5% being recorded among African patients.(11) A study done at Kenyatta National Hospital documented poorly controlled blood pressure in 75% of hypertensive patients, mainly due to non-adherent to antihypertensive therapy.(12) Suboptimal adherence contributes to a load of uncontrolled hypertension that can persist widely despite various programs aimed at enhancing adherence with both non-drug and drug regimens.(13)

There are various multi-factorial causes for poor medication adherence that had to be clarified before undertaking diverse measures to enhance adherence to medication.(14) Several causes lead to poor adherence to medication, which are categorized into 5 clusters namely: therapy-related factors, condition-related factors, socioeconomic factors, patient-related factors, and health system/health care team- (HCT-) related factors.(15) Therefore, it is ideal to come up with a suitable tailored individual intervention to improve medication taking behaviour for every patient.

A variety of ways are used to evaluate adherence behaviours of hypertensive patients, grouped into either subjective reports or indirect objective methods. On the other hand, self-reporting ways have the merits of low cost and are easier to gather information, and are mainly used to assess adherence behaviours.(16)

Self-reported questionnaires are available to measure adherence behaviours in patients with hypertension, each with its own merits and demerits. The commonly used questionnaires are the Morisky Medication Adherence Scale (MMAS-4 and MMAS-8) established to provide reliable and valid evidence.(17) No Somali data is presently accessible. Therefore, the main aim of the study was to evaluate the degree of non-adherence to antihypertensive medications and various rationales for non-adherence in patients attended to a tertiary hospital in Somalia.

## CHAPTER TWO: LITERATURE REVIEW

### 2.1 Definition of Hypertension

The European Society of Cardiology and European Society of Hypertension (ESC/ESH),(18) and the International Society of Hypertension (ISH) (19) define hypertension as a clinic-based blood pressure with a systolic pressure  $\geq 140$  mmHg and/or diastolic pressure  $\geq 90$  mmHg. However, there is a conflicting definition of hypertension by the American College of Cardiology/American Heart Association which is systolic blood pressure  $\geq 130$  mmHg or diastolic blood pressure  $\geq 80$  mmHg,(20) but the widely accepted definition is  $\geq 140/90$  mmHg.

The definition of hypertension may vary based on BP cut-off and mode of measurement, as indicated in the table below:

SBP/DBP	Clinic	HBPM	Daytime ABPM	Night-time ABPM	24-hour ABPM
ACC/AHA Guidelines 2017[20]	$\geq 130/80$	$\geq 130/80$	$\geq 130/80$	$\geq 110/65$	$\geq 125/75$
ESC/ESH Guidelines 2018[18]	$\geq 140/90$	$\geq 135/85$	$\geq 135/85$	$\geq 120/70$	$\geq 130/80$

**Table 1:** BP cut-off in different modes of blood pressure measurement

### 2.2 Aetiology and Pathophysiology

The origin of primary hypertension remains unclear, but it is believed to be a result of multiple genetic and environmental factors that impact on cardiovascular function. These factors can include blood volume circulation, blood viscosity, cardiac output, humoral mediators, neural stimulation, and vascular calibre and reactivity.(21)

Studies have revealed gene loci in hypertension pathways through genome-wide correlations and epigenetic factors such as methylation from high-salt diets may also play a role in hypertension.(22) The exact cause of primary hypertension is still not known, but there are several independent risk factors that are associated with its development. These include aging, particularly systolic hypertension, obesity and weight gain, family history of hypertension, race, high sodium intake, low potassium, high alcohol consumption, and physical inactivity.(21)

## **2.3 Burden of hypertension**

### **2.3.1 Prevalence of hypertension**

Globally, 26% of adult population in 2000, or 972 million people, were hypertensive, with a projected increase to 29% by 2025, particularly in the economically developing world. Hypertension is the leading contributor to heart disease and stroke, which are the leading and third leading causes of global mortality, respectively, and are responsible for the leading cause of disability-adjusted life-years (DALYs) in people over 50 years old.(7)

In the developing nations, there is a growing prevalence of hypertension, with 31.1% of adults, or 1.39 billion people, affected in low middle income countries (LMIC). The level of prevalence is higher in developing nations (31.5%) than in developed nations (28.5%) due to differences in risk factors such as high sodium intake, low potassium intake, obesity, alcohol consumption, lack of physical activity, and poor diet. Despite the high incidence, awareness, treatment, and control of hypertension is still low in many developing countries.(23)

In Africa, the number of hypertension cases has steadily increased from 54.6 million (19.7%) in 1990 to 130.2 million (30.8%) in 2010, and is expected to reach 216.8 million by 2030, a 66% increase from 2010. (23)

Groups that were previously thought to be at low risk for hypertension, such as those living in rural areas and young, poor households, are now facing a major challenge from the disease, which is a common cause of hospital admissions in Africa.(24) The number of patients with hypertension will continue to rise with urbanization, an aging population, and associated stress, lack of physical activity, and westernized diets.(25)

The overall prevalence of hypertension varied among different Kenyan communities as they utilized a step-wise instrument. A study conducted in Korogocho slums in Nairobi showed that the overall prevalence of hypertension among adults was 18%. On the other hand, the level was lower, at 12.6%, in Garrissa County. Additionally, in Nakuru, 50% of the population over 50 years had hypertension.(26)

A survey conducted by May measurement month program (MMM) in 2017 found that 24.6% of the 14,847 people screened in 17 locations in Kenya were hypertensive, with 15.3% not receiving any medication for the condition. Of those taking antihypertensive drugs, 45.5% had uncontrolled blood pressure.(27)

In Hargeisa, a study using the STEP-wise method for non-communicable disease risk factor surveillance found the prevalence of hypertension to be 15% for those 20-34 years old and 67% for those 50-69 years old.(28) No data on the prevalence of hypertension in Somalia as a whole is available.

### **2.3.2 Consequences of hypertension**

Hypertension is often referred to as a "silent killer." A 20 mmHg increase in systolic blood pressure (SBP) or a 10 mmHg increase in diastolic blood pressure (DBP) in individuals aged 40–69, regardless of their baseline blood pressure, doubles or more their risk for mortality due to ischemic heart disease and stroke.(29)

Atherosclerosis Risk in Communities (ARIC) study showed that hypertensive retinopathy is associated with a higher long-term risk of stroke, even in individuals with well-controlled blood pressure.(30) Another study by Tochi M et al concluded that left ventricular hypertrophy (LVH) has significant independent associations with cardiovascular disease.(31)

People in the prehypertensive stage have an increasing risk of premature adverse effects of elevated blood pressure. A meta-analysis of 762,393 person by Huang et al showed that prehypertension was associated with a 66% higher risk of stroke compared to optimal blood pressure (below 120/80 mmHg) after adjusting for several cardiovascular risk factors.(32)



The Multiple Risk Factor Intervention Trial data indicated that the mortality rate due to coronary artery disease was 2.3 to 6.9 times higher in people with mild to severe hypertension compared to those with normal blood pressure.(33)

Other common complications include chronic kidney disease, congestive heart failure, hypertensive encephalopathy and peripheral arterial disease.(8)

## **2.4 Management of Hypertension**

### **2.4.1 Nonpharmacologic Therapy**

Lifestyle changes can prevent or delay the onset of hypertension and reduce the need for medication in individuals with grade one hypertension. Modifying one's lifestyle is the preferred approach to managing hypertension. Common recommended lifestyle changes that lower blood pressure and decrease cardiovascular risk include weight loss, regular exercise, eating a healthy diet, reducing sodium intake, quitting smoking, and limiting daily alcohol intake to 2 drinks for men and 1.5 drinks for women (10g of alcohol per drink).(19)

There is a correlation between high salt intake and increased blood pressure, especially in older people.(34) Modest sodium reduction has been shown to lower blood pressure in both hypertensive and normotensive individuals. So, to lower salt intake, it is recommended to reduce or avoid foods high in salt such as fast foods, soy sauce, and processed foods.(35)

Eating in a DASH diet that is rich in whole grain, vegetables, fruits, polyunsaturated fat, magnesium, potassium, calcium, protein, and fibre but low in total fat, saturated fat, and cholesterol is known to reduce BP.(36)

Weight loss in obese individuals leads to a significant decrease in blood pressure, with each 1kg of weight loss leading to a decrease in blood pressure of 0.5 to 2 mmHg.(37)

Individuals who drink more than 2 drinks per day (women) or 3 drinks per day (men) have a higher frequency of high blood pressure compared to non-drinkers.(38)

Smoking is a major risk factor for cancer and cardiovascular disease, and research has shown that both smokers and normotensive individuals have higher daily blood pressure values compared to non-smokers.(39)

The PREMIER randomized control trial found that a behavioural intervention was more effective in reducing the prevalence of hypertension (22% versus 32%) and reducing the need for antihypertensive medication (10% to 14% versus 19%) compared to advice alone.(40)

#### **2.4.2 Pharmacologic Therapy**

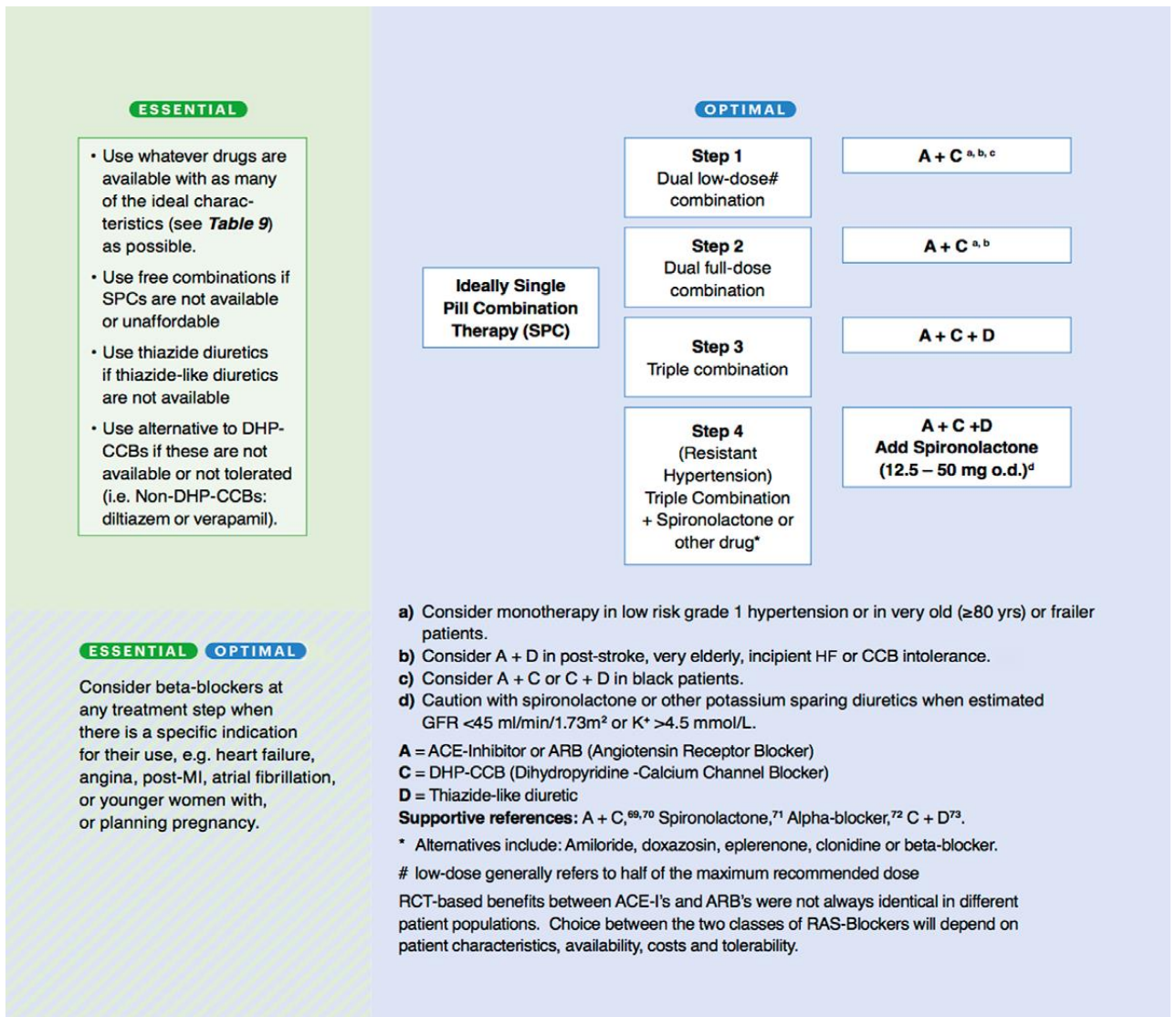
The 2020 ISH global hypertension guidelines suggest that the first choice of medication should be selected from the following group: thiazide-type or thiazide-like diuretics, long-acting calcium channel blockers, angiotensin-converting enzyme (ACE) inhibitors, or angiotensin II receptor blockers (ARBs).(19)

Anti-hypertensive therapy has been shown to reduce the relative risk of heart failure by almost 50% compared to placebo, decrease the relative risk of stroke by 30% to 40%, and reduce the relative risk of myocardial infarction by 20% to 25%.(20)

Most patients with a high blood pressure will not have their hypertension adequately managed with single-agent therapy, except stage 1 hypertension and elderly patients. Combination therapy with drugs from different groups has been shown to effectively lower blood pressure and reduce the side effects associated with higher doses of monotherapy.(41)

The majority of hypertensive patients will require combination medication to reach their goal. The CREOLE trials, which compared dual therapies for lowering blood pressure in black patients in Sub-Saharan Africa, concluded that the combination of amlodipine and either hydrochlorothiazide or perindopril was more effective in lowering blood pressure at 6 months compared to perindopril plus hydrochlorothiazide.(42)

The ISH recommends pharmacologic treatment strategies that are compatible globally, as shown in the accompanying figure:



**Figure 1:** Core drug-treatment strategy recommended by ISH.(19)

A= ACE-inhibitor or ARB. C= Dihydropyridine Calcium channel blocker. D= Thiazide-like Diuretics

### 2.5 Adequacy of blood pressure control

The inadequate treatment of hypertension remains a significant issue, both in developed and developing countries, presenting challenges for medical professionals.

In a study conducted in Europe, it was found that 40-60% of patients with hypertension still had uncontrolled blood pressure despite being on recommended therapy.(43) Similar results were found in Brazil, where 75.2% of patients had uncontrolled hypertension and 57.1% were not adhering to their medication.(44)

In a survey across twelve sub-Saharan African countries, 77.4% had uncontrolled hypertension and 64.4% were not taking their antihypertensive medication as prescribed.(45) A study in South Africa revealed that only 49% of participants had well-controlled blood pressure despite moderate adherence, highlighting the need for better approaches to adherence.(46) In Ethiopia, a hospital-based study found the prevalence of inadequate BP control was 52.2%.(47)

In Kenya, a study conducted in Kenyatta National Hospital indicated that only 26% of patients with HTN on follow-up in the MOPCs had well-controlled BP.(12) Another study conducted in Nandi district found a much lower level of BP control, with only 2.6% of patients receiving drugs actually had their BP within the recommended levels ( $< 140/90$  mmHg).(48)

The main cause of inadequate blood pressure control is poor adherence to medication, although other factors such as comorbidities and resistance to medication may also play a role.(49)

## **2.6 Prevalence of non-adherence to antihypertensive therapy**

Non-adherence refers to when a patient fails to take their medications as instructed by their doctor or the medical guidelines, and it is a major concern that leads to poor health outcomes.(50) Maintaining adherence to multiple medications can be challenging for those with chronic illnesses. Poor adherence to medications for high blood pressure is a major cause of poorly managed blood pressure. Roughly 43% to 65.5% of patients with chronic illnesses do not adhere to their medication regimen, leading to uncontrolled hypertension.(51)

A review of 25 studies with 12,603 participants showed that 45.2% were hypertensive and 31.2% were non-adherent to their medications, with 83.7% of non-adherent individuals having poorly controlled blood pressure. (9) Adherence was evaluated in 1348 patients in the UK and Czechoslovakia and was found to be poor, ranging from 20% to 27% for poor adherence and 12% to 14% for absolute non-adherence.(52) Younger patients, male patients, and those on diuretics or multiple medications had lower adherence rates.

Studies have shown that developing nations have lower rates of awareness, control, and treatment for hypertension.(53) A study in Egypt found that 41.3% of patients with hypertension were highly adherent to their medications,(54) while a study in Ethiopia showed that 61.8% of hypertensive patients were adherent..(55) A study by Achieng et al. found that

only 31.8% of patients were adherent to their antihypertensive medications, with non-adherence being a significant factor in poorly managed blood pressure, as only 26% had adequate BP control.(12) Currently, there is no data on the adherence to antihypertensive medications in Somalia.

## **2.7 Determinants for non-adherence to antihypertensive medications**

The World Health Organization has recommended five dimensions of adherence, including socio-economic factors, patient-related factors (such as health beliefs and literacy), therapy-related factors (such as medication cost and side effects), condition-related factors (such as comorbid conditions), and healthcare-related factors.(15)

A study in Nigeria found that poor adherence to anti-hypertensive medications can be linked to socio-demographic characteristics such as age, marital status, and place of residence (56) Health illiteracy is a common factor in non-adherence, with 41% of elderly patients not understanding medication instructions; 50 per cent of their spouses and 25 per cent of their children were unaware of the patient's having this difficulty.(57) Side effects, such as impotence and erectile dysfunction, can also lead to poor adherence.(58) The cost of medication was reported as the cause of non-adherence in 10.7% of patients in the United States.(59) Clinical depression can also influence a patient's adherence, as depressed patients are three times more likely to be non-adherent to anti-hypertensive medications than those without depression.(60)

## **2.8 Assessment of Adherence Level**

Accurately measuring medication adherence is crucial for clinicians and researchers as improper estimation can lead to costly and dangerous consequences.(14) The selection of monitoring methods must align with the study's characteristics and goals. Currently, no method is considered the gold standard.(61) WHO categorizes adherence methods as subjective and objective. Subjective methods are based on patient self-report through questionnaires, while objective methods such as dosage counts and electronic monitoring offer more precise measures.(62)

Objective methods can further be divided into direct and indirect measures. Direct measures are the drug measurement like blood or urine to assess the availability of a biological marker given with the drug and the patient's direct observation on medication-taking behaviour. Although it is acceptable and precise method, there are some variables that should take into consideration such as drug-food and drug-drug interaction, drug metabolism which impede the accuracy of the method. They are accurate but expensive and difficult to carry out .(61,62)

Indirect methods are more common and include: counting pills, self-reported measures, electronic monitoring devices and electronic health records. Pill count is an indirect objective measure to count the number of unit dosages consumed amid two clinic visits or scheduled appointments. The number obtained is then compared with the sum number of units received by a patient to calculate the ratio of adherence. This method is cheap and simple hence contributing to its popularity. Pill count can be used for various formulations like capsules, tablets and inhalers. Its main disadvantage is that removing the right amount of dosage units from the container doesn't essentially mean that the patient is consistently following the dosing regimen, so it doesn't give definite information about daily adherence and pattern of adherence.(63,64)

Electronic monitoring devices such as Medication Events Monitoring System (MEMS) dictates that the medication is picked from the container with a computer processor entrenched to record the date and time with the assumption that the patient consumed the dose at a certain time. It is a very accurate measure in most studies. It helps to discover if non-adherence is sporadic or consistent by providing the number of daily consumed doses on any incomplete adherence state. Consequently, it is mainly used as a standard for reference to validate other adherence measures. Incorrect use of the device could lead false results and the use of it for large population is limited because of the expensiveness of the device.(65)

A secondary database may include patterns and sequences obtained from the curated principal data such as pharmacy insurance claims or electronic prescription services. This kind of data allows medication adherence quantification to a variety of refill adherence ways. Refill adherence supposes that prescription-refilling outlines match with the behaviour of the patient taking medication, this kind of supposition is a suitable estimate.(65) Additionally, these kinds

of measures presume that the medication is used precisely as per the prescription. Consequently, partial adherence in which patients take only some of the medication at intervals may not be exposed by these methods and it doesn't give information on individual patient's rates of adherence.(66)

Self-reported assessments are simple procedures and the easiest for measuring level of adherence. Patients or their caretakers should be able to complete self-report questionnaires. The 8-item Morisky Medication Adherence Scale (MMAS), Hill-Bone Compliance Scale (Hill-Bone), Brief Medication Questionnaire and the Medication Adherence Questionnaire (MAQ) are the most common scales covering the medication-taking behaviours concept, limitations to adherence, and beliefs related to adherence.(61)

Morisky et al. designed the 8-item MMAS (MMAS-8) in 2008 with the first 7 items being Yes/No response whilst the last being a 5-point Likert response. Additional features focus on medication-taking behaviours due to underuse, like forgetfulness hence a clear identification of obstacles to adherence.(17) Hence, it is highly recommended to be used in the clinical setting as a tool for screening validated conditions.

## **2.9 Study Justification**

Hypertension is the commonest cardiovascular risk factor affecting Somalis. In Africa, poor adherence to anti-hypertensive medications is a major reason for uncontrolled BP. No research has been conducted in Somalia to determine the level of adherence to anti-hypertensive medication. The aim of this study was to determine the level of adherence and adequacy of blood pressure control among the Somali population.

## **2.10 Research Question**

What is the level of adherence, adequacy of blood pressure control and determinants of non-adherence to antihypertensive medications among patients with hypertension in Somalia?

## **2.11 Objectives**

### **2.11.1 Broad Objective**

To assess the level of adherence to anti-hypertensive medications and adequacy of blood pressure control among hypertensive patients at a tertiary hospital in Somalia.

## 2.11.2 Specific Objectives

### 2.11.2.1 Primary objective

1. To determine the level of adherence to antihypertensive medications among hypertensive patients at a tertiary hospital in Mogadishu, Somalia.
2. To determine the adequacy of blood pressure control among hypertensive patients at a tertiary hospital in Mogadishu, Somalia.

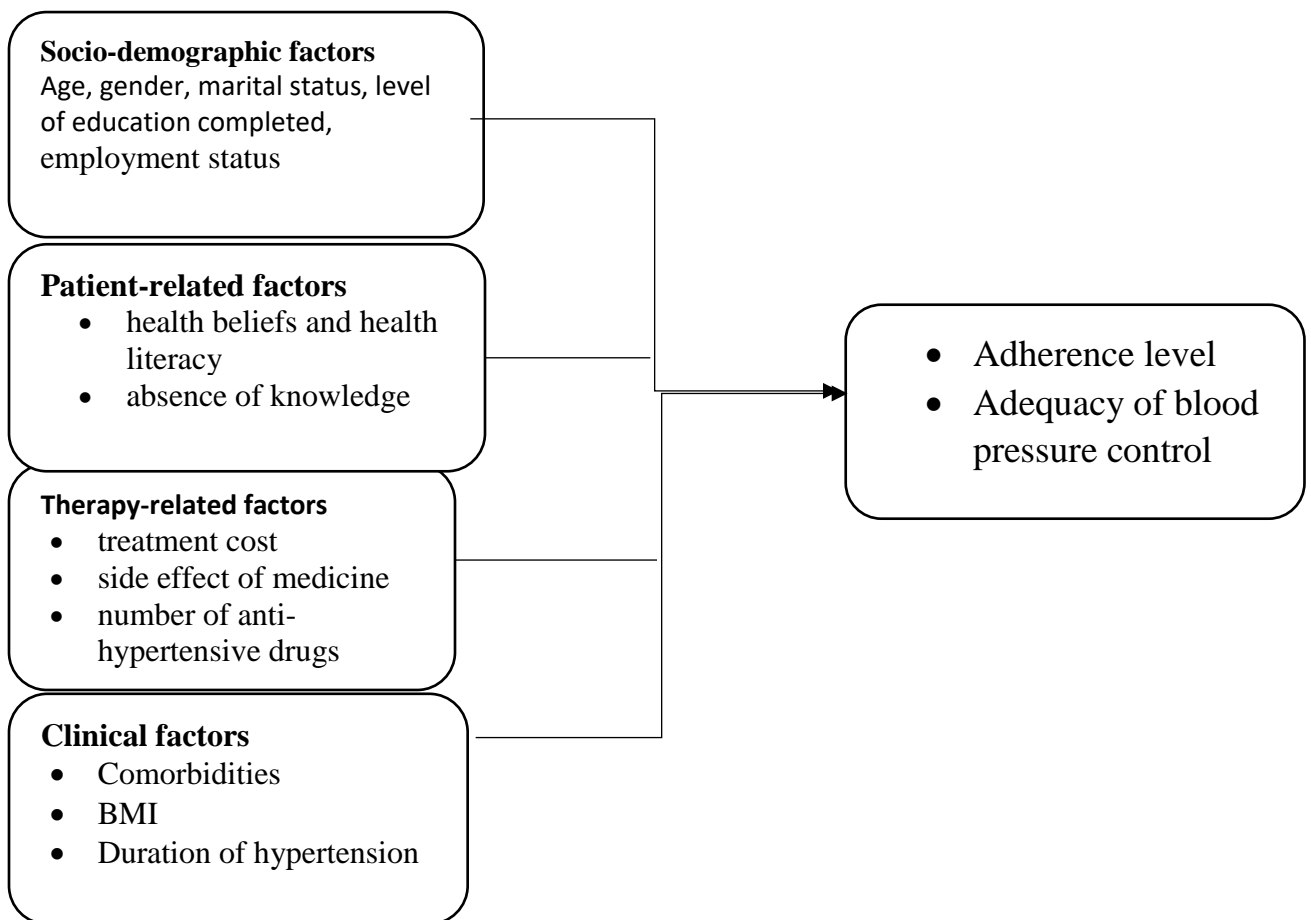
### 2.11.2.2 Secondary objective

1. To determine the association between selected determinants and non-adherence to antihypertensive medications.
2. To determine the correlation between adherence level and adequacy of blood pressure control.

## 2.12 Conceptual framework

### Independent variables

### dependent variables



**Figure 2:** Conceptual Framework



## CHAPTER THREE: METHODOLOGY

### 3.1 Study Design

Descriptive cross-sectional study

### 3.2 Study Site

The study was conducted at the medical out-patient clinic (MOPC) handling patients with hypertension at Somali-Turkey Recep Tayyip Erdogan Training and Research Hospital. It is a tertiary national referral hospital with an 800-bed capacity, offering both inpatient and outpatient services including specialized care. The hospital has 32 wards, 15 outpatient clinics, 6 theatres, ICU, and an accident and emergency department.

The MOPCs are open from 8:00 AM to 5:00 PM daily except Fridays, and are run by consultant physicians and registrars in the internal medicine program.

### 3.3 Study Population

Hypertensive patients on follow up at medical outpatient clinics

### 3.4 Case Definitions

Cases were defined as adult patients with a diagnosis of hypertension who had been receiving pharmacologic therapy for at least six months.

**Hypertension** was defined as a systolic blood pressure of 140 mmHg or more, or a diastolic blood pressure of 90 mmHg or more, or taking antihypertensive medication.(19)

**Controlled hypertension** was determined as having a SBP less than 140 mmHg and a DBP less than 90 mmHg among those with hypertension during their last visit to the clinic.

**Medication adherence**, high or medium adherence in morisky scale, usually refers to whether patients take their medications as prescribed.(9) Non-adherence, low adherence in morisky scale, is the degree to which a patients' medication-taking behaviour fails to coincide with the guidelines provided by a health care provider.(50)

### 3.5 Inclusion Criteria

- $\geq 18$  years and older with a diagnosis of hypertension.
- Patients who have been on antihypertensive drug therapy for at least 6 months.
- Patients be willing to sign an informed written consent.

### 3.6 Exclusion Criteria

- Patients with neurocognitive impairment such as dementia or psychosis and are not able to give accurate response.
- Hypertensive disorders in pregnancy.

### 3.7 Sample Size and Sampling Technique

Calculation in prevalence for cross-sectional studies, the sample size was calculated using the following formula (Daniel, 1999):

$$n = \frac{Z^2 P(1 - P)}{d^2}$$

Where:

**n**=sample size required to estimate the proportion of non-adherent patients who meets the criteria

**Z**= is 95% confidence interval (standard value 1.96)

**P**= proportion of patients with non-adherence as 68.

This is based on a study by Achieng et al. who assessed adherence level to antihypertensive medications.(12)

**d**=margin of error = 5%

Confidence level 95% is 1.96; non-adherent population-based on earlier studies is 68%,

Margin of error 5%,

$$n = \frac{Z^2 P(1-P)}{d^2}$$

$$\text{Sample size} = \frac{1.96^2 \{0.68 (1-0.68)\}}{0.05^2} = \frac{1.96^2 \times 0.68 \times 0.32}{0.0025} = 334$$

A minimum of **334 patients** with hypertensive was recruited for this study.

### **3.8 Sampling method**

A systematic sampling of all patients with a diagnosis of hypertension who meet the inclusion criteria was applied until the desired sample size was achieved.

The sample size was determined after a pilot study was carried out for one month. The MOPC clinic operates 6 days a week and sees approximately 40 patients per day, with at least 15 of them being hypertensive. During the one-month pilot period, 360 hypertensive patients were seen, which extrapolates to 720 hypertensive patients expected to pass through the MOPC over the two-month projected study duration. The final sample size for this study was determined to be 334 hypertensive patients.

$C=N/n$ , where  $N= 720$   $n=334$  therefore,  $720/334= 2$ .

A total of 7 to 10 patients with hypertension were recruited daily.

### **3.9 Screening and Recruitment**

The Turkey Recep Tayyip Erdogan Training and Research Hospital operates daily medical outpatient clinics from 8 AM to 5 PM, except on Fridays. Before the clinic began, the patient files of those with hypertension were identified. Files of patients who met the case definition were then tagged. A systematic sampling procedure was carried out among patients, where a starting point was first selected and every second individual on the population list was then selected. The chosen individuals were approached and consented to participate.

### **3.10 Data collection**

After introducing myself to the patient and took consent (**Appendix D**), I, along with a trained research assistant proceeded to administer the baseline data. The socio-demographic characteristics of patients, such as age, gender, residence, marital status, education level, employment status, and information on the duration of hypertension, were obtained using a researcher-developed questionnaire. (**Appendix V**)

The current body mass index of the patients was calculated by taking both their height and weight measurements during their visit. Information regarding comorbid conditions like diabetes, heart failure, chronic kidney disease, and stroke was gathered from the patients' records.

The patient's health beliefs, health literacy, and therapy-related factors (number of antihypertensive medications, side effect and cost of medications) affecting non-adherence to antihypertensive medications were assessed using a researcher-designed questionnaire.

#### **(Appendix V)**

The researcher developed questionnaires regarding determinants developed based on the original WHO report description, which was extracted from source publications.(15)

The adequacy of blood pressure control was evaluated by measuring the blood pressure using an automatic sphygmomanometer and following the World Health Organization's recommendations.(67) The patient was seated and rested for at least 15 minutes before taking the measurement, and the measurement was taken after ensuring that the patient had not consumed coffee in the past 30 minutes. Two readings were taken at intervals of 1-2 minutes, standardized, and the average measurement was recorded. Patients were then grouped into either controlled blood pressure (<140/90 mmHg) or uncontrolled blood pressure (>140/90 mmHg).(67)

The adherence level was evaluated using self-administered Morisky Medication Adherence Scale (MMAS-8). (**Appendix III**), more details on study instruments.

The researcher-developed questionnaire and the self-administered Morisky medication scale were administered in each clinic visit.

### **3.11 Study Instruments**

A researcher designed questionnaire to examine the impact of sociodemographic, clinical, patient-related, and therapy-related factors on non-adherence to antihypertensive medications. The Morisky Medication Adherence Scale (MMAS-8) is an eight-item self-administered questionnaire designed by Morisky et al to assess medication adherence. The first seven questions are answered with a yes or no and receive one point for a "yes" response and zero points for a "no" response. The last question is rated on a five-point Likert scale.(17) Scores above 2 indicate low adherence, scores of 1 or 2 indicate medium adherence, and a score of 0 indicates high adherence.(17)

This scale has been found to have a high level of validity and reliability, making it useful in tracking adherence for chronic conditions such as hypertension.(68)

### **3.12 Data Variables**

#### **3.12.1 Independent variables:**

- ✓ Sociodemographic factors (Age, marital status, employment status, educational level)
- ✓ Clinical characteristics (BMI, comorbid conditions, duration of HTN)
- ✓ Patient-related factors (health beliefs and health literacy, absence of knowledge)
- ✓ Therapy-related factors (cost of drugs, number of anti-hypertensive medications and side effect of medicine).

#### **3.12.2 Dependent variables:**

- ✓ Adherence level determined by Morisky scale
- ✓ Adequacy of blood pressure control

### **3.13 Data Analysis**

The collected data was entered into a Microsoft Excel datasheet. During the data entry process, continuous data cleaning was performed. The cleaned data was then exported into SPSS 23.0 statistical software for analysis.

#### **Primary objective**

The adherence level was determined by calculating the percentage of hypertensive patients who were classified as either having high or medium adherence to anti-hypertensive medication and those who had low adherence. The results were reported as a proportion of patients who were high, medium or low adherent.

The adequacy of blood pressure control was calculated as the proportion of patients with controlled and uncontrolled blood pressure recordings and reported as a percentage. Socio-demographic factors were summarized as counts and percentages if categorical, or as measures of central tendencies with measures of dispersion if continuous.

#### **Secondary objective:**

Socio-demographic and clinical characteristics were analysed against the adherence status of the patients to determine factors associated with non-adherence. In addition, adequacy of blood pressure control was associated with adherence level.

Chi square test of association was used to test the categorical data, and the continuous data was summarized into means and compared between the adherent and non-adherent patients using Student's t-test. Factors found to be significant associated with non-adherence to antihypertensive medications were subjected to Multivariable logistic regression. Statistical significance for all tests was considered when the  $P < 0.05$ .

### **3.14 Quality assurance and Ethical consideration**

The Morisky Scale has been widely used and validated in various languages. It was translated into the Somali language by an expert and then back-translated to English by another expert to ensure that no meaning was lost.

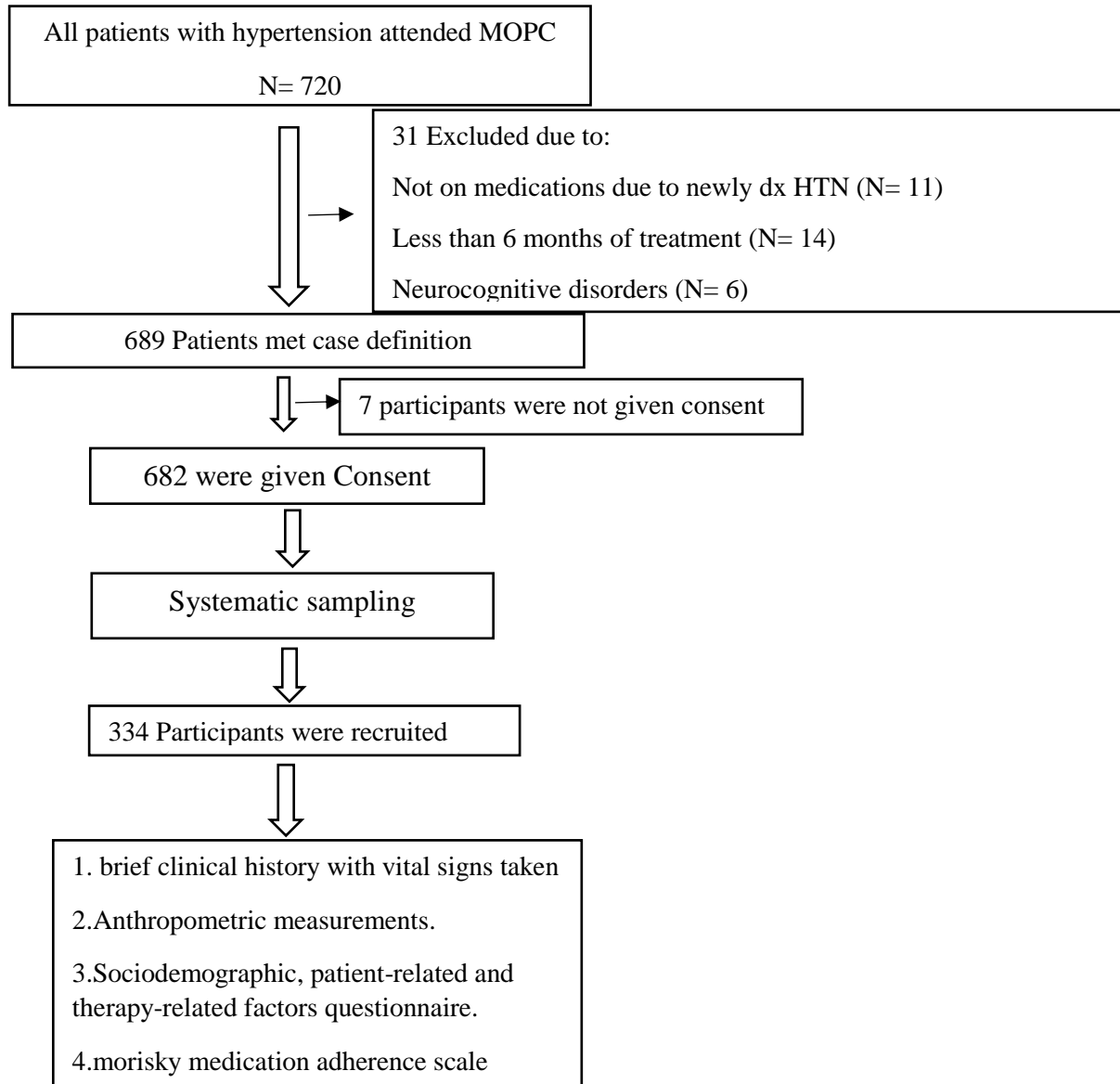
The study was conducted following approval from the University of Nairobi and Turkey Recep Tayyip Erdogan Training and Research Hospital Ethical and Review Committee. The Helsinki Declaration on the ethical principles for medical research involving human subjects was adhered to throughout the study.

The purpose of the study, potential risks and benefits, were explained to the participants, and all queries were answered. This was done to ensure that the participants had a clear understanding of the study before giving their consent. Participants were allowed to withdraw their informed consent at any time during the study without facing any negative consequences. The collected data was used only for the purposes outlined in the study protocol, and confidentiality was maintained. The results of the study were shared with the study participants and the primary physicians involved. The results could be used to make medical recommendations, where applicable. Participants were educated about hypertension and counselled on the importance of following the prescribed therapy.

## CHAPTER FOUR: RESULTS

### 4.1 Introduction:

The research took place between August and September in 2022 and involved a screening of 720 files. From these files, 689 met the criteria for inclusion in the study and 682 were given consent. Out of these, 334 patients were systematically selected and assessed for both their adherence to antihypertensive medication and the adequacy of their blood pressure control.



**Figure 3: Flow diagram of study selection process**

## 4.2 Socio-demographic characteristics

As shown in Table 2, about a third of the patients, 33.5%, were within the age range of 55 to 64. The mean age of the patients was 57.7 years with a standard deviation of 10.4. The youngest patient was 35.0 years old and the oldest was 78.0 years old. The median age was 58.5 years with an interquartile range of 50.0 to 60.0. Over half of the patients, 53.0%, were female. The majority of the patients lived in urban areas, 55.4%, and nearly four out of five patients, 79.6%, were married. The majority of the patients were without employment, 61.7%, and had no formal education, 63.5%.

**Table 2: Socio-demographic characteristics**

	Frequency, <i>n=334</i>	Percent
<b>Age</b>		
35-44	37	11.1
45-54	84	25.1
55-64	112	33.5
65 and above	101	30.2
<b>Gender</b>		
Male	157	47.0
Female	177	53.0
<b>Residence</b>		
Rural	149	44.6
Urban	185	55.4
<b>Marital status</b>		
Single	17	5.1
Married	266	79.6
Divorced	38	11.4
Widowed	13	3.9
<b>Employment</b>		
Employed	128	38.3
Unemployed	206	61.7
<b>Education</b>		
No formal education	212	63.5
Primary	45	13.5
Secondary	46	13.8
Tertiary	31	9.3



### 4.3 Clinical characteristics

Roughly 35.3% of the patients had hypertension for more than 10 years, while another 33.3% had hypertension for less than 5 years. The remaining 33.3% of patients had a duration of hypertension ranging from 5 to 10 years. Despite each group accounting for an equal percentage, their durations of hypertension differed. Nearly three-quarters of the patients had a normal BMI, 74.3%. A significant number of patients, 39.8%, had diabetes and close to one-third, 32.0%, had hypertensive heart disease. Those with heart failure accounted for almost one-tenth of the patients, 9.6%. The rest of the clinical characteristics are presented in Table 3.

**Table 3: Clinical characteristics**

	Frequency, <i>n=334</i>	Percent
<b>Duration of HTN in years</b>		
< 5	107	32.0
5 – 10	109	32.6
> 10	118	35.3
<b>BMI</b>		
Normal	248	74.3
Overweight	70	21.0
Obese	16	4.8
<b>Co-morbid conditions</b>		
<b>Diabetes Mellitus</b>		
Yes	133	39.8
No	201	60.2
<b>Hypertensive Heart Disease</b>		
Yes	107	32.0
No	227	68.0
<b>Heart failure</b>		
Yes	32	9.6
No	302	90.4
<b>Stroke</b>		
Yes	27	8.1
No	307	91.9
<b>Periphery Artery Disease</b>		
Yes	5	1.5
No	329	98.5
<b>Chronic Kidney Disease</b>		
Yes	27	8.1
No	307	91.9
<b>Asthma</b>		
Yes	6	1.8
No	328	98.2
<b>Psychiatric Disorders</b>		
Yes	3	0.9
No	331	99.1

#### 4.4 Reported adherence

The results in Table 4 indicate that the majority of participants reported that they sometimes forget to take their medication, 76.0%, and more than half, 57.2%, indicated that they missed taking their high blood pressure medication on at least one day within the previous two weeks. Over half of the patients, 51.8%, reported having stopped or decreased their medication without their doctor's knowledge. Less than half of the patients, 44.0%, reported taking their medication the previous day. Approximately two-thirds of the patients, 64.7%, reported stopping their medication when their blood pressure was under control, and a similar proportion, 64.1%, reported never feeling distressed by their blood pressure treatment. Less than half of the patients, 44.0%, reported sometimes having difficulty remembering to take all their blood pressure medications.

**Table 4: Morisky Medication Adherence Scale (MMAS-8)**

	Frequency, <i>n</i> =334	Percent
<b>Forget to take BP medication</b>		
Yes	254	76.0
No	80	24.0
<b>Past 2 weeks, any day that you did not take your BP medication</b>		
Yes	191	57.2
No	143	42.8
<b>Ever stopped/decreased medication without doctors' knowledge</b>		
Yes	173	51.8
No	161	48.2
<b>Forget to take medication when leaving or travel from house</b>		
Yes	133	39.8
No	201	60.2
<b>Took BP medications yesterday</b>		
Yes	147	44.0
No	187	56.0
<b>Stop medication when BP is controlled</b>		
Yes	216	64.7
No	118	35.3
<b>Felt distressed following BP treatment</b>		
Yes	120	35.9
No	214	64.1
<b>Difficulty in remembering to take all BP medications</b>		
A: Never/Rarely	49	14.7
B: Once in a while	95	28.4
C: Sometimes	147	44.0
D: Usually	31	9.3
E: All the time	12	3.6

As shown in Table 5, the majority of patients, 73.1%, had low adherence to their medication regimen.

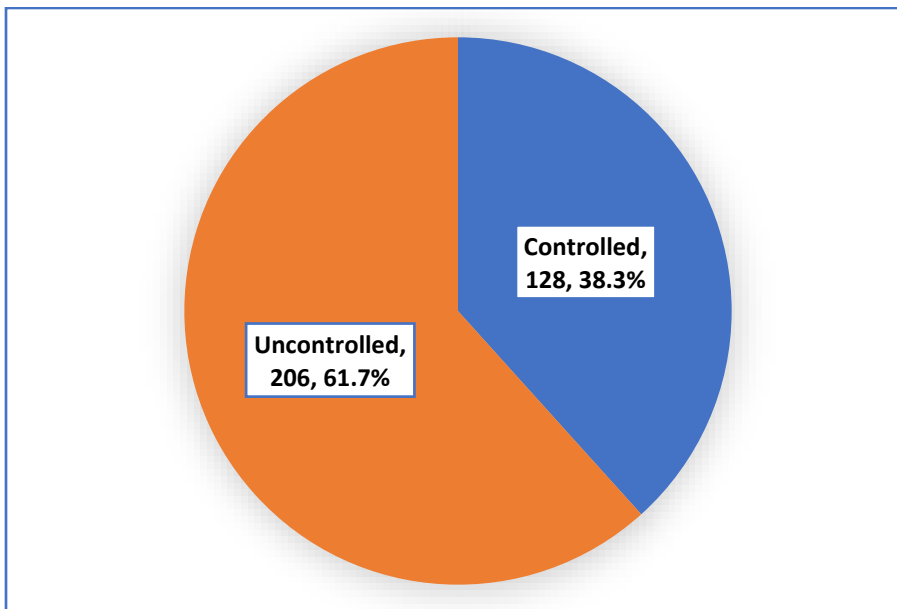
**Table 5: Morisky Medication Adherence Scale (MMAS-8) Scores**

	Frequency, <i>n=334</i>	Percent
<b>Scores:</b>		
Low adherence (>2)	244	73.1
Medium adherence (1 or 2)	81	24.3
High adherence (0)	9	2.7

#### 4.5 Recorded blood pressure

Only 38.3% of patients, or 128 individuals, had controlled blood pressure as measured during their last visit to the clinic. The remaining 61.7% had uncontrolled blood pressure.

**Figure 5: Adequacy of blood pressure control among hypertensive patients**



#### 4.6 Patient related factors for non-adherence

A large majority of the patients, 81.1%, had a good understanding of the background of the disease and the effectiveness of their medication. Over two-thirds of the patients, 67.7%, did not believe that alternative therapies were more effective than anti-hypertensive medication. The majority of the patients, 78.4%, understood the need for long-term medication use, and the majority of them, 69.5%, did not believe that treatment could make them sick. Finally, the majority of patients, 68.3%, did not have a fear that their blood pressure could drop dangerously low while taking medication. These results are presented in Table 6.

**Table 6: Patient related factors that contribute non-adherence to antihypertensive medications**

	Frequency, <i>n=334</i>	Percent
<b>Understanding of the context of hypertension and the efficacy of its treatment through medication</b>		
Yes	271	81.1
No	63	18.9
<b>Alternative therapies are more effective than anti-hypertensive medications</b>		
Yes	108	32.3
No	226	67.7
<b>Understand the long-term taking of drugs</b>		
Yes	262	78.4
No	72	21.6
<b>Belief that treatment could make you ill</b>		
Yes	102	30.5
No	232	69.5
<b>Fear BP could go low on medication</b>		
Yes	106	31.7
No	228	68.3

#### 4.7 Therapy related factors for non-adherence

As shown in table 7, majority of the patients (65.6%) were taking only one type of anti-hypertensive medication, and the majority, 74.9%, had not experienced side effects that led to discontinuing their medication. Majority of the patients (75.4%) were able to afford the cost of their medications.

**Table 7: Therapy related factors that contribute non-adherence to antihypertensive medications**

	Frequency, <i>n=334</i>	Percent
<b>Number of HTN medications</b>		
1 medication	219	65.6
≥ 2 medications	115	34.4
<b>Experienced side effects leading to stopping medication</b>		
Yes	84	25.1
No	250	74.9
<b>Afford cost of medication</b>		
Yes	252	75.4
No	82	24.6

#### 4.8 Association between selected determinants and non-adherence to antihypertensive medications.

According to Table 8, older patients were more likely to be non-adherent compared to younger patients and there were statistical differences between the reference age of 35-44 years and the older age groups of 55-64 years and 65 years and above. Males had 1.2 times higher odds of being non-adherent compared to females, but the relationship between adherence and gender was not statistically significant. Patients residing in rural areas were twice as likely to be non-adherent compared to those in urban areas and the relationship between residence and adherence was statistically significant. Married patients were less likely to be non-adherent compared to single patients, while divorced or widowed patients had 3.6 times the odds of being non-adherent. No statistical differences were found between single and married patients, or between divorced/widowed patients. Patients with no employment had 1.4 times higher odds

of being non-adherent compared to those who were employed, but there was no statistically significant relationship between employment status and adherence. Patients with lower levels of education were more likely to be non-adherent compared to those with a tertiary level of education, with statistical differences noted between the tertiary level and both the primary level and those with no formal education.

**Table 8: Association between socio-demographic and non-adherence**

	Non-adherence	Adherence	OR (95% CI)	p-value
<b>Age</b>				
35 – 44	20 (8.2)	17 (18.9)	Reference	
45 – 54	58 (23.8)	26 (28.9)	1.9 (0.9 – 4.2)	0.115
55 – 64	92 (37.7)	20 (22.2)	3.9 (1.7 – 8.8)	<b>&lt;0.001</b>
65 and above	74 (30.3)	27 (30.0)	2.3 (1.1 – 5.1)	<b>0.034</b>
<b>Gender</b>				
Male	118 (48.4)	39 (43.3)	1.2 (0.8 – 2.0)	0.414
Female	126 (51.6)	51 (56.7)	Reference	
<b>Residence</b>				
Rural	120 (49.2)	29 (32.2)	2.0 (1.2 – 3.4)	<b>0.006</b>
Urban	124 (50.8)	61 (67.8)	Reference	
<b>Marital status</b>				
Single	13 (5.3)	4 (4.4)	Reference	
Married	184 (75.4)	82 (91.1)	0.7 (0.2 – 2.2)	0.528
Div./Wid.	47 (19.3)	4 (4.4)	3.6 (0.8 – 16.4)	0.097
<b>Employment status</b>				
Employed	88 (36.1)	40 (44.4)	Reference	
Unemployed	156 (63.9)	50 (55.6)	1.4 (0.9 – 2.3)	0.163
<b>Education</b>				
No formal	168 (68.9)	44 (48.9)	4.6 (2.1 – 10.1)	<b>&lt;0.001</b>
Primary	36 (14.8)	9 (10.0)	4.9 (1.8 – 13.4)	<b>0.002</b>
Secondary	26 (10.7)	20 (22.2)	1.6 (0.6 – 3.9)	0.329
Tertiary	14 (5.7)	17 (18.9)	Reference	

The findings of Table 9 showed that only one clinical factor, diabetes, had a statistically significant relationship with adherence levels. Patients with diabetes were 2.1 times more likely to be non-adherent compared to those without diabetes.

**Table 9: Association between clinical factors and non-adherence**

	<b>Non-adherence</b>	<b>Adherence</b>	<b>OR (95% CI)</b>	<b>p-value</b>
<b>Duration of HTN (years)</b>				
<5	73 (29.9)	34 (37.8)	Reference	
5 – 10	81 (33.2)	28 (31.1)	1.3 (0.7 – 2.4)	0.323
>10	90 (36.9)	28 (31.1)	1.5 (0.8 – 2.7)	0.178
<b>BMI</b>				
Normal	176 (72.1)	72 (80)	Reference	
Overweight	55 (22.5)	15 (16.7)	1.5 (0.8 – 2.8)	0.210
Obese	13 (5.3)	3 (3.3)	1.8 (0.5 – 6.4)	0.383
<b>Diabetes Mellitus</b>				
Yes	108 (44.3)	25 (27.8)	2.1 (1.2 – 3.5)	<b>0.007</b>
No	136 (55.7)	65 (72.2)	Reference	
<b>Hypertensive heart disease</b>				
Yes	85 (34.8)	22 (24.4)	1.7 (1.0 – 2.9)	0.073
No	159 (65.2)	68 (75.6)	Reference	
<b>Heart failure</b>				
Yes	24 (9.8)	8 (8.9)	1.1 (0.5 – 2.6)	0.794
No	220 (90.2)	82 (91.1)	Reference	
<b>Stroke</b>				
Yes	22 (9.0)	5 (5.6)	1.7 (0.6 – 4.6)	0.308
No	222 (91.0)	85 (94.4)	Reference	
<b>Peripheral Artery Disease</b>				
Yes	5 (2.0)	0 (0.0)	-	
No	239 (98.0)	90 (100.0)	Reference	
<b>Chronic Kidney Disease</b>				
Yes	18 (7.4)	9 (10.0)	0.7 (0.3 – 1.7)	0.437
No	226 (92.6)	81 (90.0)	Reference	
<b>Asthma</b>				
Yes	5 (2.0)	1 (1.1)	1.9 (0.2 – 16.2)	0.573
No	239 (98)	89 (98.9)	Reference	

Table 10 reveals that all patient-related factors had a statistically significant impact on adherence levels. Patients who comprehended the background of their disease and the efficacy of their medication were less likely to be non-adherent. Conversely, those who believed that herbal drugs were more effective than anti-hypertensive medications were 4.7 times more likely to be non-adherent. Understanding the necessity of long-term medication was associated with lower odds of non-adherence, while the belief that treatment would make them ill was linked to 4.8 times higher odds of non-adherence. Lastly, fear of excessively low blood pressure from taking medication resulted in 15.4 times higher odds of non-adherence.

**Table 10: Association between patient related factors and non-adherence**

	Non-adherence	Adherence	OR (95% CI)	p-value
<b>Understand background of disease and effectiveness of medication</b>				
Yes	190 (77.9)	81 (90.0)	0.4 (0.2 – 0.8)	<b>0.014</b>
No	54 (22.1)	9 (10.0)	Reference	
<b>Herbal drugs are more effective than anti-hypertensive medications</b>				
Yes	97 (39.8)	11 (12.2)	4.7 (2.4 – 9.4)	<b>&lt;0.001</b>
No	147 (60.2)	79 (87.8)	Reference	
<b>Understand need for long-term taking of the drugs</b>				
Yes	177 (72.5)	85 (94.4)	0.2 (0.1 – 0.4)	<b>&lt;0.001</b>
No	67 (27.5)	5 (5.6)	Reference	
<b>Belief treatment could make you ill</b>				
Yes	92 (37.7)	10 (11.1)	4.8 (2.4 – 9.8)	<b>&lt;0.001</b>
No	152 (62.3)	80 (88.9)	Reference	
<b>Fear that BP will go low on taking medication</b>				
Yes	102 (41.8)	4 (4.4)	15.4 (5.5-43.4)	<b>&lt;0.001</b>
No	142 (58.2)	86 (95.6)	Reference	



Table 11 illustrates that all therapy-related factors had a statistically significant impact on adherence levels. Patients taking only one medication were 3.9 times more likely to be non-adherent compared to those taking two or more. Those who discontinued medication due to side effects were 5.5 times more likely to be non-adherent, while those who could afford the cost of their medication had lower odds of non-adherence.

**Table 11: Association between therapy-related factors and non-adherence**

	Non-adherence	Adherence	OR (95% CI)	p-value
<b>Number of anti HTN medications</b>				
1 medication	181 (74.2)	38 (42.2)	3.9 (2.4 – 6.5)	< <b>0.001</b>
≥ 2 medications	63 (25.8)	52 (57.8)	Reference	
<b>Experienced side effects make you stop medications</b>				
Yes	77 (31.6)	7 (7.8)	5.5 (2.4 – 12.4)	< <b>0.001</b>
No	167 (68.4)	83 (92.2)	Reference	
<b>Afford cost of medications</b>				
Yes	168 (68.9)	84 (93.3)	0.2 (0.1 – 0.4)	< <b>0.001</b>
No	76 (31.1)	6 (6.7)	Reference	

**4.9. To determine the correlation between adherence level and adequacy of blood pressure control.**

Results on table 12 indicate that patients who had nonadherent to medication were 1.7 times the odds of being uncontrolled, and the association between blood pressure control and adherence level was statistically significant.

**Table 12: Association between blood pressure control and adherence level**

	Uncontrolled	Controlled	OR (95% CI)	p-value
<b>Adherence level</b>				
Non-adherence	167 (76.6)	77 (66.4)	1.7 (1.0-2.7)	< <b>0.045</b>
Adherence	51 (23.4)	39 (33.6)	Reference	

## **CHAPTER FIVE: DISCUSSION**

### **5.1 Introduction**

A cross-sectional, hospital-based study whose aim was to assess the level of adherence and adequacy of blood pressure control among hypertensive patients undergoing follow-up care at medical outpatient clinics within a referral hospital in Somalia. There have been no studies of this kind conducted in Somalia before.

### **5.2 Adherence level**

More than two-third (73.1%) of the study subjects were found to have low adherence to their antihypertensive medications, which was high number compared to other regional studies. For example, in Ethiopia, 61.8% of hypertensive patients were compliant with their medication,(55) while in Kenya, 68% of patients were non-adherent.(12) In a study done in Kwazulu-Natal South Africa, adherence was reported to be moderate at 63%.(46) In Egypt, the reported high adherence level was 41.3%.(54) However, the Egypt study's setup was different from ours as their target population was patients taking fixed-dose combinations of antihypertensive medications, instead of single medications. Another factor that may have contributed to the higher adherence rate in Egypt was the higher level of education and employment among participants. A study covering 12 sub-Saharan countries found that 64.4% of participants had poor adherence.(45)

On the other hand, western countries like the US and the UK reported higher levels of adherence, with 25% (10) and 14.5% (52) of patients being non-adherent, respectively. These differences in adherence levels may be due to factors such as access to free medication, better healthcare and health facilities.

### **5.3 Blood pressure control**

Only 38.3% of patients had their BP controlled as measured over their visit to the MOPC. This result is similar to findings in other regional studies. For example, a study at Nyeri Provincial General Hospital found that only 33.4% of hypertensive patients had their blood pressure controlled,(69) while a study at KNH found that 26% of patients had controlled blood pressure. (12) A study involving 2198 patients from 12 sub-Saharan countries showed that 77.4% had uncontrolled blood pressure. (45) South Africa had a better result with 49% of participants

having controlled blood pressure.(46) In the Netherlands, Victor J.M reported that 40-60% of patients had uncontrolled blood pressure, despite the routine use of guideline-recommended therapy.(43)

#### **5.4 Determinants for nonadherence**

Two demographic characteristics of our patients showed statistically significant correlation to adherence level. older patients (55-64, 65 and above) had increased odds of being non-adherent to antihypertensive medications when compared to the younger patients (35-55). Main reason is that older adults may have difficulty remembering to take their medications regularly, or they may have difficulty accessing their medications due to mobility or transportation issues, and may have trouble understanding the instructions for taking them. Patients who had lower levels of education (no formal education and primary level) were more likely to be non-adherent when compared to those with tertiary level of education. Individuals with lower levels of education may have difficulty understanding the importance of taking their medications and the consequences of not doing so. Other socio-demographic factors were statistically not significant.

Most participants in this study had no formal education or only primary-level education. This has significant implications for adherence of antihypertensive medications in this population; educational materials must be delivered in a form that can be understood by those with lower literacy levels. An association was found between a higher level of education and better reported adherence.

This study revealed a strong link between having diabetes alongside hypertension and the likelihood of not adhering to anti-hypertensive medication. Individuals with diabetes were found to be 2.1 times more likely to be non-adherent compared to those without diabetes. This finding aligns with a previous study conducted in Ethiopia, which also identified diabetic comorbidity as a factor affecting adherence rates.(70) The possible explanation for this connection could be the complexity of the treatment regimen due to the need for multiple medications for both hypertension and diabetes, leading to polypharmacy and a greater pill burden, ultimately impeding adherence.

All patient's related factors in our population included (understanding background of the disease, using herbal drugs, believing that long term treatment could make them ill and fear that BP could drop for continuing medications) were statistically significantly associated with the nonadherence of antihypertensive medications. Some patients may have concerns about the potential for increased morbidity and mortality related to antihypertensive medications for various reasons, one being exposure to false or incorrect information via sources such as the internet, social media, or by word of mouth. This can lead to misunderstandings and loss of trust. Additionally, some cultural or religious convictions may cause individuals to distrust Western medicine, including anti-hypertensive medications.

Patients mentioned that they stopped medication due to relief of symptoms or due to fear of low blood pressure once they achieved adequate control. This shows that patients regard hypertension as an intermittent condition that only needs treatment in the presence of symptoms. This may be due to lack of information or patients' peculiar interpretation of information from health care givers and may be reinforced by input from friends, family or media. This highlights the necessity for adequate communication between patients and physicians.

Other statistically significant factors for nonadherence in our study was experiencing side effects, which led patients to discontinue taking their medications. Furthermore, the cost of medications was mentioned by several patients as a barrier to adherence. This could be attributed to personal experiences, as individuals who have had negative encounters with anti-hypertensive medications, such as experiencing side effects or perceiving a lack of improvement, might be more inclined to question the effectiveness of these medications and consequently become nonadherent.

This study found a significant association between adherence level and BP control, as patients who had nonadherent to medication were 1.7 times the odds of being uncontrolled. This is not an unexpected finding, as adherence to medication should be associated with better BP control. This suggests a need to focus on an approach that promotes adherence as a behaviour change strategy in the control of BP. A study in Pakistan in 2011 demonstrated that continual reinforcement of education and responding to queries around adherence lead to improved,

sustained adherence.(71) In addition, health care providers could consider using the 5As approach, which has been found to be successful in behaviour change counselling (ask, alert, assess, arrange and assist), as a structured, proactive approach to motivate for changes in adherence behaviour.(72) Improved adherence, in turn, should have a positive effect on hypertension control, with a resultant decrease in complications that can arise from uncontrolled hypertension.(71) Patients must also be encouraged to play an active role in controlling their hypertension, including asking questions freely at every opportunity, as this has been shown to improve adherence and control.(73) Adherence is key to achieving good control of BP, but with only about 2.7% of the studied population having high adherence levels, more needs to be done to explore the causes of poor adherence and to find pragmatic strategies to address any issues identified.(74) Unless this is addressed, the low hypertension control rate, especially when associated with concurrent diabetes, will lead to enhanced morbidity and mortality and associated higher expenditure on hypertension-related illnesses.

## **5.5 Conclusion**

More than two-thirds of the participants in the study were found to have low adherence to their antihypertensive medication. Majority of the study population had poor blood pressure control. Several factors were identified as affecting adherence levels, including older age, lower education levels, the presence of diabetes, patients' knowledge about the long-term use of medication, belief that medication should only be taken when blood pressure is high, fear of low blood pressure, use of alternative therapies, medication side effects, and medication cost. These factors were found to be statistically significant in their impact on adherence.

## **5.6 Recommendations**

Strategies to improve treatment adherence and blood pressure control include:

1. Regular educational programs focusing on antihypertensive medication towards vulnerable groups.
2. Combination antihypertensive medications.
3. Instruction on hypertension's standard therapeutic guidelines for the clinicians.
4. Allocating time during clinic visits for patients to ask questions, enabling them to actively participate in managing their hypertension.
5. Minimizing costs of medications.

### **5.7 Study limitations**

- Self-reported adherence method
- The study only took into account a few of the variables related to adherence levels, without taking into account other factors such as health care-related factors that may impact blood pressure control

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## APPENDICES

### Appendix I: Informed Consent Form

Study Number..... Sex.....

Age .....

#### Introduction

Hello. I am **Ahmed Hassan Adan**, a post-graduate student in the Department of Clinical Medicine and Therapeutics, University of Nairobi. This information form seeks informed consent for your participation in the study that seeks to assess “**Adherence level and determinants of nonadherence to antihypertensive medications among hypertensive patients attending Somali-Turkish hospital.**”. Poor adherence of anti-hypertensive medication is a main cause of poor control of high blood pressure. The findings of this study will be an evidence-based epidemiological and clinical research reference point that could be utilized in informing decisions in patient care and management.

#### Purpose of the Study

- To assess treatment adherence level and determinants of non-adherence among hypertensive patients attending Somali Turkish training and research hospital.

#### Procedure

If you agree to participate in this study, you will receive an identification number. you will be given a questionnaire to fill yourself. The questions in the questionnaire are about socio-demographic and factors affect treatment adherence and the second is on self-reporting scale of adherence level.

#### Risks/ Discomforts

There are no anticipated risks in participating in this study. However, if there are any problems that may arise due to your participation, you will be assisted accordingly.

#### Benefits

It is hoped that the outcome of the study will lead to awareness of the prevalence of nonadherence to antihypertensive medications, and hence enable/lead to a greater understanding of how to manage the conditions.

**Alternatives to participation/withdrawal from the study**

If you decide not to take part in this study no one will force you to, so you will be free to make your own decision. You are free to withdraw from the study, and this shall not affect your care in any way, and you will not be discriminated against in any way. You can also choose to take part in any other studies in the future.

**Confidentiality**

Any information you provide during the study will be kept strictly confidential. Your name will not appear on any study document and instead, a unique number shall be assigned to your questionnaire that will match both questionnaires.

**Voluntariness**

Your participation in this study, which will be in the form of a self-reported interview. You are free to choose whether to participate in this study. You are also free to withdraw from the study at any time you wish to do so.

In case of any questions or concerns about this study, please feel free to contact:

**Principal Investigator:**

**Ahmed Hassan Adan,**

Department of Clinical Medicine and Therapeutics

University of Nairobi

Tel:0748858485

Email: [drahmedzak32@gmail.com](mailto:drahmedzak32@gmail.com)

**Declaration**

I have read and understood the study information. I have been given the opportunity to ask questions about the study. I understand that my taking part is voluntary; I can withdraw from the study at any time, and I will not be asked questions about why I no longer want to take part. I understand my personal details will be kept private. I hereby consent to participate in the said study as has been explained and as I have understood.

**Participants' name:** .....

**Participants' signature:** .....

**Date:** .....

**Name of the Investigator: Ahmed Hassan Adan,**

**Signature of the Investigator:** .....

**Date:** .....



## **Appendix II: Informed Consent Form (Somali version)**

Numbarka baaritaanka ..... lab ama dhedig.....

Da'da .....

### **Horudhac**

waxaan ahay Dr Ahmed Hassan Adan arday takhasus ka diyaariya qaybta cafimaadka ee jamacada Nairobi. Warbixintanu waxa ay khuseysaa ogolaanshahada ka qayb qadashada baxthi caafimaad oo ku saabsan 'heerka uu gaarsiinsayahay qaadasho la'anta daawada dhiikarka iyo waxyaabaha keena in daawada la qaadanwaayo'. Daawada dhiikarka oo aanan loo qaadanin sidii loogu talagalay waa waxa ugu weyn ee keena in la contorooli waayo dhiikarka. Natijada kasoo baxda baaritaankan waxa ay noqonaysaa mid la isku halayn karo loona maray wada cilmiyaysann faaidana u leh tayaynta iyo daawaynta dhiikarka.

### **Hadafka baaritaanka:**

In la ogaado heerka uu gaarsiisanyahay qaadashada dawada dhiikarka iyo waxyaabaha keena in si joogta ah loo qaadanwaayo daawada iyada dadka la eegayo ay yihiin kuwa qaba dhiikarka ee imaanaya isbitaalka digfeer.

### **Qaabka loo sameynayo baaritaanka**

Hadii aad ogolaato ka qaybqaadashada baaritaankan waxaa lagu siin doona number aqoonsi ah. Waxa lagu dhiibaya labo warqad ay ku qoranyihiin suaalo aad ka jawabaysid, suaalaha ku qoran warqada koowaad waxa lagu ogaanaya heerka uu joogo daawo qaadashada halka suaalaha ku xardhan warqada labaad lagu ogaanayo waxyaabaha keena in aanan si joogto ah loo qaadanin daawada dhiikarka.

### **Qatarta baxthiga**

Baaritaankan malahan wax Qatar kugu ah dhan caafiamad ama dhankaleba. Hadii aad dareento wax dhibaato ah waad soo gudbin karta xili walba

### **Faaiidada baxthiga**

Faaiidada ugu weyn eel aga helayo baaritaankan waa ogaanshaha heerkeena qaadashada joogtada ah ee dawada dhiikarka iyo waxyaabaha keena joogteyn la'aanta daawada iyo in sare loo qaado wacyiga bulshada ku aadan qaadashada dawada iyo joogteynteedaba.

### **Ka bixitaankada baaritaanka**

Hadii aad goaansato inaad ka qayb qaadan baaritaankan amaba aad iskaga baxdo adigoo dhexda uga jira, xor baad u tahay goaankada. Cidna kuguma qasbi karto ka qaybqadashada baaritaankan. Wax saameyn ah kuma yelanayso qabka lagula tacumulayo, waxbana iskama badalayaan xiriirka ka dhexeeya baaraha iyo adiga. Majirayo wax takoor ah , xor baadna u tahay ka qaybqadashada baaritaanao kale mustaqbalka.

### **Kalsooni**

Macluumaad walba oo aad nala wadaagto waxa ay noqonaysaa mid ilaalsan, magacaaga ama numberkada kama so muqanayo baaritaanka, waxa la isticmalaya number garasho ah kaliya.

### **Mutadawcnimo**

Waxaad uga qayb qadanaysa baritankan qaab mutadawcnimo ah adigoo ka jawabaya suaalaha. Goaanka ka qaybqadashada adiga iska leh xor baana u tahay inaad kabaxdo xili walba aad doonto. Hadii aad dareento wax suaal ah waad ila soo xiriiri karta contacts kaygan hoos ku qoran

### **Baaraha koowaad**

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**Ogolaansho**

Waxaan aqriyay oo aan fahmay warbixintan kor ku xusan. Waxa la isiiyay waqti aan uga jawabo suaalaha. Waan ogahay inaan si mutadawacnimo ah uga qayb qdanayo xorna u ahay xili walba inaan ka bixi karo baaritaankan. Waan fahmay in waxyabaha shaqsiga ah la ii ilaalinayo. Diyaar baan u ahay inaan ka qayb qaato baaritaanka.

**Magaca ka qaybqaadaha:**.....

**Saxiixa ka qaybqaadaha:**.....

**Waqtiga:**.....

**Magaca baaraha: Ahmed Hassan Adan**

**Saxiixa baaraha:**.....

**Waqtiga:**.....

**APPENDIX III: Morisky Medication Adherence Scale (MMAS-8)**

No	Questions	Patient answer (yes/no)	Score. Y=1; N=0
1	Do you sometimes forget to take your blood pressure medication?		
2	In the last two weeks, was there any day when you did not take your high blood pressure medication?		
3	Have you ever stopped taking your medications or decreased the dose without first warning your doctor because you felt worse when you took them?		
4	When you travel or leave the house, do you sometimes forget to take your medications?		
5	Did you take your high blood pressure medication yesterday?		
6	When you feel your blood pressure is controlled, do you sometimes stop taking your medications?		
7	Have you ever felt distressed for strictly following your high blood pressure treatment?		
8	How often do you have difficulty to remember taking all your blood pressure medications? A. Never/rarely B. Once in a while C. Sometimes D. Usually E. All the time		A= 0 B-E= 1

Scores: >2 = low adherence. 1 or 2 = medium adherence. 0 = high adherence.

**APPENDIX IV: MORISKY MEDICATION ADHERENCE SCALE (MMAS-8)  
(SOMALI VERSION)**

Tiro	Waydiimo	Jawaab (yes/no)	Score. Haa=1; Maya=0
1	Xiliyada qaar miyaad hilmaamta qadashada dawada dhiikarka?		
2	Labadii usbuuc ee lasoo dhaafay, majirtaa maalin aadan qaadanin daawada dhiikarka?		
3	Waligaa miyaad iska joojisay ama aad yareysa tirade daawada adiga oo aanan ogeysiinin dhakhtarka, sabab la xiriirta inaad kusii xanuunsatay?		
4	Markaad safraysid ama aad guriga kabaxdo miyaad hilmaamta qadashada daawada dhiikarka?		
5	Maad qaadatay daawada dhiikarka shalay?		
6	Markaad dareento in dhiigaagu control lanyahay, ma iska daysaa qadashada daawada?		
7	Waligaa walwal makaa galay sida joogteynta ah ee aad u qadanaysid daawada dhiikarka?		
8	Ilaa iyo inee bay kugu adagtahay qadashada daawada dhiikarka?  A. Marnaba B. Halmar dhawrkii jeerba C. Marmarka qaar D. Badanaa E. Marwalba		A= 0 B-E= 1

Scores: >2 = qadashada dawada oo hooseeysa. 1 or 2 = qadashada oo meel dhexe ah .  
0 = qadashada dawada waa heer sare.

**APPENDIX V: QUESTIONNAIRE ABOUT DETERMINANTS OF NON-ADHERENCE TO ANTIHYPERTENSIVE MEDICATION AND ADEQUACY OF BLOOD PRESSURE CONTROL**

**Determinants of nonadherence**

• **Socio-demographic and clinical characteristics:**

1. Age (years): <35  35-44  45-54  55-64  65 and above
2. Gender: Male  Female
3. Residence: Rural  Urban
4. Marital status: single  married  divorced  widowed
5. Employment status: employment  unemployment
6. Educational level: No formal education  Primary  Secondary   
tertiary
7. Duration of HTN in years: < 5  5-10  >10
8. Body Mass Index (BMI): Normal  underweight  overweight  obese
9. Blood pressure level:
10. Comorbid conditions:
  - i. Diabetes Mellitus Yes  No
  - ii. Ischemic Heart Disease Yes  No
  - iii. Heart Failure Yes  No
  - iv. Stroke Yes  No
  - v. Peripheral Artery Disease Yes  No
  - vi. Chronic kidney disease Yes  No
  - vii. Asthma Yes  No
  - viii. Psychiatric disorders Yes  No
  - ix. Others Yes  No

• **Patient-related factors:**

11. Do you understand the background of the disease and effectiveness of medication:

YES  NO

12. Do you believe that alternative therapies like herbal drugs are more effective than anti-hypertensive medications? YES  NO

13. Do you understand the need for long-term taking of the drugs? Yes  No

14. Do you believe that the treatment could make you ill? YES  NO

15. Do you feel fear that your BP could go low if you take your medication?

YES  NO

• **Therapy-related factors:**

16. Number of anti HTN medications: 1 medication   $\geq$  2 medications

17. Have you experienced any side effects of medications that let you to stop the medications YES  NO

18. Can you afford the cost of medications: Yes  No

**APPENDIX VI: Questionnaire about Determinants of Non-Adherence to Antihypertensive Medication and Adequacy of Blood Pressure Control (Somali Version)**

**waxyabaha keena in dawada joogto loo qaadan waayo**

• **Macluumaad guud iyo xaalada caafimaad:**

1. Da'da (sanad)? <35  35-44  45-54  55-64  65 iyo ka sare
2. lab/dhedig: lab  dhedig
3. deegaan: baadiye  magaalo
4. Heerka guur: kali ah  la qabo  lasoo furay  laga dhintay
5. heerka shaqo: shaqaale  shaqo la'aan
6. heerka waxbarasho : waxna baran  dugsi hoose  dugsi sare   
jaamacad
7. Inta sano aad dhiikarka qabto: < 5  5-10  >10
8. miisaanka: meeshi loogu talagalay  hoos  sare  cayil
9. heerka cabirka dhiiga
10. Xanuunada waqtiyada dheer socda:
  - i. sonkor haa  maya
  - ii. xanuunada ku dhaca xididada wadnaha haa  maya
  - iii. wadnaha ooh awl gab noqda haa  maya
  - iv. maskaxda o dhiig ku furma ama xididada oo xirma haa   
maya
  - v. xididada lugaha oo xirma haa  maya
  - vi. Killiyaha o shaqadoda gaba haa  maya
  - vii. Naqas ama neef haa  maya
  - viii. Xanuunada dhimirka haa  maya
  - ix. xanuuno kale haa  maya

• **Arimo la xiriira bukaanka:**

11. faham maka haysataa xanuunkan dhiikarka iyo qaabka loo daaweeyo: haa   
maya



12. miyaad aaminsantahay in daawoyinka acshaabta ah ay ka wanagsan yihiin kuwan dhiikarka lagu daweeyo? Haa  maya

13. Miyaad fahansantahay in loo bahanyahay waqti dheer in lawado dawada haa  maya

14. miyaad aaminsatahay in daawadau xanuun ay kenayso? Haa  maya

15. miyaad aaminsantahay in pressure kaadu hoos u dhacayo hadada qaadato dawada dhiikarka? Haa  maya

• **Arimo la xiriira daawada:**

16. Tirade daawada dhiikarka ee aad qaadato: 1 daawo   $\geq$  2 daawo

17. waligaa miyaad dareentay dhibaato ay kugu keentay dawada taa o sababtay inaad iska joojiso qadashada daawada? Haa  maya


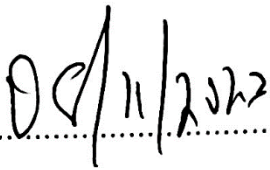
18. miyaad iska bixin kartaa dhaqalaha ku baxa daawada: haa  maya

**LEAD SUPERVISOR AND CHAIRMAN OF DEPARTMENT**

This dissertation has been submitted with the approval of my lead supervisor and chairman of the department of clinical medicine and therapeutics.

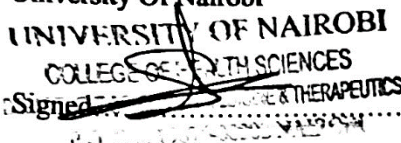
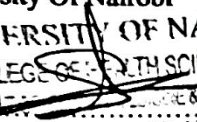

**Prof. Elijah S. N. Ogola**

Professor of Medicine  
Consultant Physician and Cardiologist  
Department of Clinical Medicine and Therapeutics  
University of Nairobi

Signed.......... Date..........

**Prof E.O. Amayo**

Chairman  
Department of Clinical Medicine and Therapeutics  
University Of Nairobi

  
Signed.......... Date..........

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ADHERENCE LEVEL AND ADEQUACY OF BLOOD PRESSURE CONTROL AMONG  
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