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St. Paul's Hospital Millennium Medical College

Determinants of Uncontrolled hypertension in Addis Ababa Public Hospitals - Case Control Study

**A Thesis to be submitted to Saint Paul Hospital Millennium Medical Collage,
Department of Public Health in Partial fulfillment of Masters of Public Health
in Field Epidemiology**

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Addis Ababa, Ethiopia

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A Thesis to be submitted to Saint Paul Hospital Millennium Medical Collage, Department of Public Heath

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LIST OF ABBREVIATIONS AND ACRONYMS

AHA- American Heart Association

BP- Blood Pressure

CHD- Coronary Heart Disease

CHF- Chronic Heart Failure

CI- Confidence Interval

CKD –Chronic Kidney Disease

DBP- Diastolic Blood Pressure

DM- Diabetes Mellitus

ESC- European Society of Cardiology

FETP- Field Epidemiology Training Program

MD- Medical Doctor

NCD- Non-Communicable Disease

SBP- Systolic Blood Pressure

SPHMMC- Saint Paul’s Hospital Millennium Medical College

SPSS- Statistical Package for Social Science

USA- United States of America

WHO- World Health Organization

ABSTRACT

Introduction

Hypertension is persistent elevation of blood pressure greater than or equal to 140/90 in two or more office measurements. Uncontrolled hypertension is a major problem both in developed and developing countries. Only one third to half of hypertensive patients have their blood pressure controlled.

Objective:

This study is designed to assess determinants of uncontrolled hypertension among hypertensive patients on follow up in public hospitals in Addis Ababa.

Methods:

Unmatched 1:2 case control study was conducted between July and August, 2019 in three selected Addis Ababa public hospitals. Hypertensive patients on follow up for more than 12 months at selected Addis Ababa public hospitals except those who are not on anti- hypertensive medication and those who are very sick and not able to respond to questions are included in the study. Purposive sampling is used to select the hospitals and then convenience sampling method is used to collect data's of both cases and controls proportional to caseloads of the hospitals. Adjusted odds ratios were calculated using logistic regression and variables with p- value of less than 5% were considered significant.

Results:

The sample size was 330, but only 108 cases and 210 controls were included in the study with response rate of 96%. One hundred seventy-seven (55.7%) of the patients were male. Forty-six (42.6%) of the cases and 96(45.7%) of the controls were female. Mean age $\pm$ SD of the patients was 53 $\pm$ 10.9 years (range from 27-81). Patients who adhere to medication have less risk of developing uncontrolled hypertension (AOR: 0.248, P-value <0.0001, 95% CI 0.13-0.45). Patients who do not have awareness of hypertension complication are at higher risk of developing uncontrolled hypertension (AOR: 2.02, p-value: 0.032 and 95%CI: 1.06-3.85). Those with other chronic comorbidities were at more risk of developing uncontrolled hypertension (p-value <0.0001, 95%CI: 2.3-13.9. Age > 65 increases the risk of uncontrolled hypertension five times P-value 0.048 and 95% CI of (0.9-28.3).

Conclusion and Recommendations

Adherence to anti-hypertensive medication and awareness of hypertension complication were factors with negative association with uncontrolled hypertension whereas, presence of comorbidity and being in the age group >65 are factors that showed positive association. To ensure better controls of BP, implementing aggressive blood pressure control measures, especially in older age group and in patients with comorbidities is recommended. Adherence support and awareness creation on complications of hypertension is recommended

Key words: *Uncontrolled hypertension, Case Control, Addis Ababa, Ethiopia*

1 INTRODUCTION

1.1 Background

Hypertension is a persistent systolic blood pressure (BP) reading (SBP) of 140 mm Hg or greater and/or a diastolic blood pressure reading (DBP) of 90 mm Hg or greater. It is known as uncontrolled if SBP is ≥ 140 mm Hg and/or DBP ≥ 90 mm Hg for general hypertensive population, or SBP ≥ 130 mm Hg and/or DBP ≥ 80 mm Hg in patients with established diabetes mellitus (DM) or chronic kidney disease (CKD). This classification is based on average of two or more measurement on two or more office visits(1). It is a key public health problem and one of the most common reasons for a medical appointment and drugs prescription(2)

Hypertension is one of the most important chronic non communicable diseases with increasing trend worldwide. Analysis of the global burden of hypertension revealed that over 25% of the world's adult population had hypertension in 2000, and the proportion is expected to increase to 29% by 2025. It is projected to increase from approximately 1.0 billion in 2000 to 1.5 billion by 2025 being the leading cause of morbidity and mortality among Non-communicable diseases. It is the third cause of disability adjusted life-years worldwide accounting for 13% of all deaths globally(2, 3). It's projected that 75% of older people will be hypertensive in low- and middle-income countries by 2025. The rising epidemic of hypertension is thought to be due to mechanization, population growth and ageing(4, 5) There has been a wide range of prevalence of hypertension around the world, with the lowest prevalence in rural India (3.4% in men and 6.8% in women) and the highest prevalence (78%) for South Africa and Poland (68.9% in men and 72.5% in women). Similarly the prevalence of hypertension is rising among older adults in Sub-Saharan Africa(6). There is a vast difference in prevalence of hypertension from region to region in Africa. In South Africa, for example, up to 50% of the people between the ages of 40 and 60 suffered from high blood pressure whereas, in rural Burkina Faso there was only a 15% prevalence(7). Although there is shortage of extensive data, 10.5% of the Ethiopian population has been estimated to have hypertension(8). The prevalence has been steadily increasing in Ethiopia from 3.6% in 1983, to 11.8 in 2002, 29.6 in 2006 and 19.6 % in 2015.(8, 9). It accounted for 1.4% of all deaths in 2000/01, making it the 7th leading cause of death in the

country (3). Approximately 30% of adults in Addis Ababa have BP above 140/90mmHg or reported use of antihypertensive medication (8).

Approximately 7.6 million deaths (13–15% of the total) and 92 million disability-adjusted life years worldwide were attributable to hypertension in 2001. Hypertension doubles the risk of cardiovascular diseases, including coronary heart disease (CHD), ischemic and hemorrhagic stroke, renal failure, peripheral arterial disease and triples the risk of congestive heart failure and strokes. The incidence of stroke increases approximately 3-fold in patients with borderline hypertension and approximately 8-fold in those with definite hypertension(10).It often is associated with additional cardiovascular disease risk factors, and the risk of cardiovascular disease increases with the total burden of risk factors. Although antihypertensive therapy clearly reduces the risks of cardiovascular and renal disease, large segments of the hypertensive population are either untreated or inadequately treated(1). In face of the exposed, estimates show that only a third of people who are regularly monitored in basic health services have their BP maintained at desirable levels(11, 12).

Uncontrolled hypertension is common among patients taking treatment and is a major public health problem in both developed and developing countries. A study conducted in the USA in older adults (65 years and above) revealed that presence of uncontrolled hypertension was highly prevalent and estimated as 54%(3). In a study conducted in Cameroon, only 36.8% of patients had their mean blood pressure controlled ($BP \leq 140/90$ mmHg)(12). Few studies conducted in Ethiopia justified that the prevalence of uncontrolled hypertension among patients on treatment varied from 53.4% in Gondar hospital to 59.9% in Tikur Anbessa Hospital(13, 14). Another study done at Jimma University shows that the prevalence of uncontrolled hypertension is 52.7%(3).

1.2 Statement of the Problem

Addis Ababa is the capital city of Ethiopia with an area of 530 km² and a total population of 3.4 million and 10 sub-cities. It has 12 public hospitals, and of which 10 has hypertension follow up clinic (30).

Population studies suggest that blood pressure is often inadequately controlled in clinical practice. Indeed, the available evidence suggests that, despite the availability of effective treatment, blood pressure control can still be described by the traditional ‘rule of halves’(15). According to this rule, only about half of all hypertensive patients are diagnosed, only half of these receive treatment, and in only half of these is blood pressure adequately controlled; thus, only about 12.5% of patients are adequately treated. In a survey of hypertension management in 10 countries worldwide, the proportion of patients in whom blood targets of below 140/90 mm Hg were achieved ranged from 27% in the US to only 6% in England, and the proportion achieving more conservative targets of below 160/90 mm Hg ranged from 2.5–22.5%(16). The reasons for inadequate blood pressure control are complex and arise from a combination of factors related to the way that physicians treat hypertension, poor patient adherence to therapy, and the properties of the antihypertensive drugs themselves(17). Uncontrolled of hypertension is associated with higher drug costs and more physician visits(18).

1.3 Significance of the Study

In Addis Ababa, prevalence of hypertension is 25%(19) which is high. So far, studies done concerning hypertension are more of about the prevalence of hypertension and Determinants of hypertension in Addis Ababa. After searching several data bases, studies in this area are limited despite high prevalence of hypertension in the city. The present study is intended to contribute to bridging the information gap, and subsequently identifying Determinants of uncontrolled of hypertension in hypertensive patients on follow up at Addis Ababa public Hospitals.

2. LITERATURE REVIEW

2.1 Definition of Hypertension

There are several published guidelines on classification of hypertension which help physicians in reaching to proper control of hypertension. Blood pressure (BP) for adults age ≥ 18 can be categorized based on stage: pre-hypertension is systolic blood pressure (SBP) 120-139 mm Hg or diastolic blood pressure (DBP) 80-89 mm Hg, stage 1 hypertension SBP 140-159 mm Hg or DBP 90-99 mm Hg and stage 2 hypertension for SBP ≥ 160 mm Hg or DBP ≥ 100 mmHg (20). But according to the 2018 European Heart Journal classification, <120 mmHg systolic and <80 mmHg diastolic is Optimal blood pressure (BP), Normal BP is systolic 120-129mmHg and/or diastolic 80-84mmHg, high normal is systolic 130-139 and/or 85-89 diastolic, Grade 1 hypertension is systolic 140-149 and/or 90-99 diastolic, grade 2 is systolic 160-179 and or 100-109 diastolic, grade 3 is systolic ≥ 180 and/or ≥ 110 diastolic and isolated systolic hypertension is systolic ≥ 140 and <90 diastolic.(21) The American guidelines have lowered the threshold to define hypertension to 130/80mmHg whereas the ESC/ESH guidelines have retained the previous threshold of 140/90mmHg to define hypertension. (21). While the American and European guidelines differ in the definition of hypertension, the recommended therapeutic goal is the same, i.e. $<130/80$ mmHg(21). Hypertension is asymptomatic and is usually diagnosed incidentally or after major organ damage has occurred (17).

2.2 Epidemiology

Hypertension is present in all populations except for a small number of individuals living in primitive, culturally isolated societies. In industrialized societies, blood pressure increases steadily during the first two decades of life. In children and adolescents, blood pressure is associated with growth and maturation. Blood pressure "tracks" over time in children and between adolescence and young adulthood. In the United States, average systolic blood pressure is higher for men than for women during early adulthood, although among older individuals the age-related rate of rise is steeper for women. Consequently, among individuals age 60 and older, systolic blood pressures of women are higher than those of men. Among adults, diastolic blood pressure also increases progressively with age until ~ 55 years, after which it tends to decrease.

The consequence is a widening of pulse pressure (the difference between systolic and diastolic blood pressure) beyond age 60. The probability that a middle-aged or elderly individual will develop hypertension in his or her lifetime is 90%.(1, 23).It has been estimated that 60% of hypertensives are >20% overweight. (1, 13, 22)

2.3 Risk Factors

Both environmental and genetic factors may contribute to regional and racial variations in blood pressure and hypertension prevalence. Studies of societies undergoing "acculturation" and studies of migrants from a less to a more urbanized setting indicate a profound environmental contribution to blood pressure. Obesity and weight gain are strong, independent risk factors for hypertension (1). Another independent risk factors for hypertension are, high dietary salt intake, low dietary intake of calcium and potassium, alcohol consumption, psychosocial stress, low levels of physical activity, and family history of hypertension.(23-26). From the available research in the field of hypertension treatment, factors influencing hypertensive patients' adherence behavior to antihypertensive medication include patient related factors (e.g., socio-demographic factors and the individual's knowledge and skills), health system-related factors (such as treatment cost and patients' resources), and provider-related factors (such as patient-provider relationships and communication).3,9 medication nonadherence is an enormous burden to the world's health care system.(10, 27, 28).

2.4 Uncontrolled hypertension

Uncontrolled hypertension is defined as, SBP ≥ 140 mm Hg and/or DBP ≥ 90 mm Hg for general hypertensive population, or SBP ≥ 130 mm Hg and/or DBP ≥ 80 mm Hg in patients with established diabetes mellitus (DM) or chronic kidney disease (CKD). Based on clinical trial data, the maximum protection against combined cardiovascular endpoints is achieved with pressures <135–140 mmHg for systolic blood pressure and <80–85 mmHg for diastolic blood pressure; however, treatment has not reduced cardiovascular disease risk to the level in non-hypertensive individuals. More aggressive blood pressure targets for blood pressure control (e.g., office or clinic blood pressure < 130/80 mmHg) are generally recommended for patients with diabetes, coronary heart disease, chronic kidney disease, or additional cardiovascular disease risk factors. An even lower goal blood pressure (systolic blood pressure ~ 120 mmHg) may be desirable for patients with proteinuria (>1 g/d) since the decline of glomerular filtration rate in these patients

is particularly blood pressure–dependent(1). Percentages of persons with controlled hypertension has lessened in recent years, even though several new effective pharmacologic and non-pharmacologic interventions have been introduced for lowering BP(23). In one study done in Cameroon, only 36.8% of patients had their mean blood pressure controlled (BP $\leq$ 140/90 mmHg). Multivariable logistic regression analysis revealed good adherence to anti-hypertensive medications (OR= 3.99; 95% CI: 2.20–7.23; P<0.000) and dietary lifestyle changes (OR =1.5; 95% CI: 0.53–2.49; P=0.031) to be factors independently associated with controlled hypertension(12). In another study done at south western Ethiopia, the rate of blood pressure control was 50.3%. In a univariate logistic regression analyses, age 65 years old (P = 0.008), physical inactivity (p<0.001), chat chewing (P<0.001), adding salt to food (P<0.001), and coffee use (P<0.001) are significantly associated with uncontrolled blood pressure(29). The following diagram (Figure 1) shows the conceptual frame work of factor associated with uncontrolled of hypertension

2.5 Conceptual frame work

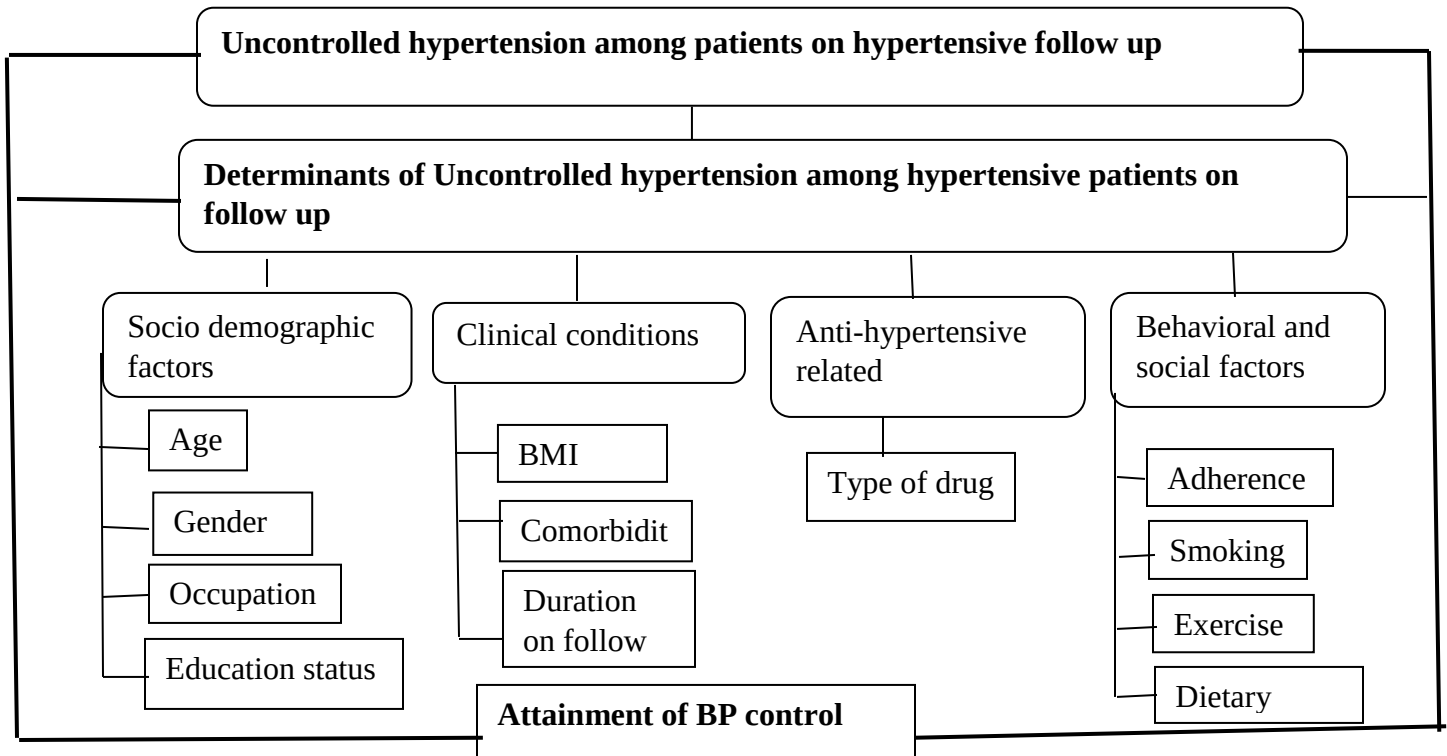


Figure 1: A conceptual frame work of the study (1, 5, 6, 8, 11, 17)

3. OBJECTIVES OF THE STUDY

3.1 General Objective

- To identify predictors of uncontrolled of hypertension in patients on follow up at Addis Ababa public Hospitals from July 10 to August 10.

3.2 Specific Objectives

- Assess independent predictors of uncontrolled hypertension in patients on follow up at Addis Ababa selected public Hospitals from July 10 to August 10.

4. METHODS AND MATERIALS

4.1 Study Area

Addis Ababa is the capital city of Ethiopia which is one of the self-governing two cities in the country. The altitude of the city is 2,355m above sea level. It is the 3rd highest capital in the world. Total surface area of the city is 530.14Km² It has 10 administrative zones which are called 'kifleketemas'. The city is found between 9°0'19" N and 38°45'48" E. The total population of the city in 2018 according to 2007 census is, 3,450,636. The city has 11 public hospitals of which six are under Addis Ababa City Government and five are under Federal Ministry of Health.

4.2 Study Design and Period

Un-matched case control study was conducted between July 10, 2019 and August 10, 2019.

4.3. Source and Study population

4.3.1 Source Population

All hypertensive patients on follow up for at least 12 months in Ethiopian Public Hospitals

4.3.2 Study Population

All hypertensive patients on follow up for at least 12 months at Addis Ababa selected Public Hospitals who are included in the sample.

4.4 Inclusion and Exclusion criteria

4.4.1 Inclusion Criteria;

All hypertensive patients on follow up at Addis Ababa selected Public Hospitals who are on anti-hypertensive medications for more than 12 months

4.4.2Exclusion Criteria

- All hypertensive patients who are not taking anti-hypertensive medication, or on follow up for less than 12 months.
- All hypertensive pregnant mothers.
- All critically ill hypertensive patients who are unable to complete the interview.

4.5 Study Variables

Dependent variables

- Hypertension (1=Uncontrolled, 0=Controlled)

Independent variables

- | | |
|---------------------------------|-----------------------|
| • Age | • Height |
| • Sex | • Weight |
| • Marital status | • Adherence |
| • Residence | • Physical Exercise |
| • Occupation | • Comorbidity |
| • Educational status | • Dietary habit |
| • Duration on anti-hypertensive | • Smoking |
| • Number of anti-hypertensives | • Alcohol consumption |

4.6 Sample Size Determination

Using a two-population proportion formula (stat-calc.)

$$n_1 = \frac{\left[Z_{\alpha/2} \sqrt{\bar{p}q} (1 + 1/\lambda) + Z_{\beta} \sqrt{p_1q_1 + p_2q_2/\lambda} \right]^2}{\Delta^2}$$

Where $n_2 = n_1 \lambda$, $\bar{p} = (p_1 + \lambda p_2) / (1 + \lambda)$

n_1 = number of cases

n_2 = number of controls

$\Delta = P_1 - P_2$

P_1 = Proportion of cases exposed to the risk factor of interest

P_2 = proportion of controls exposed to the risk factor of interest

$\lambda = n_2/n_1$ - ratio of controls to cases

Z_β = power=80%

In a study done in Jimma University, the proportion of poor-adherence among patients with uncontrolled hypertension is ($p_1=0.57$) and it is ($p_2= 0.4$) among patients with controlled hypertension (24). Though poor adherence is one of the predictors of uncontrolled of hypertension, it is considered in this study for sample size determination because it is the most common cause and a variable that has high prevalence in patients with uncontrolled hypertension in several studies.

Then, when we replace the above formula using 95% confidence level and 80% power, $n_1 = 100$ cases but by adding 10% non-response rate, $n_1 = 110$ and $n_2 = 220$ and the total sample size is $n=330$ with 110 cases and 220 controls.

4.7 Sampling technique

Purposive sampling technique is used to select the hospitals and then, proportional number of cases is taken from each selected hospital according to their case load. Eventually, convenience sampling method is used to collect the data of both cases and controls. For each case, data of two controls was taken. SPHMMC from hospitals under FMOH, and MenelikII Hospital and Yekatit 12 Hospital Medical College from hospitals under Addis Ababa health bureau are included because these hospitals are the ones with high case load of hypertensive patients. Schematic presentation of the sampling procedure is depicted in figure 2 below.

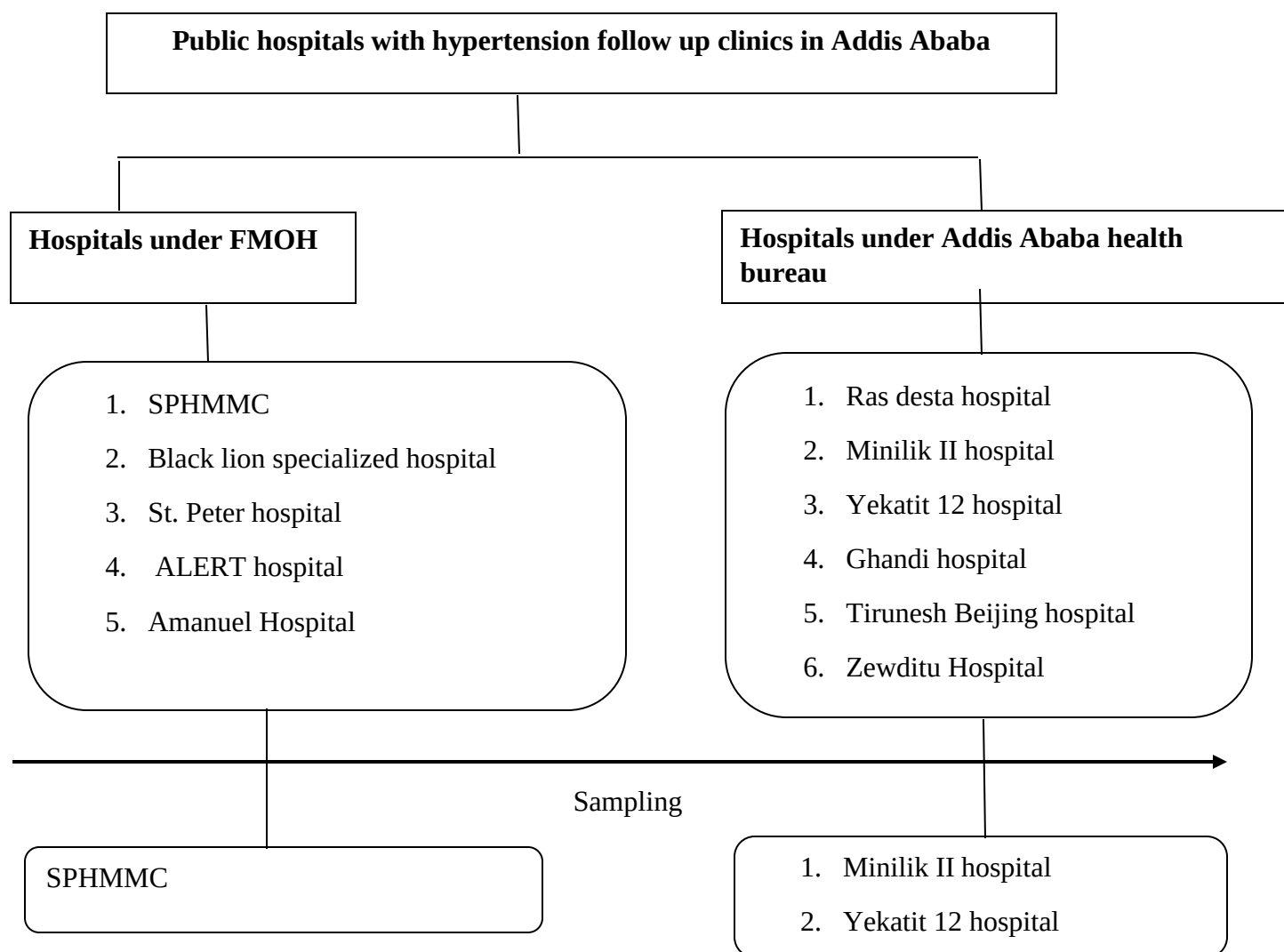


Figure 2: Schematic presentation of the sampling procedure

4.8 Data Collection Technique

Data is collected by face to face interview using structured questionnaires and reviewing the chart of the patients. Weight and height of the patients were also measured. Body weight was measured to the nearest 0.1kg using a weight scale and height was measured to the nearest 0.1cm in the standing position using a height board. Body mass index was calculated as weight in kilogram divided by squared height (meter square). Morisky's Medication Adherence Scale (MMAS-8) was used to assess the patient's medication adherence. Patient's physical activity was assessed by asking each patient the number of minutes of exercise per day and the number of days exercised in a week. The patients were classified as physically active if they reported they exercise greater than 30 minutes per day five times per week otherwise, they were classified as

physically inactive. Four BSc nurses and two medical Interns working at the hospitals were trained on data collection and they collected the data after training. Additionally, two BSc nurses were supervising the data collection.

4.9 Data Management and Analysis

Validity of the data was maintained by developing structured questionnaire and translating to local language (Amharic) and then back to English. After cleaning the data, it was entered into SPSS (Statistical Software for Social Science) version 23. Different tables were generated and logistic regression was performed using SPPSS. Variables with P-value < 0.05 were considered statistically significant predictors.

4.10 Operational Definitions

Hypertension- Sustained high blood pressure (SBP $\geq$ 140 or DBP $\geq$ 90mmHg)

Controlled hypertension- any patient on hypertension follow up for more than 12months and BP <140/90 or Diabetic or CKD patient with BP <130/80

Uncontrolled hypertension- - any patient on hypertension follow up for more than 12 months and BP $\geq$ 140/90 or diabetic or patients with Chronic Kidney Disease (CKD) on follow up for more than 12 months and BP $\geq$ 130/80

Cases- all patients with uncontrolled hypertension

Controls – all patients with controlled hypertension.

Adherent- respondents who scored $\geq$ 6 points of the Morisky medication adherence scale(30)

4.12 Ethical Considerations

Letter of approval and Ethical clearance was received from SPHMMC Institutional Review Board, and support letter was submitted to each hospital selected. Additional ethical clearance was obtained from Addis Ababa Public Health Research and Emergency Management Directorate. Oral Consent was taken from each patient before interviewing. Individual response was not associated with his or her identity in any way, they were completely anonymous. Any patient was able to withdraw from the study any time without penalty.

4.13 Dissemination of the Result

The result of the study will be disseminated to, SPHMMC research department, Addis Ababa Public Health Research and Emergency Management Directorate and each hospital's administration and treating clinicians.

5. RESULTS

5.1 Socio Demographic characteristics

Out of 330 sample, 318(108 cases and 210 controls) patients were included in the study with response rate of 96%. Of all participants, 50 cases and 100 controls are from SPHMMC, 35 cases and 65 controls are from Yekatit 12 hospital whereas the remaining 23 cases and 45 controls are from Menelik II Hospital. One hundred seventy-seven (55.7%) of the participants were males. Forty-six (42.6%) of the cases and 96(45.7%) the controls were females. Age 45-54 years is the most frequent, 32(29.6%) of cases and 81(38.5%) of controls, age group. Majority, 96(87.2%) of cases and 161(76.6%) of the controls were married. 25(22.7%) of cases and 44(20.9%) the controls had no formal education. Three hundred one (94.7%) of the study participants were urban residents. The socio demographic characteristics of the study participants is indicated in **table 1** below.

5.2 Behavioral and Clinical characteristics

Fifty six (17.6%) of the patients were overweight. Majority, 255(80.2%), of the study participants were on hypertension follow up for less than five years. Fifty (15.7%) of the patients had comorbidities, type two diabetes contributing 56% (28) of the comorbidities. Majority, 101(38.3) of cases and 163(61.7) controls, exercise for less than 30 minutes per day. Only 37 (11.6%) and 11(3.5%) of the study participants consume alcohol and smoke cigarette respectively. Most, 199(62.6%) of the patients were adherent to antihypertensive medications but only 114(35.8%) of them were adherent to the recommended salt consumption. Only 72(43.4) of cases and 156(78.4) of controls were aware about hypertension complications. The behavioral and clinical characteristics of the study participants is indicated in **table 2** below

5.3 Determinants of blood pressure control

The association of socio-demographic, behavioral and clinical variables with the uncontrolled hypertension was investigated using both bivariable and multivariable logistic regression. The results are presented in **tables 3, 4 and 5** below. In the bivariable logistic regression, nine variables, namely; BMI, marital status, education level, drug adherence, salt adherence, awareness of hypertension complications, physical exercise minutes per day, age, and presence of comorbidities, showed statistically significant association with control of hypertension at 20%

level of significance. However, in the multiple logistic regression, only four variables namely; age > 65, adherence to anti-hypertensive medication, awareness of hypertension complication and presence of comorbidity showed statistically significant association at 5% level of significance. Those patients who adhere to anti-hypertensive medication have 75.2% less risk of developing uncontrolled hypertension with P-value of <0.001 and 95% CI of 0.13-0.45. Patients who do not have awareness of hypertension complication are 2.02 times at higher risk of developing uncontrolled hypertension with p-value 0.032 and 95%CI of 1.06-3.85. Among hypertensive patients, those with other chronic comorbidities are 5.73 times more risk of developing uncontrolled hypertension with p-value of 0.000 and 95%CI of 2.36-13.92. Patients who are greater than 65 years of age are five times at higher risk of developing uncontrolled hypertension with p-value of 0.048 and 95% CI of (0.88-28.34).

Table 1: *Socio demographic characteristics of hypertensive patients in public hospitals in Addis Ababa, Ethiopia, 2019*

	Characteristics	N (%)	Type	
			Case (%)	Control (%)
Age in years	<35	16(5)	2(1.85)	14(6.6)
	35-44	49(15.4)	12(11.2)	37(17.6)
	45-54	113(35.5)	32(29.6)	81(38.5)
	55-64	85(26.7)	32(29.6)	53(25.2)
	≥65	55(17.3)	30(27.7)	25(11.9)
Gender	Male	177(55.7)	62(57.4)	115(54.7)
	Female	141(44.3)	46(42.5)	96(45.7)
Marital status	Divorced	31(9.7)	5(4.5)	26(12.3)
	Married	257(80.8)	96(87.2)	161(76.6)
	Un married	20(6.3)	4(3.6)	16(7.6)
	Widowed	10(3.1)	3(2.7)	7(3.4)

Education	No formal Education	98(30.8)	25(22.7)	44(20.9)
	Primary education	99(31.1)	34(30.9)	65(30.9)
	Secondary Education	52(16.4)	25(22.7)	27(12.8)
	College	69(21.7)	24(21.8)	74(35.2)

Table 2: Behavioral and clinical characteristics of hypertensive patients at public hospitals in Addis Ababa, Ethiopia, 2019

	Factor	Frequency (%)
BMI	Normal	245(77)
	Under weight	8(2.5)
	Over weight	56(17.6)
	Obese	9(2.8)
Duration of hypertension in years	Less than 5 years	255(80.2)
	5 years and above	63(19.8)
Comorbidities	Type II DM	28(56)
	CHF	5(10)
	CHD	3(6)
	HHD	9(18)
	Stroke	5(10)
Physical exercise	Less than 30 minutes per day	264(83)
	30 minutes and above	54(17)
Alcohol consumption	Yes	37 (11.6)
	No	281 (88.4)
Smoking	No	307(96.5)
	Yes	11(3.5)
Drug adherence	Yes	199(62.6)
	No	119(37.4)

Salt adherence	Yes	114(35.8)
	No	204(64.2)
Awareness of HTN complication	No	166(52.2)
	Yes	152(47.8)

Table 3: Bivariable logistic regression results of determinants of uncontrolled hypertension in Addis Ababa public hospitals, Ethiopia, 2019

Variables	BP status		COR	P-value	95% CI
	Uncontrolled (%)	Controlled (%)			
Gender					
Male	62(35)	115(65)	1	1	1
Female	46(32.6)	96(67.4)	.65	.898	.562-1.43
Marital status					
Un married	4(20)	16(80)	.583	.544	.06-2.3
Married	96(37.4)	161(62.6)	1.391	.638	.51-5.08
Divorced	5(16.1)	26(83.9)	.449	.343	.02-.35
Widowed	3(30)	7(70)	1	1	1
Education					
No formal Education	24(24.5)	74(75.5)	.571	.102	.89-3.34
Elementary	34(34.3)	65(65.7)	.921	.801	.68-2.7
High school	25(48.1)	27(51.9)	1.63	.191	1.4-5.2
College	25(36.2)	44(63.8)	1	1	1
Drug adherence					
Adhered	43(21.6)	156(78.4)	.229	<0.001	.140-.375
Not adhered	65(54.6)	54(45.4)	1	1	1
Salt adherence					
Adhered	22(19.3)	92(80.7)	.328	<0.001	.191-.564

Not adhered	86(42.2)	118(57.8)	1	1	1
Awareness of HTN complication					
Aware	72(43.4)	94(56.6)	1	1	1
Not aware	36(23.7)	116(76.3)	2.468	<0.001	1.52-4
Physical exercise/day					
30 minutes & above	7(13)	47(87)	.240	.001	.105-.552
Less than 30 minutes	101(38.3)	163(61.7)	1	1	1
Diet adherence					
Adhered	22(26.8)	60(73.2)	.64	.115	.367-1.115
Not adhered	86(36.4)	150(63.6)	1	1	1
BMI					
Under weight	0(0)	8(100)	.398	.235	1
Normal	85(34.7)	160(65.3)	.188	.128	.15-2.5
Overweight	17(30.4)	39(69.6)	.327	.171	.3-1.53
Obese	6(66.7)	3(33.3)	1	1	1
Age group					
<35	2(12.5)	14(87.5)	1	1	1
35-44	12(24.5)	37(75.5)	2.270	.321	.45-11.45
45-54	32(28.3)	81(71.7)	2.765	.195	.59-12.86
55-64	32(37.6)	53(62.4)	4.226	.068	.90-19.81
≥ 65	30(54.5)	25(45.5)	8.40	.008	1.74-40.5
Comorbidity					
Yes	79(28.9)	194(71.1)	4.4	<0.001	2.29-8.64
No	29(64.4)	16(35.6)	1	1	1

Table 4: Multiple logistic regression result of variables associated with uncontrolled hypertension in public hospitals in Addis Ababa, Ethiopia, 2019

Variables	BP status		AOR	P-value	95% CI
	Uncontrolled (%)	Controlled (%)			
Drug adherence					
Adhered	43(21.6)	156(78.4)	.248	<0.001	.13-.45
Not adhered	65(54.6)	54(45.4)	1	1	1
Salt adherence					
Adhered	22(19.3)	92(80.7)	.55	.14	.24-1.23
Not adhered	86(42.2)	118(57.8)	1	1	1
Awareness of HTN complication					
Aware	72(43.4)	94(56.6)	1	1	1
Not aware	36(23.7)	116(76.3)	2.02	.032	1.06-3.85
Age group					
<35	2(12.5)	14(87.5)	1	1	1
35-44	12(24.5)	37(75.5)	2.654	.277	.45-15.45
45-54	32(28.3)	81(71.7)	1.932	.434	.37-10.06
55-64	32(37.6)	53(62.4)	3.055	.192	.57-16.34
≥ 65	30(54.5)	25(45.5)	5.018	.048	.88-28.34
Comorbidity					
Yes	79(28.9)	194(71.1)	5.73	<0.001	2.36-13.92
No	29(64.4)	16(35.6)	1	1	1
BMI					
Under weight	0(0)	8(100)	1.731	.536	.304-9.847
Normal	85(34.7)	160(65.3)	.244	.253	.022-2.740
Overweight	17(30.4)	39(69.6)	.726	.732	.116-4.536
Obese	6(66.7)	3(33.3)	1	1	1
Education					
No formal Education	24(24.5)	74(75.5)	.488	.077	.22-1.08

Elementary	34(34.3)	65(65.7)	.797	.570	.36-1.74
High school	25(48.1)	27(51.9)	1.452	.388	.62-3.38
College	25(36.2)	44(63.8)	1	1	1
Physical exercise/day					
30 minutes & above	7(13)	47(87)	1.13	.81	.39-3.25
Less than 30 minutes	101(38.3)	163(61.7)	1	1	1

6. DISCUSSION

Elevated blood pressure kills more people than any other condition – approximately 10 million people each year, more than all infectious diseases combined. Reducing blood pressure prevents stroke, heart attack, kidney damage, and other health problems. An estimated 1.4 billion people worldwide have high blood pressure, but just 14% have it under control – that is roughly one person in seven.(31).

The mean age of the study participants is 53 ± 10.9 years which is more or less similar to a study done in North West Ethiopia on determinants of blood pressure control among hypertensive patients.(32) In our study, age is one of the identified predictors of blood pressure control. As the age of the patient increases by the odds of being categorized into uncontrolled BP increases by 1.048, that means a unit increase of age increases the chance of uncontrolled BP by 4.8%.

Additionally, age greater than 65 is also one of the factors associated with blood pressure control. Those patients whose age is greater than 65 are five times at higher risk of developing uncontrolled blood pressure compared to those who are less than 65 years old. Resistant or difficult-to-control hypertension is more common in patients >60 years than in younger patients. Rarely, in older patients, pseudo hypertension may be related to the inability to measure blood pressure accurately in severely sclerotic arteries.(1) This increase in the rate of uncontrolled BP in the older age group could be due to longer years of medication use and reluctance to adhere to medication or concomitant comorbidities which makes them less likely to be adherent to their treatment than those with no co morbidities. Patients with more number of comorbidities could suffer from serious complications and complex treatment regimens which were favorable conditions not to adhere to their medications. In line with this study, one cross sectional study done in Jimma University in 2015 shows that age greater than or equal to 65 is significantly associated with uncontrolled blood pressure.(29). In another cross sectional study done at Zewditu Memorial Hospital in 2016, there was statistically significant positive association between uncontrolled BP and those patients who are aged greater than 60 years.(33). In contrast to this study, another study conducted by Firehiwot Amare at Addis Ababa Health Centers in 2016 shows that age younger than 60 years is positively associated with uncontrolled

hypertension with AOR of 2.47 compared to those whose age is greater than 60 years old.(34). On Ethiopia STEPS survey conducted by WHO in 2016, age was one of the significant risk factors ($P<0.05$) that showed positive association with developing raised blood pressure.(35)

In this study, anti-hypertensive drug adherence is one of the determinants of uncontrolled hypertension. Those who adhere to antihypertensive medication are 75.2% protected from uncontrolled hypertension compared to those who do not adhere to a medication. In many developing countries, maintaining good adherence to antihypertensive medications remained the most important challenge. Adherence to antihypertensive medications contributes for controlled blood pressure and the prevention of complications.

This study is in line with one similar study conducted in South Africa in which good adherence to anti-hypertensive medication was significantly associated with good odds of BP control(36). Additionally, a hospital based study from Zimbabwe and Nigeria reported that compliance with medication regimen was found to be protective against uncontrolled hypertension (37, 38). In other study conducted in elderly hypertensive patients in Indonesia, irregular taking of medication is significantly associated with BP control with AOR of 2.96 and P-value of 0.029(39). This study is also consistent with another study done in Cameroon on factors associated with blood pressure control in which, good adherence to anti-hypertensive medications (OR= 3.99; 95% CI: 2.20–7.23; $P<0.000$) is one of the factors independently associated with controlled hypertension.(12). To further support this study, a study done in Addis Ababa Health Centers in 2016, showed that non-adherence to medications (AOR 1.71, 95% CI: 1.11, 2.63) is one of the identified factors that are positively associated with uncontrolled BP.(34)

In this study another factor that showed significant association with uncontrolled hypertension is awareness of hypertension complication. Thus, those patients who are not aware of complications of hypertension are two times at higher risk of having uncontrolled BP compared to those who have awareness. This is in line with study done in Adama Referral Hospital, Pakistan, Zambia and university of Gonder which shows that respondents who have not at all understood the information provided about their medication are less likely to be adherent as

compared to those who understood the information very well. Right knowledge about HTN and its treatment creates a clear understanding and avoids confusion about the treatment and the disease condition. This is due to the fact that people are more likely to be convinced after sufficient information pertaining to their disease, medication regimen and associated risks is supplied. Hence it is worth mentioning that health care professionals are responsible at providing valuable and relevant information to their clients so as to raise consciousness and stimulate action which help to overcome the problem of poor adherence.(40-42)

Co-morbidities can precipitate the health status of the patient and make them fail to adhere to their antihypertensive treatment. Hypertension usually co exists with obesity, diabetes, hyperlipidemia, or metabolic syndrome; their association with cardiovascular disease is well established. The identification and management of this risk factors is an important part of the overall management of hypertensive patients. Because patients with these comorbidities are more predisposed to target organ damage.

This study shows that the presence of comorbidities is strongly associated with uncontrolled BP. The odds of developing uncontrolled BP is five times higher in patients with comorbidities with AOR of 5.73 with P-value of 0.000 when compared to those who do not have. This study is in line with one study done at South Korea in which comorbidity is significant risk factor for control of hypertension(43). This could be due to the fact that patients with co morbidities are less likely to be adherent to their treatment than those with no co morbidities. Patients with more number of co morbidities could suffer from serious complications and complex treatment regimens which were favorable conditions not to adhere to their medications. This study is in line with the study done in Pakistan, Zambia and University of Gonder(40-42).

7. CONCLUSION AND RECOMMENDATIONS

Mean age $\pm$ SD of the patients is 53 ± 10.9 years (range from 27-81). Age 45-54 years is the most frequent age group. Majority of the study participants are married. Majority of the patients exercise for less than 30 minutes per day. Most of the patients in the control group are adherent to antihypertensive medications but only a few of them are adherent to the recommended salt consumption. Most of the patients with uncontrolled BP have no awareness of hypertension complication. For a unit increase in age of a person, the odds of developing uncontrolled hypertension increases by 4.8%. Adherence to anti-hypertensive medication and awareness of hypertension complication are factors identified to have negative significant association with uncontrolled hypertension whereas, presence of comorbidity and being in the age group >65 are factors that are positively associated with uncontrolled hypertension.

To ensure better controls of BP among hypertensive patients attending Addis Ababa Public hospitals, it is recommended,

- To use evidence based medicines in the management of hypertension.
- To implement aggressive blood pressure control in older age group and in patients with comorbidities
- To assess adherence to medications and provide counseling and adherence support accordingly.
- To do awareness creation about the complications of hypertension

For future researchers:

- To assess prevalence of uncontrolled hypertension
- To assess prevalence and barriers of medication adherence

8. LIMITATIONS OF THE STUDY

- A self- reported measure of medication adherence was used which could have caused overestimation of adherence to medications
- Some BP readings were taken from patients' medication records hence no information was available on how BP was measured.
- White coat hypertension could have caused underestimation of BP control as office BP readings were used.
- Purposive and convenience sampling method is used which may compromise the representativeness of the data.
- A case control study design was used which doesn't allow for estimation of prevalence of uncontrolled hypertension
- Since only public Hospitals of Addis Ababa were included, caution should be exercised in extrapolating the results to all Hospitals of Addis Ababa

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8. ANNEX

8.1 Questionnaire

My name is _____ on behalf of SPMMC, Ethiopia. I am conducting study in SPMMC aiming at assessing determinants of uncontrolled hypertension in public hospitals in Addis Ababa. You are kindly requested to participate in this study and give out your answers and opinions. All information will be kept secretly; no name is needed on my research paper. As your individual responses will not be associated with your identity in any way, it will be completely anonymous. Your participation is vital; however, your participation is voluntary. You are free to participate, refuse or withdraw at any time. There are no foreseeable risks or discomfort expected with these interviews and procedures. There are no direct benefits from participating in the research but the addition of knowledge on control of hypertension is the indirect benefit. You will not receive any cash or other incentive for participating in this study.

Statement of Consent:

I have read the above information, and have received answers to the questions I asked. I am at least 18 years old and I consent to participate in the study.

Signature of Participant _____ Date _____

Signature of Principal Investigator: _____ Date _____

1. How old are you? _____

2. Gender _____

5. What is your marital status?

A. Married B. unmarried c. Divorced D. widowed

6. Did you go to school?

A. Yes B. No

7. If yes to question number four (6), to what level?

A. elementary B. high school C. college or university

8. Area of residence

A) Urban b) Rural

9. What is your occupation?

A. House wife B. Merchant C. Government or private employee D. Farmer E. Unemployed

10. What is your monthly income?

A. <500-birr B. 500-1000-birr C. 1000-2000-birr D. 2000-5000-birr E.>5000 birr

11. Height _____ Weight _____

12. Current BP _____

13. Number of drugs used

14. Appointment length

15. Years on follow up? _____

16. Drug Adherence

A) Good b) Poor

17. Physical Exercise

A) No exercise b) Less than 30 min per day c) at least 30 min per day

18. Diet

a) Adhered to recommended diet b) not adhered to recommended diet

19. Alcohol consumption

a) No consumption b) less than 2 bottles per day c) more than 2 bottles per day

20. Cigarette smoking

a) Smoker b) non smoker

21. Do you have other chronic disease?

a) Yes b) No

23. If yes name of chronic disease _____

24. Family History of Hypertension

a) Yes b) No

8.2 መጠይቅ

እኔ _____ የ ቅ/ጳ/ሆ/ሚ/መ ኮለጅን ወከየ በአዲስ አበባ የሚገኙ የህዝብ ሆስፒታሎች ላይ በደካማ ቁጥጥር ከሚደረግባቸው የደም ግፊት ጋር የተዛመዱ ምክንያቶችን ለመገምገም ጥናት ላይ እገኛለሁ ። በዚህ ጥናት ተሳታፊ እንድትሆኑ እና መልስ እና አስተያየትን እንድናገኝ ትህትና እጠይቃለሁ። ሁሉም መረጃ በምስጢር ይያዛል። በምርምር ወረቀቴ ላይ ምንም ስም አያስፈልግም። የግለሰብ ምላሾች በማናቸውም መልኩ ከማንነትዎ ጋር እንደማይዛመዱ ሁሉ ሙሉ በሙሉ ስም-አልባ ይሆናል። ተሳትፎዎ ወሳኝ ነው ይሁን እንጂ ተሳትፎዎ በፈቃደኝነት ነው። በማንኛውም ጊዜ ለመሳተፍ ላለመቀበል ወይም ለመውጣት ነጻ ነዎት። በእነዚህ ቃለመጠይቆች እና ሂደቶች ላይ የሚጠበቅ አደጋ አይኖርም። በጥናቱ ውስጥ መሳተፍ ምንም ቀጥተኛ ጥቅም አያስገኝም ነገር ግን የደም ግፊትን የመቆጣጠር ዕውቀት መጨመር ላይ ተዘዋዋሪ ጥቅም አለው። በዚህ ጥናት ውስጥ ለመሳተፍ ምንም ዓይነት ገንዘብ ወይም ሌላ ማበረታቻ አይሰጥዎትም።

የስምምነት መግለጫ:

ከላይ ያለውን መረጃ አንብቤያለሁ እና ለጠየኳቸው ጥያቄዎች መልሶች አግኝቻለሁ። እድሜዬ ከ18 አመት በላይ ነው እናም በጥናቱ ለመሳተፍ ተስማምቻለሁ።

የ ተሳታፊው ፊርማ _____ ቀን _____

የዋና ተቆጣጣሪ ፊርማ: _____ ቀን _____

1. ዕድሜዎ ስንት ዓመት ነው? _____

2. ጾታ _____

3. የጋብቻ ሁኔታዎ ምንድነው?

ሀ) ያገባ ለ) ያላገባ. ሐ) የፈታ መ) ባል/ሚስት የሞተበት/የሞተባት

4. ትምህርት ተምራቅዋል?

ሀ) አዎ ለ) አይደለም

5. ለጥያቄ ቁጥር ስድስት (6) አዎ ከሆነ በየትኛው ደረጃ?

ሀ) አንደኛ ደረጃ ለ) የሁ / ደ ት / ቤት ሐ) ኮሌጅ ወይም ዩኒቨርሲቲ

6. የመኖሪያ አካባቢ

ሀ) ከተማ ለ) ገጠር

7. ሥራዎ ምንድን ነው?

ሀ) የቤት እመቤት ለ) ነጋዴ ሐ) የመንግስት ወይም የግል ሰራተኛ መ) ገበሬ ሠ) ስራ የለኝም

8. የወር ገቢዎ ስንት ነው?

ሀ) <500 ብር ለ) 500-1000 ብር መ) ከ 1000 እስከ 2000 ብር ሐ) 2000-5000 ብር መ) > 5000 ብር

9. ቁመት _____ ከብደት _____

10. የ አሁን የ ደም የግፊት መጠን _____ mmHg

11. ለ ደም ግፊቱ ስንት አይነት መድሀኒት ይወስዳሉ

12. የቀጠሮ ርዝመት _____

13. ለስነት ግዘ ከትትል ላይ ቆዩ? _____

14. የመድሃኒት በጊዜ የመውሰድ ባህሪዎ እንደት ነው?

ሀ)ጥሩ ለ) ደካማ

15. አካላዊ እንቅስቃሴ በየ ስንት ግዜ ያፈጋሉ?

ሀ) ከኔ ጭራሹ የለም ለ) በቀን ከ 30 ደቂቃ ያነሰ ሀ) ቢያንስ 30 ደቂቃ በቀን

16. አመጋገብ

a) ሀክም የምመክሬኝን ምግብ እመገባለሁ ለ) እንደፌለኩ እመገባለሁ

17. አልኮል መጠጣት

ሀ) በቀን ከ 2 ጠርመሶች በታች ለ) በቀን ከ 2 በላይ ጠርመሶች

18. ሲጋራ ያጨሳሉ?

ሀ) አይ ለ) አዎ

19. ጫት ይቅማሉ?

ሀ) አዎ ሀ) አይ

20. ሌላ ከባድ/የማይደኑ በሽታ አለብዎት?

ሀ) አዎ ሀ) አይ

21. ለ 22ኛ ጥያቄ መልሶ አዎ ከሆነ በሽታው ስም ማንድነው? _____

22. የቤተሰብ/ዘመድ ውስጥ የ ደም ግፊት በሽታ ያለበት ሰው አሌ?

ሀ) አዎ ለ) አይ